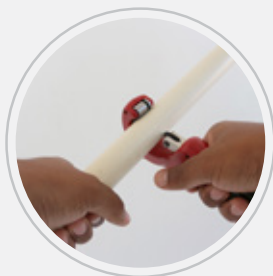


FLO-TEK FLOWGUARD CPVC PLUMBING SOLUTION

Introducing the New and Innovative Plumbing Technology for Hot and Cold Water Applications

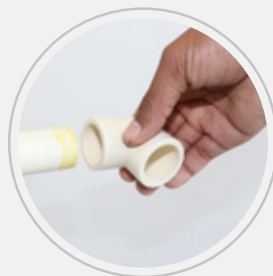
Installation as Easy as 1,2 & 3



CUT



GLUE



JOIN

BUILDERS, CONTRACTORS AND PLUMBERS TRUST FLOWGUARD CPVC PIPING SYSTEMS PERFORMANCE FOR OVER 50 YEARS.



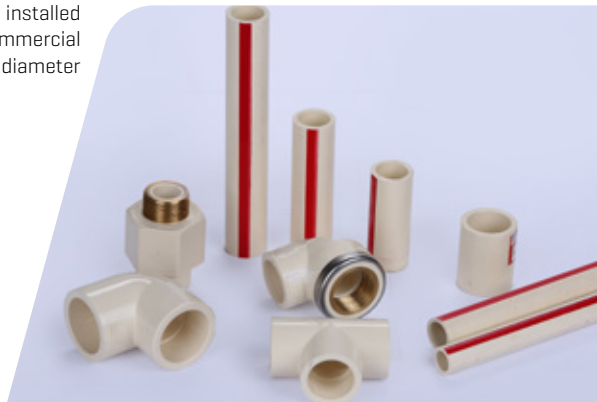
Flo-tek Flowguard CPVC Benefits

- ✓ Corrosion Resistance
- ✓ Hot & Cold Water Application
- ✓ Easy Installation
- ✓ Cost Effective
- ✓ Advanced Insulating Properties
- ✓ Sustainability
- ✓ High Chlorine Resistance
- ✓ Greater Material Safety – Human Health

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The Flowguard CPVC Piping system has been installed worldwide for over 50 years in domestic and commercial projects. Our piping system comes standard in diameter sizes of 16mm — 110mm and are suitable for:

- ♦ **Apartments / Town Houses**
- ♦ **Universities**
- ♦ **Hotels & Lodges**
- ♦ **Hospitals & Healthcare Facilities**
- ♦ **Commercial Building**
- ♦ **Retail stores**
- ♦ **Restaurants**
- ♦ **Schools**
- ♦ **Residential homes**



OUR NETWORK

Angola
Botswana
Namibia
South Africa
Zambia

South Africa

Tel: +27 11 316 6891 | Fax: +27 11 316 6896

Angola

Tel: +244 2222 90662 | Fax: +244 2222 90880

Email: info@flotekafrica.com

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Tel: +267 533 2180 | Fax: +267 533 3146

Namibia

Tel: +264 61 244239 | Fax: +264 61 232339

 Flo-Tek Botswana

www.flotekafrica.com

EXCEED THE EXPECTED WITH FLOWGUARD® PLUMBING SYSTEMS !



FLOWGUARD®
PIPE & FITTINGS

INSTALLATION GUIDE

FlowGuard® plumbing pipe is made from a specialty thermoplastic, known chemically as post-chlorinated polyvinyl chloride (CPVC). FlowGuard® CPVC systems are assembled with readily available, inexpensive tools. Solvent welded joints – proven reliable with more than 50 years of successful CPVC service history – assure the reliability of a FlowGuard® system.

Where to use FlowGuard® systems?

FlowGuard® CPVC is used in hot and cold water distribution systems. Typical potable water piping requirements in today's residential homes, apartments, hotels and commercial buildings can be accommodated by FlowGuard® CPVC systems.

CPVC plumbing systems are approved for contact with potable water in a wide range of countries including USA, Canada, UK, Germany, France and The Netherlands amongst others.

Joining FlowGuard® tubing and fittings

1. CUTTING

FlowGuard® tubing can be easily cut with a wheel-type plastic tubing cutter, a hack saw or other fine toothed hand or power saws. Use of ratchet cutters is permitted, provided blades are sharpened regularly. A miter box should be used to ensure a square cut when using a saw. Cutting tubing as squarely as possible provides optimal bonding area within the joint. If any indication of damage or cracking is evident at the tubing end, cut off at least 5 cm beyond any visible crack.

2. DEBURRING/BEVELING

Burrs and filings can prevent proper contact between tube and fitting during assembly, and should be removed from the outside and inside of the tubing. A chamfering tool is preferred but a pocketknife or file are suitable for this purpose. A slight bevel on the end of the tubing will ease entry of the tubing into the fitting socket and minimize the chances of pushing solvent cement to the bottom of the joint.

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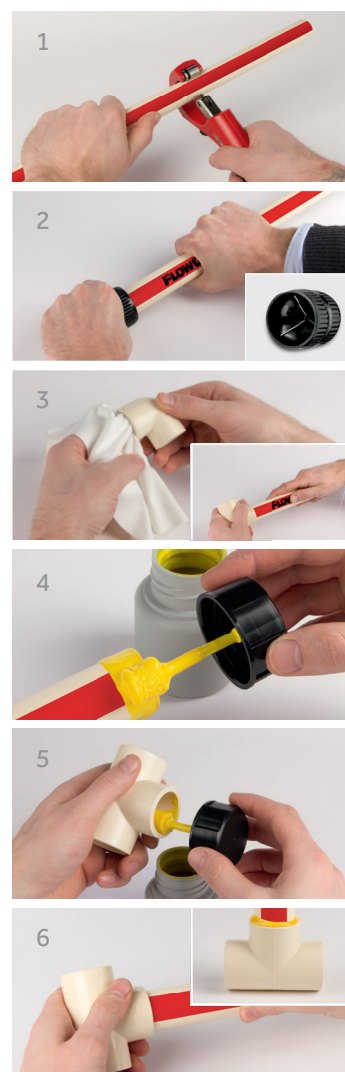
Wipe any dirt or moisture from the fitting sockets and tubing end. Check the dry fit of the tubing and fitting. The tubing should make contact with the socket wall 1/3 to 2/3 of the way into the fitting socket. At this stage, tubing should not bottom out in the socket.

4 & 5. SOLVENT CEMENT APPLICATION

Use only CPVC cement or joint failure may result! Apply a heavy, even coat of cement on the tubing end. Apply a thin coat inside the fitting socket. It is important to use a proper applicator. A dauber or natural bristle paint brush approximately ½ the size of the tubing diameter is appropriate.

6. ASSEMBLY

Immediately insert the tubing into the fitting socket, rotating the tubing ¼ to ½ turn while inserting. This motion ensures an even distribution of cement within the joint. Properly align the fitting. Hold the assembly for approximately 10 seconds allowing the joint to set-up. An even bead of cement should be evident around the joint. If this bead is not continuous around the socket edge, it may indicate that insufficient cement was applied. In this case, remake the joint to avoid potential leaks. Wipe excess cement from the tubing and fittings surfaces for an attractive, professional appearance.



SET AND CURE TIMES

Solvent cement set and cure times are a function of pipe size, temperature, and relative humidity. Curing time is shorter for drier environments, smaller sizes, and higher temperatures. Refer to the following table for minimum cure times after the last joint has been made up before pressure testing can begin.

Minimum cure prior to pressure testing at 10 bar		
ambient temperature during cure period	pipe size	
	up to 32 mm	40 mm and above
Above 15°C	1 hour	2 hours
4 - 15°C	2 hours	4 hours
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Special care should be exercised when assembling CPVC systems in extremely low temperatures (below 4°C) or extremely high temperatures (above 38°C). Frozen cement cannot be recovered and should be discarded. In extremely hot temperatures, make sure both surfaces to be joined are still wet with cement when putting them together.

TESTING

Once an installation is completed and cured per these recommendations, the systems should be hydrostatically pressure tested. 10 bar for one hour is recommended. When pressure testing, the system should be filled with water and all air bled from the highest and farthest points in the run. If a leak is found, the joint must be cut out and discarded. A new section can be installed using couplings. During sub-freezing temperatures, water should be blown out of the lines after testing to eliminate potential damage from freezing. Air testing is not recommended.

HANDLING AND STORAGE

FlowGuard® CPVC is a tough, corrosion resistant material, but it does not have the mechanical strength of metal. Reasonable care should be exercised in handling tubing and fittings. They should not be dropped, stepped on, or have objects thrown on them. If improper handling or heavy impact results in cracks, splits, or gouges, the damaged section should be discarded. FlowGuard® tubing should be covered with a non-transparent material when stored outdoors for long periods of time. Normal short term exposure to sunlight on the job site will not affect physical properties or ultimate performance.

Product rating and capabilities

DIMENSIONS

CPVC plumbing systems are produced according to a wide range of international standards including ASTM F441 (schedule 80), ASTM D2846 (copper tube size), DIN 8079 and EN ISO 15877. The below table shows the EN ISO 15877 dimensions.

Pipe series			
Outside diameter	S 6,3 (SDR 13.6)	S 5 (SDR 11)	S 4 (SDR 9)
	Minimum wall thickness in millimeters		
20	1,5	1,9	2,3
25	1,9	2,3	2,8
32	2,4	2,9	3,6
40	3,0	3,7	4,5
50	3,7	4,6	5,6
63	4,7	5,8	7,1

PRESSURE RATING

Pipes, fittings and joints are designed for continuous use at the following conditions (DIN 8079):

Pressure rating			
	S 6,3 (PN16)	S 5 (PN20)	S 4 (PN25)
20°C	16 bar	20 bar	25 bar
40°C	11 bar	14 bar	17 bar
60°C	6 bar	8 bar	10 bar
80°C	4 bar	4 bar	6 bar

HYDRAULIC DESIGN

Hydraulic calculations should be calculated using the Hazen-Williams C value of 150.

FIRE RATED CONSTRUCTION

Testing demonstrates that FlowGuard® CPVC meets 25/50 flame spread/smoke development requirements for installations within plenums. Fire wall penetrations must be sealed with approved materials or devices, such as those listed in the UL® Building Materials Directory. Consult the local building official in your area.

THERMAL EXPANSION

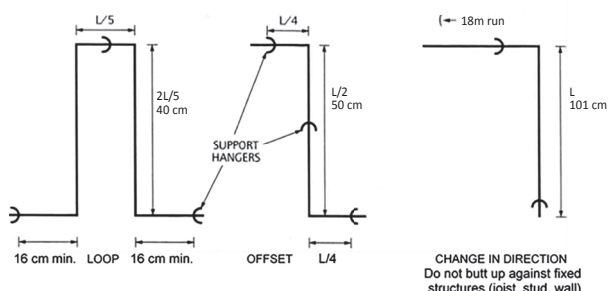
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For convenience, loop (or offset) lengths have been calculated for different pipe sizes and different run lengths with a temperature increase of 50 °C. The results, shown in the table below, are presented simply as a handy guide for quick and easy determinations of acceptable loop lengths for the approximate conditions.

Expansion loop length (L) for 50°C temperature change					
Pipe size	Length of run				
	6 meters	12 meters	18 meters	24 meters	30 meters
20 mm	58 cm	81 cm	101 cm	115 cm	130 cm
25 mm	64 cm	92 cm	113 cm	130 cm	144 cm
32 mm	73 cm	103 cm	124 cm	144 cm	161 cm
40 mm	78 cm	110 cm	135 cm	156 cm	173 cm
50 mm	86 cm	122 cm	150 cm	173 cm	193 cm

An example was selected from the table to demonstrate the use of these data in the following 3 methods of compensating for the thermal expansion.
Example: Pipe size = 20 mm, length of run = 18 m, L = 101 cm (from table)



TRANSITIONS FROM FLOWGUARD® CPVC TO OTHER MATERIALS

Numerous specialty transitions incorporating rubber seals at the plastic-to-metal interface are available and should always be used on lines where normal water temperature of 65 °C or higher are anticipated. Male CPVC threaded adapters are also available for connecting valves and appurtenances on cold water lines. CPVC female threaded adapters SHOULD NOT BE USED.

TFE (Teflon®) thread tape is always safe for making CPVC threaded connections. Some paste-type sealants contain solvents that may be damaging to CPVC. If you prefer to use a paste or pipe dope, always check with the manufacturer regarding its compatibility with CPVC. Use of an improper paste or dope can result in failure of CPVC systems.

HANGERS AND SUPPORT

Because FlowGuard® tubing is rigid, it requires fewer supports than flexible plastic systems.

For vertical runs, provide a support at each floor level, plus a mid-story guide. For horizontal runs, support at 90 cm intervals for diameters of 32 mm and below and at 1.2 m intervals for larger sizes.

Piping should not be anchored tightly to supports, but rather secured with smooth straps or hangers that allow for movement caused by expansion and contraction. Most hangers designed for metal pipe are suitable for FlowGuard®. Hangers should not have rough or sharp edges which come in contact with the tubing.

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When connecting electrical water heaters to a CPVC plumbing system it is recommended that a suitable flexible hose, braided or non-braided, with union type end couplings be used to connect both the inlet cold water and outlet hot water CPVC lines. The flexible connector shall be in accordance with the water heater manufacturer's specifications/recommendations.

When connecting gas water heaters to a CPVC plumbing system, it is recommended that at least 50 cm of a suitable metal nipple or flexible metal connector be used so that the CPVC piping system cannot be damaged by the build-up of excessive radiant heat from the water heater flue.

Note: Some code jurisdictions require metal connections on all water heaters. Verify code requirements prior to installation. For all installations adequate safety valves should be incorporated in case of water heater malfunction.

FLOWGUARD®
PIPE & FITTINGS

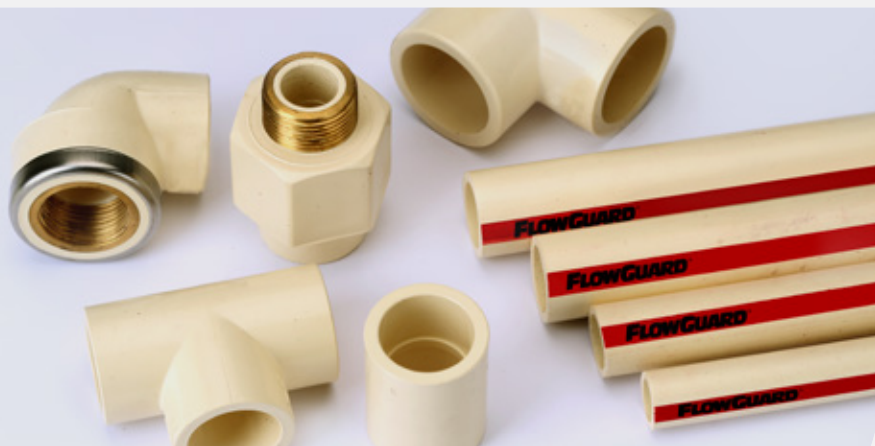
If you would like to know more about FlowGuard® CPVC plumbing systems, please visit our website:
www.lubrizolcpvc.com or contact us by e-mail, cpvc.emena@lubrizol.com or at the address below.

Lubrizol Advanced Materials Europe B.V.B.A., TempRite® Engineered Polymers

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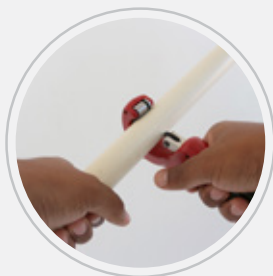
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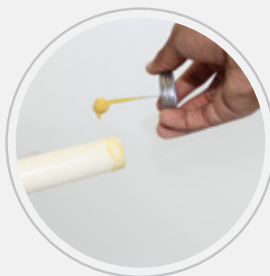
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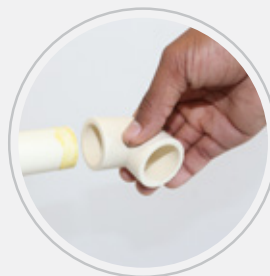
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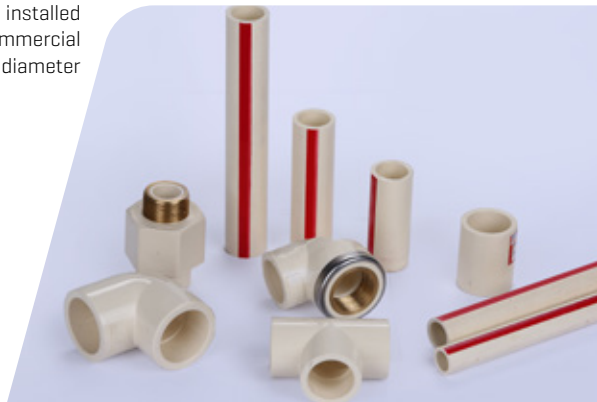
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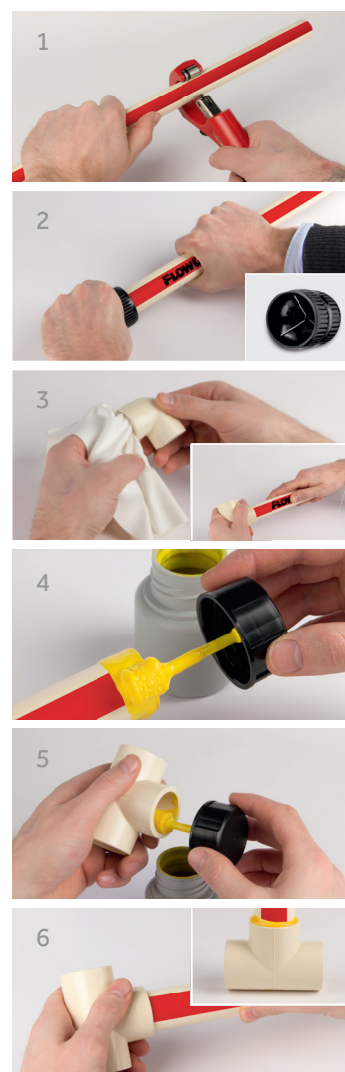
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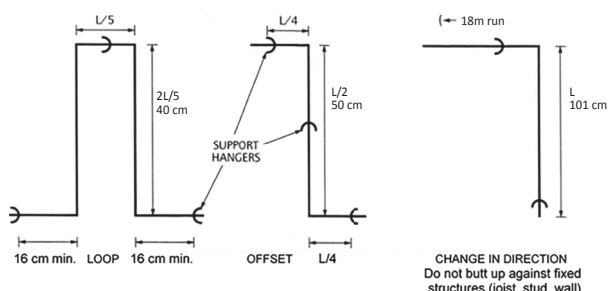
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FLOWGUARD®
PIPE & FITTINGS

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www.lubrizolcpvc.com or contact us by e-mail, cpvc.emena@lubrizol.com or at the address below.

Lubrizol Advanced Materials Europe B.V.B.A., TempRite® Engineered Polymers

Chaussée de Wavre, 1945 | B-1160 Brussels, Belgium. | Tel.: +32.2.678.19.11 | Fax: +32.2.678.20.01

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FLO-TEK®

Flow better with us

PVC Sewer & Drain Systems

Pipes | Fittings



Flo-Tek the leading manufacturer and supplier of plastic Pipes, Tanks, Fittings and Irrigation products, since 1998.

Radical Investments (Pty) Ltd, trading as Flo-Tek Pipes & Irrigation was established in Botswana in 1998 manufacturing PVC pipes. In July 2003 and June 2004 Flo-Tek commenced manufacturing rotational moulded products and HDPE pipes, respectively.

The company was established in South Africa in 2005 and an HDPE pipe factory was started in Clayville in August 2007. Flo-Tek South Africa has since opened subsidiary companies in Dundee, Port Elizabeth, Nelspruit and Klerksdorp. Flo-Tek also has an established operations in Angola and Namibia.

Within our South African and Botswana operations, we have trained staff who bring a wealth of knowledge and experience.

Flo-Tek ensures the best quality of products and the highest delivery standards.

www.flotekafrika.com

Flo-Tek's core business is the manufacturing and distribution of PVC-U and PVC-M Pressure Pipes & Fittings, HDPE Pipes & Fittings, Sewer Pipes & Fittings, Irrigation and Rotomoulded products. We also produce Borehole Casings, Screens and PVC Cable Ducts.

Our ISO 9001 certified factories in Botswana and South Africa enable us to manufacture our pipes and tanks as well as to distribute across the SADC region. Our factories have fully equipped laboratories which ensure Flo-Tek manufactures to SANS, BOBS ISO and SAPPMA specifications.

Broad-Based Black Economic Empowerment (BBBEE)

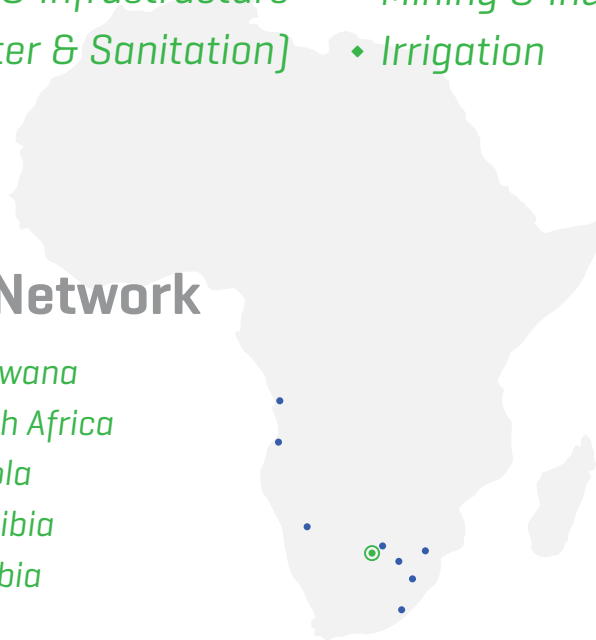
Flo-Tek South Africa is a BEE compliant company. The principles of broad-based BEE, through stakeholder empowerment, have also been integrated into how we do business, and how we can assist and support our Clients in how they do their business. The empowerment of women and the development of skills at lower levels of the organization to facilitate career and personal growth opportunities are the particular areas that will continue to receive attention and focus within our business.

Sectors Served

- ♦ *Civil & Infrastructure [Water & Sanitation]*
- ♦ *Mining & Industrial*
- ♦ *Irrigation*

Our Network

- *Botswana*
- *South Africa*
- *Angola*
- *Namibia*
- *Zambia*



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OVERVIEW

Composition of PVC Pipe Materials

Polyvinyl Chloride or PVC is one of the most versatile type of pipe materials. It is produced by the polymerisation of vinyl chloride which is made from coal (or oil) and common salt. In fact, salt makes up over 50% of the polymer, thus making PVC one of the most environmentally friendly plastic materials, being least dependent on increasingly scarce hydrocarbon resources.

The unique properties of PVC can be enhanced by the addition of special additives, for example, to create strong yet tough pipe materials such as modified PVC [PVC-M], foamed multilayer sewer and drainage pipes, and weather resistant, above ground drainage pipes. These additives, as well as heat stabilisers and lubricants, which are necessary to facilitate the extrusion of the pipes, are added to the PVC raw material in a special high speed mixer to produce a dry blend specially formulated for the pipe extrusion process.

During the manufacture of the pipe the dry blend is mixed in the extruder and through a combination of heat and shear, the material is 'gelled' into a homogeneous molten mass ready for passage through the die and calibrator to form a pipe which has tight tolerances in terms of the outside diameter, wall thickness and mechanical properties.

The integral pipe end rubber ring socket is formed at the end of the extrusion line and the sealing ring fitted. A similar process is used in the injection moulding of the fittings; the material is gelled in the barrel and screw of the machine and then injected into the mould where it is cooled to form the fitting.

Rubber sealing rings and retainer caps are fitted during subsequent assembly of the finished fitting.

It should be noted that in recent years heat stabilisers and lubricants have been changed from lead based compounds to alternative, environmentally friendly materials such as organic and calcium/zinc compounds.

Applications - PVC Pipe and Fittings Systems

PVC-U gravity effluent and sewer sanitation pipe and fittings systems and water purification. [SANS 791 and SANS 1601].

• PVC-U weather resistant pipes and fittings for above ground drainage. [SANS 967].



Features and Benefits

- *Excellent flow characteristics: reduces friction losses.*
- *Best long-term strength/ cost ratio of all pipe materials: economical and cost effective and lowers the capital cost of projects for the provision of potable water and sanitation.*
- *Service performance in excess of 50 years.*
- *Unique combination of mechanical properties: long-term strength and stiffness, making it ideal for sewer and drainage pipes.*
- *Resistant to acids and alkalis: no problems when installed in acidic soils and resistant to acidic chemicals in sewerage and in mining.*
- *Resistant to abrasion and scouring and modern cleaning methods: ideal for use as sewer and drainage pipes.*
- *Above ground soil, waste and vent pipes and fittings [white colour] - excellent long-term resistance to UV [sunlight].*
- *Light mass: lower transport costs and easy handling and installation, ideally suited for labour intensive projects.*
- *Elastomeric locked-in sealing ring system: resistant to most chemicals, long-term sealing performance and easy low cost installation with unskilled labour.*

Physical Properties

Major properties of PVC pressure and sewer and drain pipes are given in Table. Please note that as with all thermoplastics, properties are dependent on the operating temperature and the duration of the stress application.

For example, working pressures of pipes used at higher temperatures should be lowered (or a higher class used) in order to maintain the long-term design life of the pipe.

In the case of buried sewer and drain pipes, the correct pipe stiffness should be selected depending on installation and soil and live traffic loads [refer below].

Product Range

PRODUCT	RANGE (ia)	SPECIFICATION
PVC-U Sewer & Drain Pipes	110 - 500mm	SANS 791
PVC-U Sewer and Drain Fittings	110 - 160mm	SANS 791
PVC-U Soil & Vent Pipes	40 - 160mm	SANS 967
PVC-U Soil and Vent Fittings	50 - 110mm	SANS 967
PVC-U Structured Wall Sewer & Drain Pipes [Multi-Layer Foamcore]	110 - 200mm	SANS 1601

Product Properties

PHYSICAL	UNITS	PVC-U
Co-Efficient of Linear Expansion	k^{-1}	6×10^{-5}
Density	Kg/m^3	1.4×10^3
Flammability [oxygen index]	%	45
Shore Hardness [D]		70—80
Softening Point [Vicat- minimum]	$^{\circ}C$	> 80
Specific Heat	J/Kg/K	1.0×10^3
Thermal Conductivity [$0^{\circ}C$ — $50^{\circ}C$]	W/m/K	0.14
MECHANICAL		
Elastic Modulus [long term: 50 years]	MPa	1500
Elastic Modulus [short term: 100 seconds]	MPa	3300
Elongation at break [Minimum]	%	45
Poisons Ratio		0.4
Tensile Strength [50 year - extrapolated]	MPa	26
Tensile Strength [short-term / Minimum]	MPa	45
FRICTION FACTORS		
Manning		0.008—0.009
Hazen Williams		150
Nikuradse Roughness [k]	mm	0.03





FLOTEK 160MM CLASS 34 HEAVY DUTY S&D PIPE 3226022016 SANS-791

FLOTEK 160MM CLASS 34



PIPES

PIPE DIMENSIONS

WALL THICKNESS & MASS / METER

Sewer and drainage pipes

Flo-Tek's PVC Sewer and Drainage pipes are made to SABS Specifications in an ISO 9001:2008 accredited factory. This accreditation demonstrates the company's ability to manufacture quality products to SABS and International standards.

All pipes are made to provide an effective length of 6.0 meters from 110mm — 250mm and 5.8 meters from 315mm — 500mm after installation. The outside diameters are the same for both classes of the same size. Pipe sizes 110mm and 160mm are available with plain ends [for solvent welding] or with integral rubber ring socket. The minimum wall thicknesses [as per the applicable SASS Standard] and mass per meter are given in the Tables.

Foamcore sewer and drain pipes have a multi-layered structure as shown below. The three layers provide strength and resistance to soil loads.

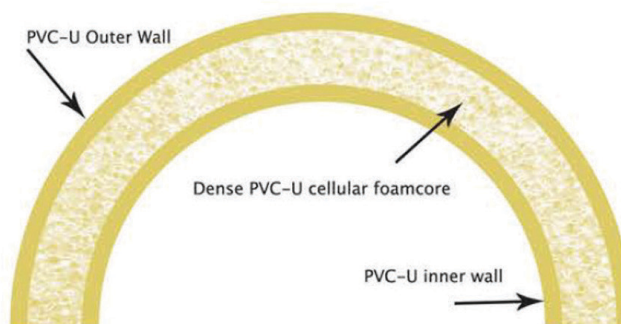


Figure showing the multi-layered structure of foamcore pipes

These pipes have smooth inner and outer walls and a middle layer consisting of dense cellular, foamed PVC having a high stiffness to weight ratio, providing weight and cost savings and higher pipe stiffness. Outside diameters are the same as solid wall pipes made to SANS 791. Foamcore pipes are thus compatible with all moulded and fabricated sewer and drain fittings.

SANS 791 PVC-U SEWER & DRAIN PIPE [Solid Wall]				
NOMINAL SIZE [mm]	MIN. WALL THICKNESS [mm]		MASS [kg/m]	
OUTSIDE DIAMETER	NORMAL DUTY	HEAVY DUTY	NORMAL DUTY	HEAVY DUTY
110	2.2	3.0	1.2	1.6
160	3.2	4.7	2.5	3.6
200	3.9	5.9	3.8	5.7
250	5.0	7.3	6.1	8.8
315	6.2	9.2	9.6	14.1
355	7.0	10.2	12.2	17.7
400	7.9	11.7	15.6	22.9
450	8.8	13.2	19.6	29.1
500	9.8	14.6	23.3	35.8

- **Normal Duty:** Class 51 [SDR 51]: Pipe Stiffness 100 kPa
- **Heavy Duty:** Class 34 [SDR 34]: Pipe Stiffness 300 kPa.

SABS 1601 Structured Wall Sewer and Drain Pipes			
NOMINAL SIZE [mm]	STIFFNESS CLASS	STIFFNESS CLASS	STIFFNESS CLASS
OUTSIDE DIAMETER	[in kPa]	[in kPa]	[in kPa]
110	100	200	400
160	100	200	400
200	100	200	400

Soil, Waste and Vent Pipes

SABS 967 Soil, Waste and Vent Pipes		
NOMINAL SIZE [mm]	MIN. WALL THICKNESS [mm]	MASS [kg/m]
OUTSIDE DIAMETER		
40	2.0	0.4
50	2.2	0.5
75	2.2	0.8
110	3.2	1.6
160	3.3	2.5

Flo-Tek's soil, waste and vent pipes are specially formulated for resistance to sunlight and long-term outdoor exposure. Minimum wall thickness and mass per meter are given in Table.

DESIGN CONSIDERATIONS

Solid wall PVC sewer and drain pipes have been used throughout the world for over 40 years and given exceptional service. Structured wall foamcore pipes are a later development designed to give weight and cost savings with greater pipe stiffness and performance. These pipes have been in use for over 25 years in Europe and elsewhere and at least 15 years in Southern Africa.

A detailed account of sewer and drain pipes, their properties, design parameters, pipe deflection, soil and traffic loads and installation is given in the SAPPMA [Southern African Plastic Pipe Manufacturers Association] Technical Manual 2013, 4th Revision.

This manual is available from Flo-Tek Pipes and Irrigation and from the SAPPMA website [www.sappma.co.za]. The following notes summarise some of the important considerations which are covered in detail in the SAPPMA Technical Manual.



Pipe stiffness test with the pipe sample placed between parallel plates in the Tensometer at the start of the test and prior to any force being applied.



A 200mm foam core pipe deflected far beyond the 5% required for the test. Note the absence of buckling and the strength and toughness of the pipe at a deflection of 40%.

Various parameters are used to define pipe stiffness. They all relate to the ability of a pipe to resist deformation. Knowledge of these parameters is important to prevent overloading and excessive deflection of pipes.

Pipe stiffness is determined from a parallel plate test on a pipe.

$$PS = F/\Delta Y$$

- PS is pipe stiffness expressed as kPa [kN/m²]
- F is the force necessary to deflect the pipe by a given percentage taken from the relevant specifications
- ΔY is the vertical deflection of pipe

The pipe stiffness factor used in the DIN standards is calculated from the pipe material properties and the pipe geometry.

$$PSF = EI/r^3$$

- PSF is the pipe stiffness factor in kN/m/m
- E is the elastic modulus of the pipe material
- I is the moment of inertia of the pipe wall
- r is the pipe radius

Pipe ring stiffness used in ISO standards is also calculated from the pipe material properties and the pipe geometry. It is an eighth of the PSF.

$$PRS = EI/D^3$$

- PRS is the pipe ring stiffness in kN/ m/m
- E is the elastic modulus of the pipe material
- I is the moment of inertia of the pipe wall
- D is the pipe diameter

The relationship between these three factors is:

$$0.149 PS = PSF = 8 PRS; PS = 6.71 PSF = 53.69 PRS$$

PRS is also referred to as the nominal stiffness, SN.

PS, PSF and PRS		
PIPE STIFFNESS [kPa]	PIPE STIFFNESS FACTOR [kN/m/m]	PIPE RING STIFFNESS [kN/m/m]
100	14.9	1.860
200	29.8	3.725
300	44.7	5.588
400	59.6	7.450

LOADS ON FLEXIBLE PIPES AND INSTALLATION

Vertical loads

The strength of buried drain pipes and sewers is invariably dictated by external loads rather than internal pressure. External loads arise mainly from vertical soil and live traffic loads. However, these loads are considerably reduced by friction and cohesion between the backfill material and the trench walls and provided recommended installation procedures have been followed, these loads on the pipes are transferred to the trench walls.

The determination of pipe deflections is covered in the SAPPMA Technical Manual for various soil loads, soil density and soil moduli. Proper bedding, side fill and backfill with selected granular material and composition to a specified density of 90% modified ASSHTO, to a depth of at least 300mm above the crown of the

pipe, combined with the load shedding ability of the pipe, will ensure acceptable deflections.

The load shedding ability of the pipe to the surrounding soil is due to the creep properties of plastic pipes under high stresses. Creep effectively lowers the modulus of elasticity of the pipe material and deflection will gradually increase with time until reaching an equilibrium at about 12 months. The 3 year or long-term elastic modulus should therefore be used by the design engineer.

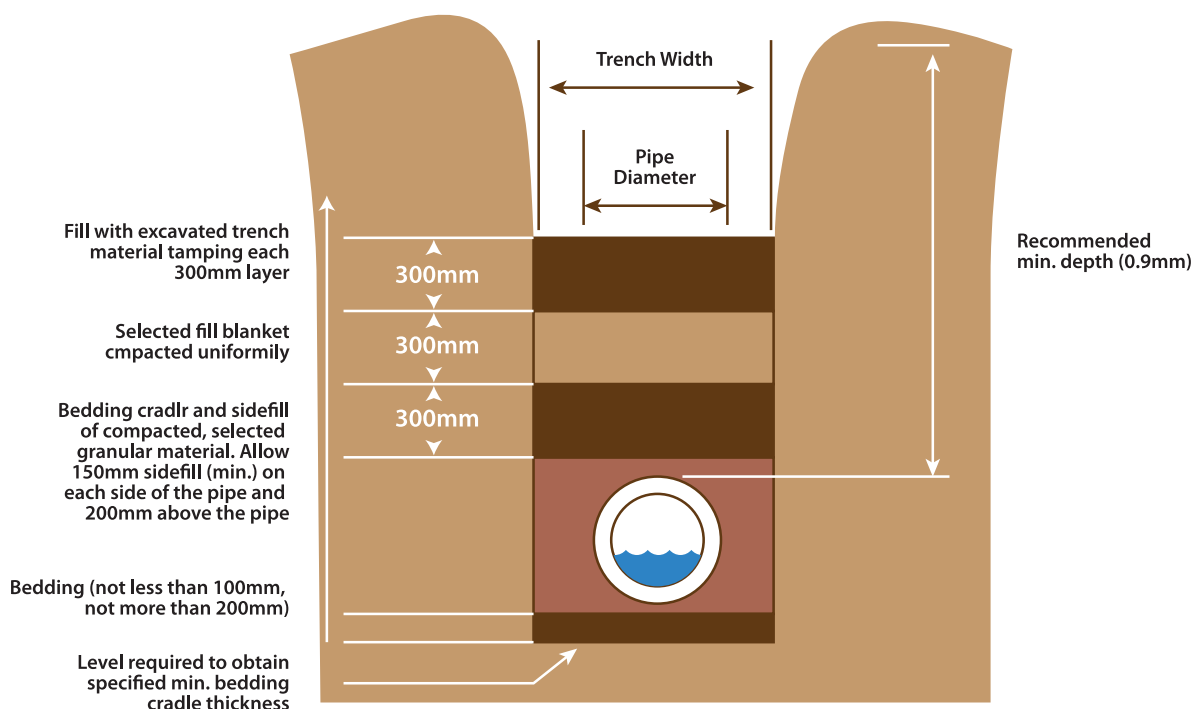
Live traffic loads

These loads are momentary and the instantaneous or short-term elastic modulus should be used in estimating additional deflections due to live loads.

Trenching, Bedding & Backfilling

These procedures are covered in the Standard Specification for Civil Engineering Construction, SABS 1200. Further recommendations are given in the Code of Practice SANS 0120. Provided installations are carried out according to these codes of practice, Flo-Tek's sewer and drain pipes will give excellent service well over and above their minimum design life of 50 years.

An illustration of the installation of PVC-U sewer and drain pipes is shown below:









FITTINGS

FITTINGS

Sewer and Drain (PVC-U Fittings SANS 791)

A range of injection moulded, rubber ring sewer and drain fittings are available in sizes 110mm and 160mm and are compatible with both solid wall [SANS 791] and foamcore [SANS 1601] sewer and drain pipes. The more popular fittings are shown in the pictures below:

- Reducing Junction
- Junction Plain
- Socket Single
- Bend Plain
- Junction Access Right
- Junction Access Left
- Bend Plain
- Stop-end Female
- Gully Head & Grate
- Rodding Eye
- Gully 'P' Trap



Fabricated Fittings

Fabricated fittings either rubber ring or solvent weld are also available in sizes from 110mm to 315mm. These include long and short radius bends, junctions, reducing junctions, reducers, channels, etc.



Soil, Waste and Vent (PVC-U Fittings SANS 967)

Injection moulded fittings are available in either rubber ring or solvent weld in sizes 50mm and 110mm as well as special fabricated fittings in sizes 50mm, 75mm, 110mm and 160mm. A range of these fittings is shown below:



- Reduced Junction 160X110 45° [UG]
- Junction Plain 110X110 45° [UG]
- Junction Access Left 110X110 45° [UG]
- Junction Access Right 110X110 45° [UG]
- Gully Head & Grate Round 190X110 [UG]
- Rodding Eye 110X45°
- Gully "P" Trap 110mm[UG]
- Stopend Plain Female 110mm [UG]
- Socket Single 110 mm [UG]
- Bend Plain 110X45° [UG]
- Bend Plain 110X87.5° [UG]
- Kimberly Socket 110mm UG
- Bend Plain 110×22.5° UG

PIPE JOINTING

JOINTING METHODS

1. Cutting

PVC pipes can be easily cut using a number of different cutting tools, such as proprietary cutting tools which cut, deburr and chamfer in one operation, circular saws or hand saws. It is important to ensure that, after cutting, the pipe end is thoroughly deburred.

2. Rubber Ring Joints

A rubber ring socket is integrally moulded on one end of the pipe and incorporates a factory fitted rubber sealing ring which is retained in position. The opposite end of the pipe (spigot end) is suitably chamfered and has a depth of entry mark near its end. Each joint is capable of handling expansion and contraction as well as angular deflection of up to 2°C and a pressure of up to 75kPa below the ambient atmospheric pressure. The seal ring is designed to provide a watertight joint at high and low pressures.

3. Depth of Entry

The depth of entry mark is a guide to ensure correct depth of insertion of the spigot into the socket of the next pipe. If pipes are cut to measure on site it is necessary to remark the depth of entry according to the dimensions given in the following table or as per the pipe being installed at the same time.

Re-marking can be done with a permanent felt tipped marker pen. The correct depth of entry allows for expansion and contraction of the pipes in the pipeline.

PIPE SIZE [mm]	DEPTH OF ENTRY [mm]	APPROX. LENGTH OF CHAMFER [mm]
50	88	10
63	93	10
75	98	10
90	105	15
110	113	15
125	114	15
140	126	20
160	129	20
200	159	25
250	183	25
315	189	30
355	203	30
400	225	30
450	235	35
500	235	35

4. Chamfering

The spigot end of all rubber ring jointed pipes is chamfered at the time of manufacture. Chamfering facilitates the insertion of the spigot end into the socket of the next pipe without damaging or dislodging the rubber ring. If however, the chamfering has been cut off it is important to re-chamfer the end correctly. Re-chamfering can easily be done using a file that leaves no sharp edges which may cut the rubber ring

It should be at an angle of about 12 - 15° and the length of the chamfer should be such that at least half the wall of the thickness is removed. The chamfering should not be done to such an extent that a sharp edge is made at rim of the bore.

5. Lubricant

It is the most important to use correct lubricant when making a joint. The lubricant considerably reduces the effort required to insert the spigot into the socket and at the same time minimizes the possibility of dislodging the rubber ring. The lubricant should be water soluble, non-toxic and of a gel consistency. Alternative lubricants such as Oil, grease, diesel, dishwashing liquid, etc. must under no circumstances be used.



JOINTING PROCEDURE

Rubber Ring Joints of Pipes

1. Check the spigot end of the pipe for correct chamfering (12 - 15 with the correct length - see table) as described in "chamfering" above. Ensure that the "depth of entry" mark is visible and that there are no burrs and damage present.
2. Wipe the spigot end clean.
3. Check the socket end of the pipe to ensure that the rubber ring is present and correctly fitted. Make sure that no dirt or mud is present.
4. Apply the thin film of lubricant evenly around the circumference of the spigot up to about half the distance to the "depth of entry" mark.
5. Lubricate the rubber ring sparingly.
6. Place the spigot end of the pipe into the socket so that it rests against the rubber ring.
7. Ensure the two pipes are correctly aligned both horizontally and vertically. Failure to do this could lead to the rubber ring being dislodged when the next step is carried out.
8. Push the spigot into the socket until the "depth of entry" mark is just visible at the end of the socket. It should not be necessary to use undue force — if this becomes necessary it is normally an indication that something is amiss and the joint making process should be started again.

Solvent Weld Joints

It must be stressed that solvent cement jointing is a welding and not gluing process. It is important therefore that there is an interference-fit between the spigot and socket to be joined.

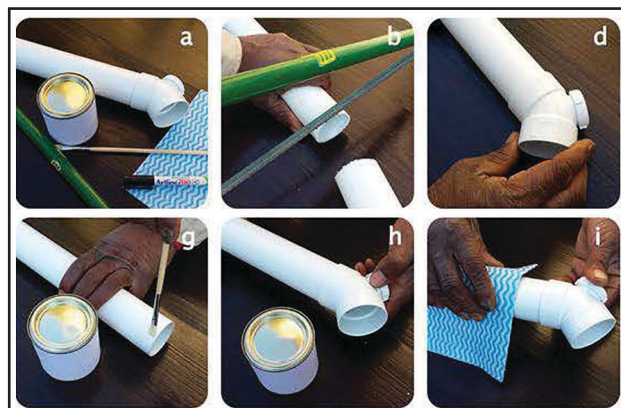
Do not attempt to make a joint when an interference-fit between a dry spigot and socket is not achieved (ie. a rattle fit). There are different types of solvent cement available for pressure pipes and for non-pressure applications. Make sure that the appropriate cement is being used. Do not dilute or add anything to the solvent cement.

Excellent solvent weld joints can be made to withstand high pressures, providing the correct welding procedure is followed.

Solvent Cement Joints of Pipes & Fittings

Assemble all the required fittings, pipes and equipment. For the best results, follow the jointing procedure below. .

- a. Make sure that the spigot has been cut square and that all burrs have been removed.
- b. Mark the spigot with a pencil line (or similar) at a distance equal to the internal depth of the socket.
- c. Check that, while dry, there is an interference fit between the spigot and the socket before the spigot reaches the full depth indicated by the pencil line.
- d. Ensure that both the spigot and the socket are properly dry (not illustrated).
- e. Degrease and clean both with an appropriate etch cleaner (not illustrated). This also acts as a primer first.
- f. With a suitable brush apply a thin film of solvent cement to the internal surface of the socket. Then apply the solvent cement in a similar manner up to the mark on the spigot. Do not use excess solvent cement. The brush width should be such that the solvent cement can be applied to both surfaces within about 30 seconds.
- g. Make the joint immediately. While inserting the spigot rotate it by about 90° and ensure that it is fully inserted up to the pencil mark, as there is a bead of excess solvent cement indicating the correct amount has been applied. Hold steady for at least 30 seconds. Mechanical assistance may be necessary for large pipes.
- h. Wipe off any excess solvent cement with a clean rag.
- i. Do not disturb for at least 5 minutes.
- j. Do not apply pressure for at least 24 hours.



STORAGE AND TRANSPORTATION

Storage

Pipes should be sorted on level, flat ground, free of stones. They may be stored on timber supports of at least 75mm width placed 1.5 meters apart with side supports. The height of pipe stacks should not exceed 1.5 meters.

All pipe stacks and stored fittings should be covered to avoid prolonged exposure to direct sunlight. Where the pipes are fitted with an integral socket, they should be stacked with sockets protruding at alternate ends. This prevents damage or distortion of the socket and spigot, especially under hot storage conditions.

Transportation

A flat-bodied vehicle is ideal for transporting pipes and fittings. Pipes with integral sockets should be loaded and spaced so that sockets protrude at alternate ends. When a mixed load of pipes [i.e. varying diameters] is to be transported, the larger pipes should be placed at the bottom. Pipes should not overhang the vehicle by more than 1 meter.

PIPE SELECTION CRITERIA

PRESSURE & NON-PRESSURE PIPES

A very good description of the criteria which may be used for the selection of the various plastics pipes available for each application is given in the SAPPMA Technical Manual [Second Edition, March 2009] [1].

The section in the Technical Manual covers the following:

HYDRAULIC REQUIREMENTS

- Basic Principles
- Operating Pressure, Hoop Stress and Wall Thickness
- Surge and Fatigue
- Factory Tests

EXTERNAL LOADS

- Design Basis
- Load Classification
- Pipe Stiffness
- Determining Required Pipe Stiffness
- Vertical Deflection

DURABILITY REQUIREMENTS SYSTEM COMPONENTS

- Secondary Loads
- Manholes
- Joints and Fittings
- Valves

PIPE INSTALLATION

An excellent section in the SAPPMA Manual covers the following on pipe installation procedures:

- Pre-construction Activities
- Excavation
- Embedment
- Pipe Laying and Jointing
- Backfilling
- Anchoring
- Support Spacing for Mine Pipes
- Support Spacing for Soil, Waste and Vent Pipes
- Site Tests

REFERENCES

1. SANS 791: 2004. Unplasticised poly(vinyl chloride)[PVC-U] sewer and drain pipes and pipe fittings
2. SANS 1601: 2004. Structured wall pipes and fittings of unplasticised poly(vinyl chloride) [PVC-U] for buried drainage and sewerage systems
3. SANS 967: 2004. Unplasticised poly(vinyl chloride)[PVC-U] soil, waste and vent pipes and pipe fittings
4. Southern African Plastics Manufacturing Association [SAPPMA] Technical Manual 2013, 4th Revision

ACCREDITATIONS



ISO 9001- FLO-TEK Botswana



ISO 9001- FLO-TEK South Africa



SANS 966-1 - PVC-U Pressure Pipe System



SANS 966-2 - PVC-M Pressure Pipe System



SANS 791 - PVC-U Sewer & Drain Pipes and Fittings



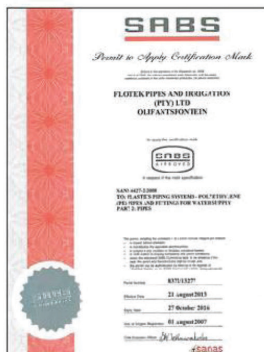
SANS 967 - PVC-U Soil, Waste and Vent Pipes and Fittings



SANS 1283 - PVC-M Pressure Pipe in Underground Mining



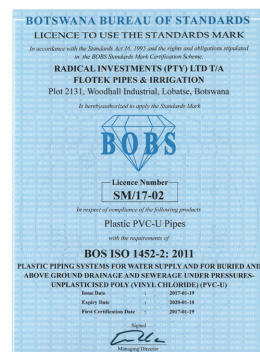
SANS 1601 - PVC-U Pipes for Buried Drainage & Sewerage Systems



SANS 4427 - HDPE Pipes and Fittings



SANS 791 - PVC-U Sewer & Drain Pipes and Fittings



ISO 1452-2 Pipes, Drainage & Sewerage under pressure



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