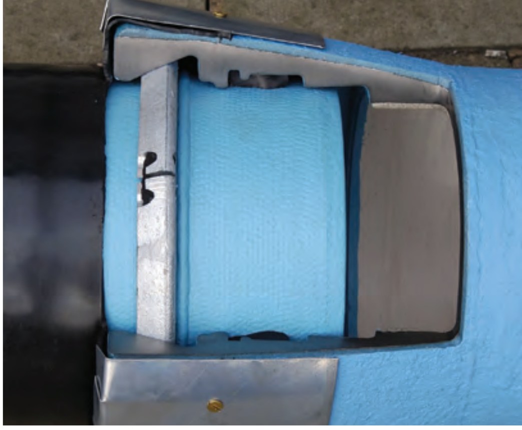
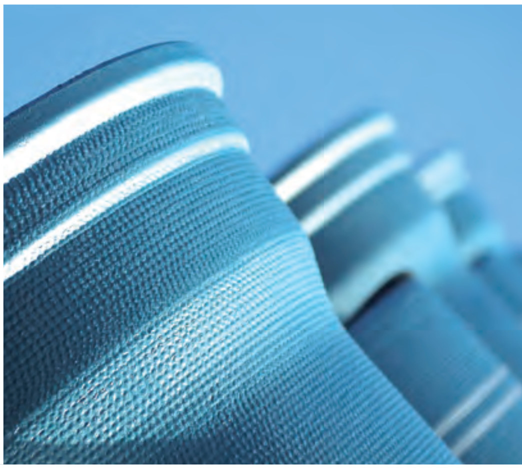


Installation Guide
Water and Sewer

Pipes and Fittings



Certificate No. FM12908

A World of Choice

Saint-Gobain PAM UK is the UK's leading supplier of ductile iron pipe systems for potable water and sewerage applications.

Saint-Gobain PAM UK is part of the Saint-Gobain Pipe Division, a global company with a presence in Europe, Asia, South America and the Far East. The pipe division has over 10600 employees and sells products in 120 different countries with over 40,000km of ductile iron pipes being installed worldwide per year.

The Saint-Gobain Pipe Division is part of the Saint-Gobain Group, one of the world's leading multi-nationals, which currently employs over 209,000 people in 59 countries and over 1200 consolidated companies.

Everyone at Saint-Gobain PAM UK is dedicated to meeting customer expectations. We encourage open communication between staff, customers and related organisations to make a positive impact on the future of the marketplace and help improve the quality of life for people worldwide.

UK customers benefit from the global network of the Pipe Division through our long term commitment to improve and develop innovative products and processes. We achieve this through continual investment in Research and Development on a global scale. In excess of £10million per annum is spent on R&D programmes worldwide, meaning an unrivalled product range of next-generation, ductile iron pipe systems being constantly developed and delivered to the UK market.

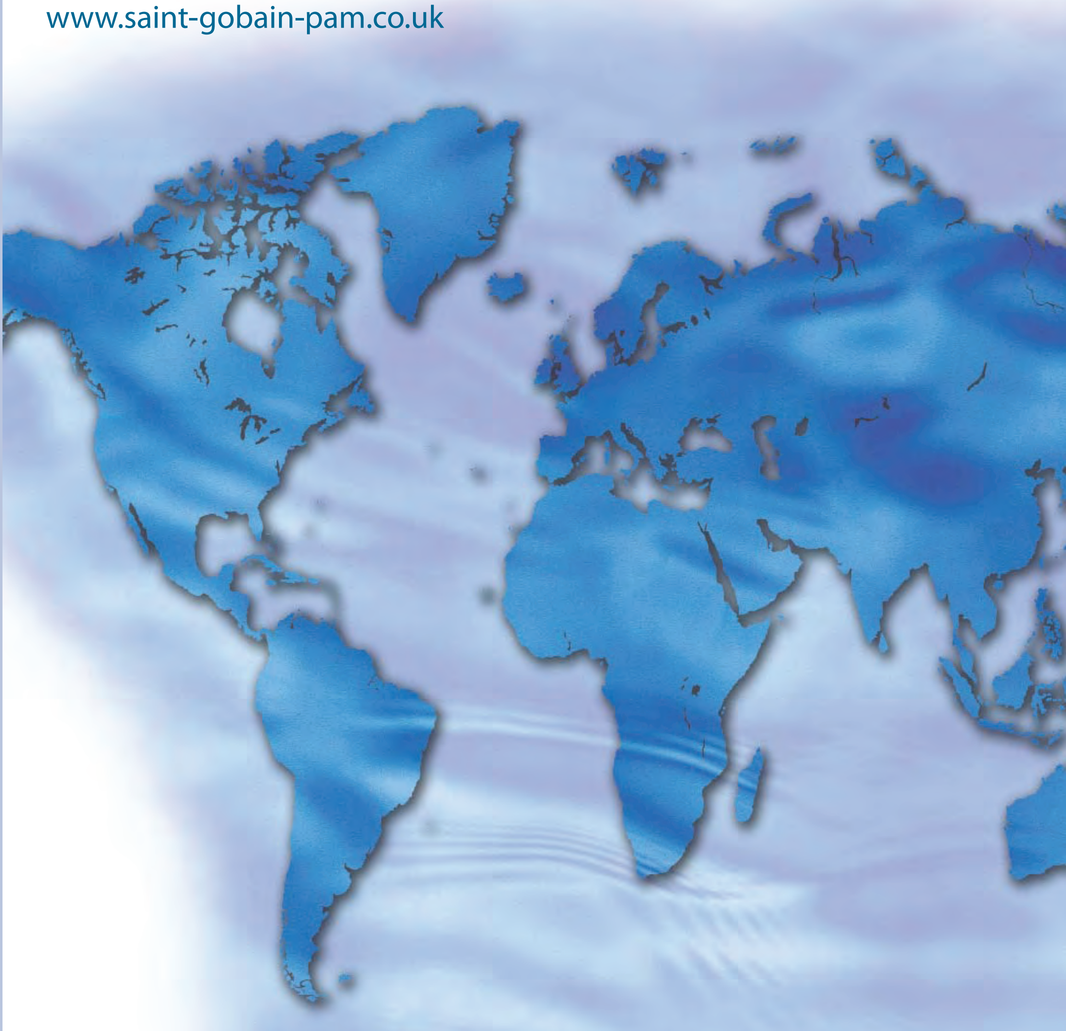
Sustainable development lies at the heart of Saint-Gobain's corporate culture.

Its state-of-the art technologies and focus on research and development have enabled us to consistently provide our customers with quality, sustainable, reliable and ergonomic solutions.

Water and sewerage pipelines are infrastructures created to last for several generations. Sustainable development depends on 'long lasting' rather that 'disposable' installations.

Saint-Gobain PAM UK has taken on board these principles and works to provide effective solutions for the environment.

For further information on Saint-Gobain PAM UK visit
www.saint-gobain-pam.co.uk



Contents

Introduction

Section 1 Pre Installation

Section 2 Pipe Laying

Section 3 Post Installation

Installation Guidelines

Introduction

This installation guide is aimed at organisations and individuals responsible for the installation of ductile iron pipes and fittings for the water industry. These instructions are based on best practices, which are acknowledged within the industry. They provide clear and concise guidance for the handling and installation of ductile iron pipelines, from delivery through to commissioning, and are designed to ensure that the performance of ductile iron pipes and fittings is not compromised during installation.

It is the responsibility of the contractor to ensure that competent personnel are employed for all site work.

This installation guide forms part of the Induct Plus scheme, which has been developed by Saint-Gobain PAM UK as an installation support initiative which aims to give confidence to water utilities and contractors, assuring that pipes and fittings will be installed effectively and in optimum condition. The scheme offers on site training, evaluation and assessment of the installation of ductile iron pipes and fittings, leading to the certification of successful contractors upon completing the scheme.

Standards and Specifications

Saint-Gobain PAM UK's ductile iron pipes and fittings are manufactured in accordance with BS EN 545 (1) and BS EN 598 (2) and where applicable they are marked with the BSI Certification Quality Mark (Kitemark).

General requirements for the installation of pipelines are contained in the Civil Engineering Specification for the Water Industry (3), Standard Specification for Water and Sewerage Schemes (applicable in Scotland and Northern Ireland) (4), BS 8010 and EN 805 (5) a code of practice for pipeline installation and Sewer for Adoption (6th Edition) (6). These publications are used as the basis for this document, with additional information provided as necessary.

DWI Regulation 31.4.a

All materials that can come into contact with potable water, including pipe linings, lining repair material, joints and jointing lubricants must comply with the requirements of Regulation 31 of The Water Supply Regulations, England and Wales (7), or The Water Supply Regulations for Scotland (8).

These instructions include the use of procedures and/or substances that may cause injury or affect health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Information contained in these instructions is given in good faith. The sole responsibility for correct installation of pipes and fittings is that of the contractor. Saint-Gobain PAM UK cannot accept any responsibility for actions taken as a result. The contract specification and drawings will prevail if they differ from these instructions.

Section 1

Pre Installation

1.1 Product Identification

Ductile iron

Ductile iron is an iron/carbon/silicon alloy. With the addition of magnesium to the molten iron the graphite forms in spheres rather than flakes. This transformation eliminates brittleness and produces a strong, ductile material.

1.1.1 Pipes & Fittings - for Potable Water

Pipes and fittings manufactured by Saint-Gobain PAM UK to BS EN 545 for the conveyance of potable water can be identified by the following methods.

PAM Natural Pipes – DN80-800

Externally coated with signal blue epoxy and marked with the manufacturing standard, pressure class, PAM logo and product range as shown in Fig. 1.1.1. The nominal diameter (DN) in mm can be found on the inside of the socket of the pipe (see Fig. 1.1.2).

Internally, the pipes will either have blast furnace cement, which has a grey appearance (System CL) or cement mortar lining with an epoxy sealcoat, which has a green appearance (System XL).

Large diameter water pipe DN900-2000

Externally coated with black bitumen and marked with the manufacturing standard, pressure class, PAM logo and product range as shown in Fig. 1.1.1. The nominal diameter (DN) in mm can be found on the inside of the socket of the pipe (see Fig. 1.1.2).

Internally these pipes are supplied with blast furnace cement which has a grey appearance (System CL).

Fig. 1.1.2

Fig. 1.1.1

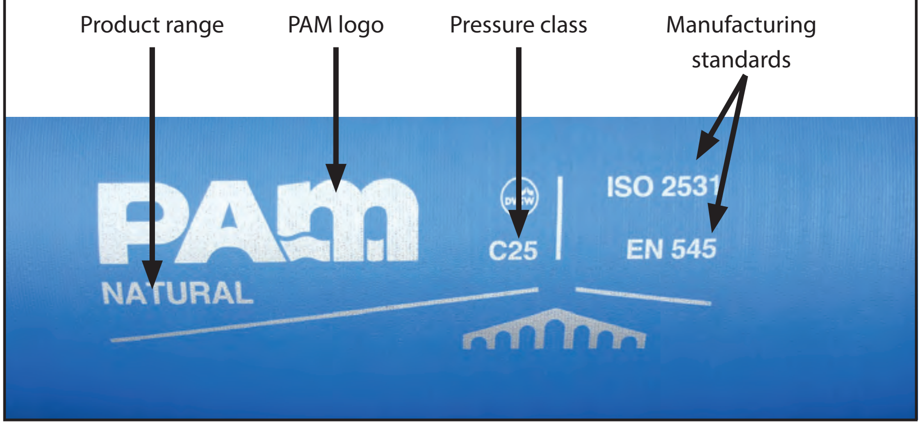
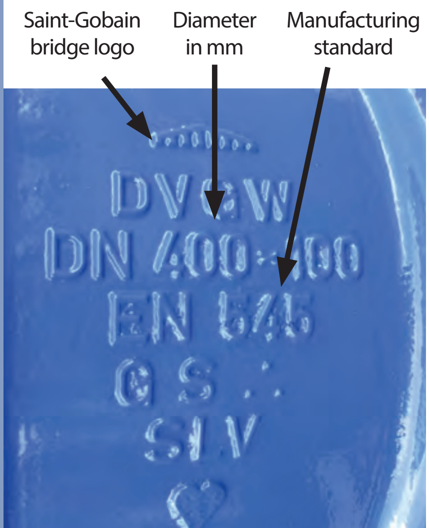


Fig. 1.1.3



Fittings

All fittings have a blue epoxy coating both externally and internally and are marked with the diameter, on the outside of the socket or alternatively on the body of the fitting. They are also marked with the manufacturing standard number (EN545) either cast on or on a sticker and with the Saint-Gobain bridge logo (see Fig.1.1.3) The body of the fitting may also have the fitting identification.

1.1.2 PAM Integral/Integral Plus pipes and fittings for sewerage

Fig. 1.1.5

Pipes and fittings manufactured by Saint-Gobain PAM UK to BS EN 598 for the conveyance of wastewater and sewage can be identified by the following methods.

Pipes

Externally coated with red epoxy and marked with the manufacturing standard, PAM logo and product range as shown in Fig. 1.1.4. The nominal diameter (DN) in mm can be found on the inside of the socket of the pipe (see Fig. 1.1.5). PAM Integral Plus pipes also have a blue paint section on the socket face (see Fig. 1.1.6).

Internally the pipes are lined with high alumina cement mortar which has a white appearance.

Fig. 1.1.4

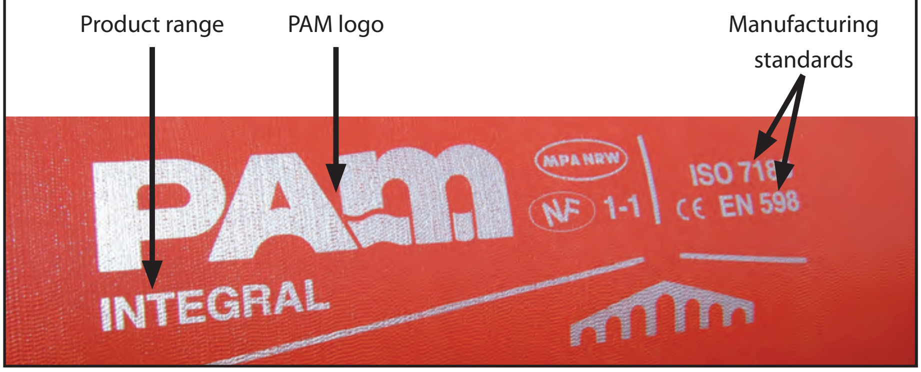
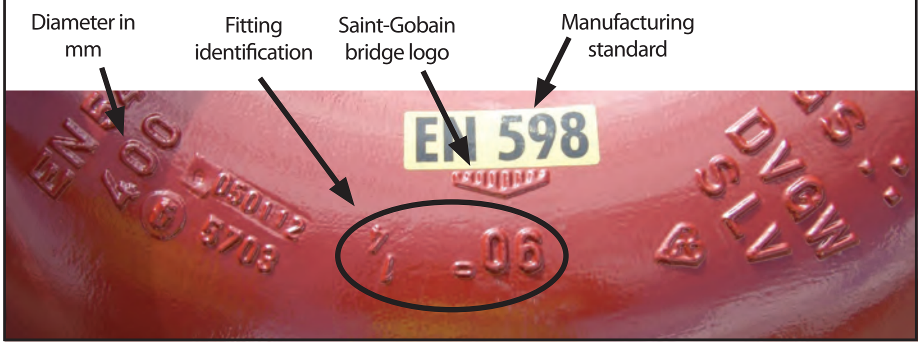


Fig. 1.1.6

Fittings

Fittings have a red/brown epoxy coating both externally and internally and are marked with the diameter on the outside of the socket or alternatively on the body of the fitting. They are also marked with the manufacturing standard number (EN598) either cast on or on a sticker and with the PAM logo (see Fig. 1.1.7). The body of the fitting may also have the fitting identification.

Fig. 1.1.7



1.1.3 Rapid Joint

Pipes

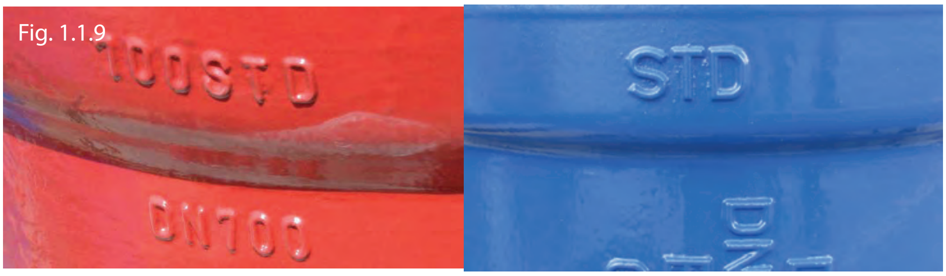
All Saint-Gobain PAM UK's pipes and fittings with push-fit joints DN80-2000 are manufactured with the Rapid Joint. Pipes are marked with the DN and with the letters 'STD' (standard push-fit joint) inside the socket (see Fig 1.1.8).

Fig. 1.1.8

Fittings

Fittings are marked with the letters 'STD' (standard push-fit joint) on the outside of the socket or sometimes inside the socket (see Fig. 1.1.9).

Fig. 1.1.9



Rapid gaskets

Fig. 1.1.10

The Rapid gasket has a fish tail profile (see Fig. 1.1.10). Gaskets intended for use with potable water are made from EPDM rubber whereas gaskets intended for use with waste water and sewage are made from Nitrile rubber.

Gaskets intended for use with potable water are embossed with the size DN, with the letters 'STD' (standard push-fit joint) and 'EPDM' (see Fig. 1.1.11). Gaskets uti DN600 can be identified by a double blue circumferential band (see Fig.1.1.12).

Fig. 1.1.11

Fig. 1.1.12

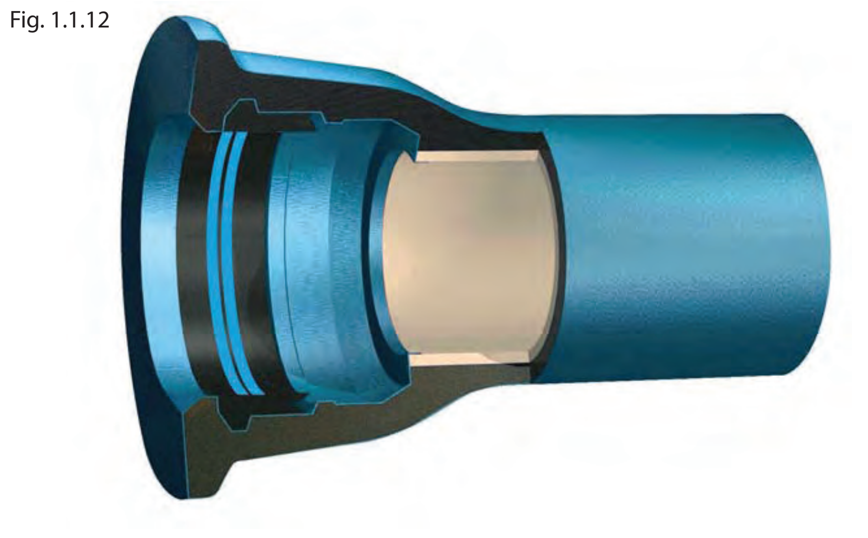


Fig. 1.1.13

Gaskets intended for use with waste water and sewage can be identified, throughout the size range, by two yellow circumferential bands and are embossed with the DN and with the letters 'STD' (standard push-fit joint) (see Fig.1.1.13).

Rapid Vi Joint (Anchor)

This system uses standard pipes and fittings with a modified gasket containing moulded-in stainless steel inserts. For use with potable water and sewerage on both pipes and fittings UTI DN600 where self-restrained joints are required (see Fig. 1.1.14).

These gaskets are only available in EPDM and therefore they may not be suitable for some sewerage applications.

Please note that test and working pressures are restricted when using anchor gaskets (see Table 2.3.1).

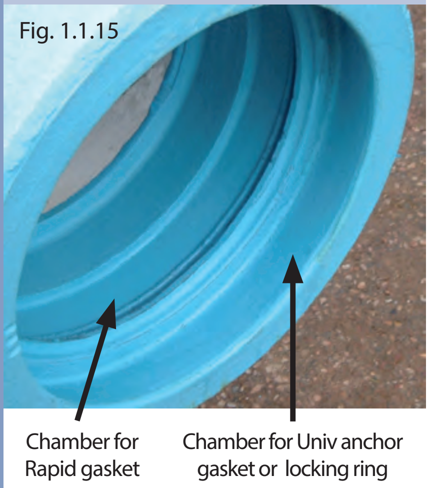
Fig. 1.1.14

PAM Universal socket and joints

The PAM Universal socket is used on pipes, DN80-1200, where self-restrained joints are required. It is used with the Universal Rapid Vi and Universal Rapid Ve joints and on directional drilling pipe joints (see Fig. 1.1.15).

The joint utilises the same gasket as an unanchored joint, but has an elongated socket and does not have the collarette.

Fig. 1.1.15



PAM Universal Rapid Vi Joint

The Universal Rapid Vi joint is for use on pipes DN80-600 where self restrained joints are required.

The joint utilises the same gasket as the unanchored Rapid joint. Anchorage is provided by a rubber retaining ring with toothed inserts (see Fig.1.1.16 and Fig.1.1.17).

Fig. 1.1.16

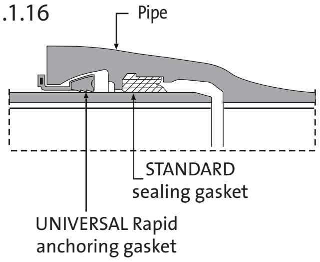
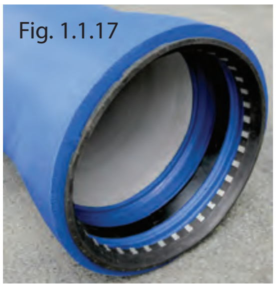


Fig. 1.1.17



PAM Universal Rapid Ve Joint

The Universal Rapid Ve joint is for use on pipes DN80-1200 where self restrained joints are required.

The joint utilises the same gasket as the unanchored Rapid joint. Anchorage is provided by the addition of a welded bead onto the pipe spigot and a locking ring which abuts the welded bead (see Fig. 1.1.18)

Fig. 1.1.18

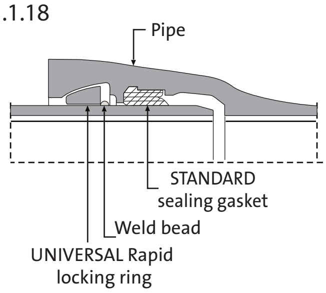


Fig. 1.1.19

Fig. 1.1.20

There are four types of locking ring dependent upon pipe size:-

1. DN100-200 (see Fig.1.1.19)
2. DN250-350 (see Fig. 1.1.20)
3. DN400-700 (see Fig. 1.1.21)
4. DN800-1200 (see Fig. 1.1.22)

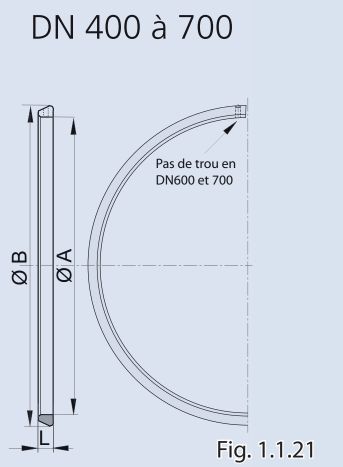


Fig. 1.1.21

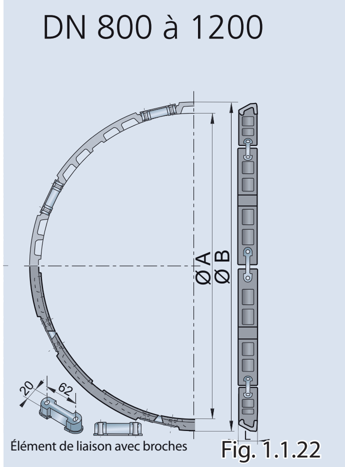
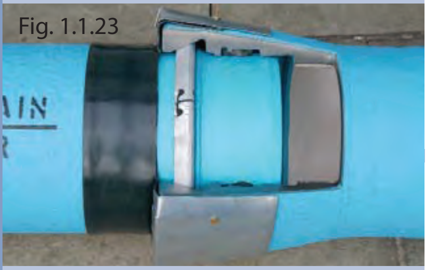


Fig. 1.1.22

PAM Direxional

Fig. 1.1.23



PAM Direxional Pipe is a pipeline system designed for directional drilling (see section 2.6). PAM Direxional drilling pipes can be used for both water and sewer applications and are available from DN100-1000. It is jointed by a self-anchored push fit double chambered socket and spigot with a welded bead. External protection consists of 200mg Zinc plus 5mm cement (ZM-U) coating for DN100-700 and thick sprayed polyurethane based (PUX) coating for DN800-1000. Internal protection for water pipes (EN545) is Blast furnace cement and for sewer pipes (EN598) a high alumina cement. The joint is protected from abrasive conditions by the use of a rubber protective collar and a metal sheet cone (see Fig. 1.1.23).

Rapid Ve Joint (Mechanical)

The Rapid Ve joint is used for DN350-1200 water and DN150-1200 sewer pipes, as an alternative to Universal joint when restrained joints are required. The joint utilises the same socket and gasket as the unanchored Rapid joint. Anchorage is provided by the addition of a weld bead on the pipe spigot, a locking ring (single piece uti DN700 and segmented for DN800-1200) which abuts the weld bead and a bolted gland which tightens against the pipe socket using hook bolts and retains the locking ring (see Fig. 1.1.24).

Fig. 1.1.24

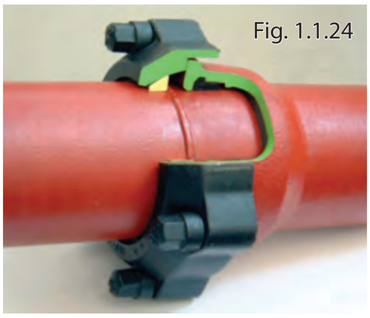
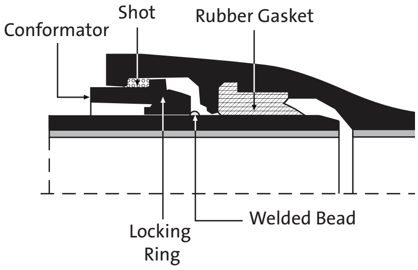


Fig. 1.1.25

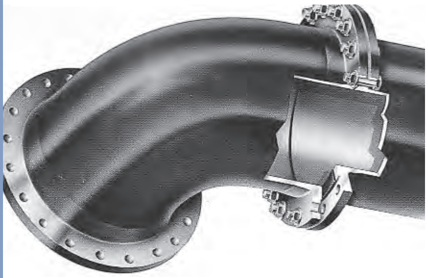


PAMLOCK

The Pamlock joint is used on pipes and fittings, DN1400-2000 where self restrained joints are required.

The joint utilises the same gasket as the unanchored Rapid joint. Anchorage is provided by the addition of a welded bead onto the pipe spigot, a segmented locking ring which abuts the welded bead, a conformator, which restricts the diameter of the socket mouth and is held in place by two locking clamps and shot (see Fig. 1.1.25).

Fig.1.1.26



Flanged joints

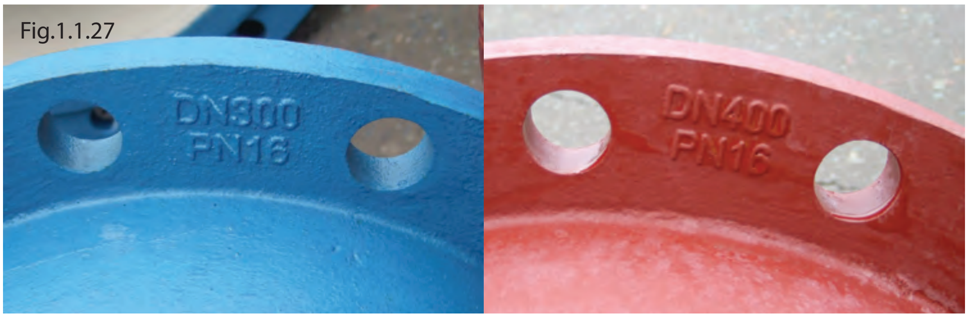
Flanged joints are both rigid and self-anchoring and are used primarily for above ground applications, **<u>it is not</u> recommended that flange systems are buried**.

The seal is achieved by axial compression of a flat gasket by clamping two flange faces together with bolts (see Fig. 1.1.26).

Fixed flange joints

Pipes with welded flanges have the DN and PN rating cast on the rear of the flange (see Fig. 1.1.27).

Fig.1.1.27



Fittings have the diameter in mm and PN rating of the flange cast behind the flange or on the fitting body (see Fig. 1.1.28).

Fig.1.1.28

Fig.1.1.29

Adjustable Flanges

Adjustable flanges are available on selected fittings DN80-600 and flange on socket tee's to DN1200 where the branch is DN600 or less. The flange is a moveable flange mounted on the fitting body and provides easy alignment of the flanges (see Fig. 1.1.29).

The diameter and PN rating of the flange is cast on the moveable flange (see Fig. 1.1.30).

Fig.1.1.30

Flange gaskets

Fixed flanges utilise a flat rubber gasket, 3mm thick and 80 IRHD hardness. These can be supplied as full face gaskets (see Fig. 1.1.31) or with two 'ears' which aid alignment (see Fig. 1.1.32).


Fig.1.1.31


Fig.1.1.32

Adjustable flanges and fixed flanges DN60, DN125, DN1800 and DN2000 use gaskets which have metal inserts, which, because of the stiffness, help in assembly and reduce the risk of extrusion in service (see Fig. 1.1.33 and Fig. 1.1.34).

Fig.1.1.33

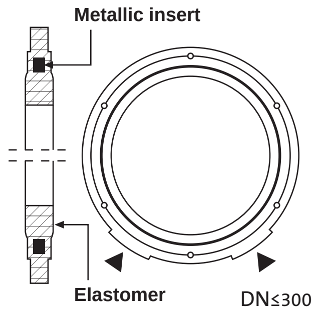
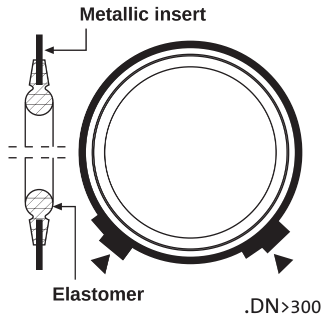


Fig.1.1.34



When using these gaskets, longer bolts will be required and a different torque setting is used (see Table 2.11.2).

1.2 Handling & Storage

It is important to consider that pipes and fittings can be heavy items and can cause injury if mishandled. Particular attention must be paid to all aspects of safety when handling. These instructions are intended for guidance to ensure that the quality of pipes and fittings is not impaired during handling. Proper regard must be paid to all appropriate health and safety regulations in handling pipes and fittings. The contractor should not rely on these instructions for any purpose other than maintaining the quality of pipes and fittings during handling, storage and installation. They should not overrule any site safety procedures.

The stock ground area should provide a firm foundation with a suitable approach road for vehicles. It is essential that pipe weights, type of stacking, outreach required and site conditions are taken into account when determining the suitability of lifting equipment. The lifting equipment must be able to cope with the weight of the load and retain the load safely in the event of power failure. Ensure that the machine is operating on hard, level and stable ground. Stacks should be arranged to provide a safe vehicular and pedestrian access.

All pipes should be secured to the lorry, trailer or railway wagon during transit to minimise movement. The preferred means of securing will depend upon the coating system on the pipes e.g. straps for standard bitumen/epoxy coatings. The pipes will be loaded on to the vehicle in bundles or singly in a straight-sided formation using timbers and chocks.

Ductile iron pipes and fittings are not generally susceptible to damage by impact, under normal use, but adverse handling can result in damaged coatings and linings.

Damage to pipes and fittings may be attributable to:

- Insecure load on lorry or wagon.
- Improper use of handling equipment.
- Use of unsuitable handling equipment.
- Incorrect stacking methods.
- Unloading on uneven or sloping ground.
- Impact between pipes.

On receipt, all pipes and fittings should be inspected for damage to:

- The pipe or fitting itself.
- Cement mortar linings.
- Factory applied wrapping.
- Jointing surfaces.

All damaged pipes or fittings should be set aside for repair and the supplier should be contacted.

Bundled Pipes

Pipes DN80-400 are supplied in bundles. Larger diameter pipes will be supplied as singles. Delivering pipes in bundles provides a number of advantages during transportation and for pipe laying contractors, stock ground personnel and site operatives:

- Ease of transportation
- Time and effort minimised in handling
- Improved on-site safety
- Effective utilisation of stock ground space
- Risk of damage to the protection systems is reduced

Water pipes DN80-300 are fitted with protective plastic end caps on both the socket and spigot ends.

Standard pipe bundles comprise of two base timbers, with raggle boards between each row of pipes. The bundle is secured by steel retaining straps, which incorporate the base timbers.

Bundles should never be lifted by their retaining straps.

Off-loading Pipes

The lifting equipment must be able to support the weight of the bundle and retain the load safely in the event of power failure (see Table 1.2.2). If it can not, refer to Section 'Dismantling bundles' on how to dismantle pipe bundles and remove the pipes individually.

Table 1.2.1: Pipe bundles dimensions and weights for **5.5m pipes**

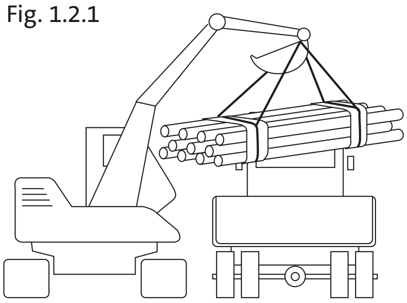
DN	Number of pipes per bundle	Overall Width (m)	Overall Height (m)	Overall Length (m)	Approx. Weight of Bundle (tonne)
80	30	1.1	0.5	5.8	2.6
100	27	1.1	0.6	5.8	2.8
150	18	1.1	0.7	5.8	2.8
200	10	1.2	0.6	5.8	2.1
250	8	1.1	0.7	5.8	2.1
300	8	1.3	0.8	5.8	2.7
350	6	1.2	0.9	5.8	2.5
400	6	1.4	1.0	5.8	2.9

Table 1.2.2: Pipe bundles dimensions and weights for **6m pipes**

DN	Number of pipes per bundle	Overall Width (m)	Overall Height (m)	Overall Length (m)	Approx. Weight of Bundle (tonne)
80	15	0.6	0.4	6.3	1.3
100	15	0.6	0.5	6.3	1.6
150	9	0.6	0.6	6.3	1.4
200	6	0.7	0.5	6.3	1.3
250	4	0.6	0.6	6.3	1.1
300	4	0.7	0.8	6.3	1.4
350	6	0.8	0.8	6.3	2.7
400	5	1.0	0.9	6.3	2.7

Weights are provided for estimation purposes only and actual values may vary from those provided in this table

Fig. 1.2.1



By Excavator/Crane

When lifting with slings, use two broad webbing slings made of Terylene, nylon or other synthetic material capable of withstanding the required loads. The slings should be of a length adequate to make an acute angle between the slings at the hook so as to reduce the risk of pipe slippage.

Never attempt to utilise chains or wire ropes as slings, these may cause slippage and/or damage to the pipes external protection system and/or bundle assembly.

Only lift complete bundles (See Fig. 1.2.1). Do not attempt to lift multiple loose pipes with slings.

When the excavator/crane operator does not have a clear view of the load, a competent person must guide the operator from a safe position.

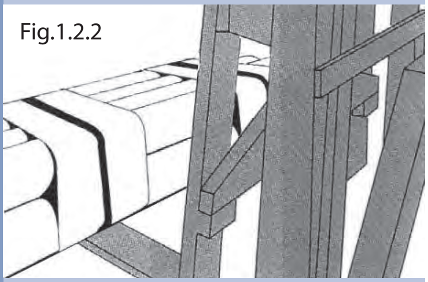
It is preferable to use guide ropes to steady the load and the bundle should be lifted smoothly without sudden jerking movements.

Take care when lifting, using and removing slings from around the pipes, to avoid damage to the pipes external protection system.

The excavator/crane operator's attention is drawn to the latest Health and Safety Guidance Note and Code of Practice for Lifting Operation and Lifting Equipment.

Ensure that the forklift is operating on hard, level and stable ground. The forklift must be capable of lifting the load (See Table 1.2.1). If not capable of lifting a complete bundle refer to Section 1.2.2 and remove either one layer of pipes at a time, or individually.

Fig.1.2.2



By Forklift

Ensure that the fork blades do not damage the pipe or external protection when feeding the forks under and back out of the pipes (See Fig. 1.2.2), and that the pipes do not move on the forks when lifting or manoeuvring.

Stacking Bundled Pipes

The forks of the forklift must be positioned under the protective bands around the bundle. When lifting pipes with factory applied wrapping by forklift truck, the metal forks should be protected using a suitable type of padding to prevent damage to wrap. The stacking area should provide a firm foundation with a suitable approach road for vehicles. Stacks should be arranged to provide a safe vehicular and pedestrian access. Bundles are provided with base timbers and these can be laid directly onto a good, level, hard-standing surface. The bundles should be stacked one on top of the other with the pipe axes parallel.

Each pipe bundle is secured to two base timbers that can be laid directly onto a level hard-standing surface.

The maximum stack height should not exceed five bundles. However, this may need to be reduced depending on site conditions and location.

Dismantling Bundles

Fig. 1.2.3

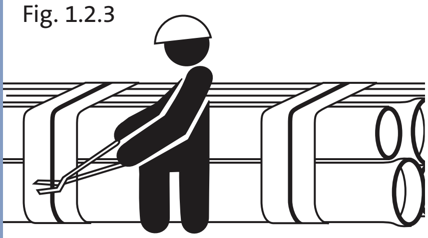
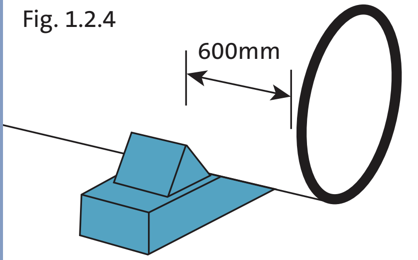


Fig. 1.2.4



If one side of the bundle is slightly higher than the other, then cut the straps from the highest side. ***Do not use the pipes as a lever to break the straps.***

Straps are applied under tension, thus extreme care should be taken when cutting. Use strap cutting tools or suitable tin shears to cut the inner straps first, preferably at the bottom of the bundle (See Fig. 1.2.3). The straps should be disposed of carefully.

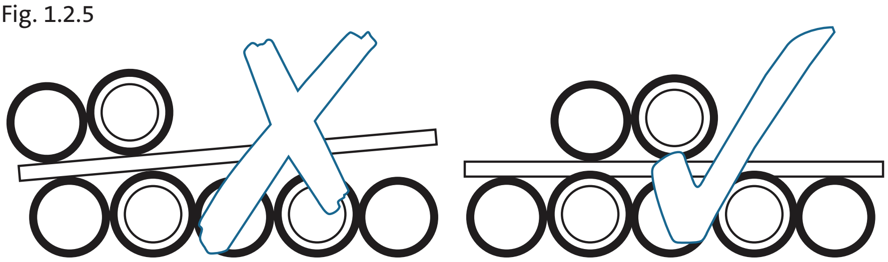
Where bundles need to be split to off-load, pipes should be lifted using either chains with padded hooks, slings or forklift (see Section 1.2.2). Pipes should be taken from the outside first so as not to over balance the raggle boards or base timbers with partially completed bundles.

Where a forklift of sufficient capability is available, pipes may be off-loaded a layer at a time taking care to avoid damage to the pipes external protection system with the forklift blades.

Off-loaded pipes should be re-located onto timber battens, placed 600mm from the pipe ends (See Fig. 1.2.4).

When only two pipes remain, move them carefully to the centre of the timber and chock them both for stability, then remove them one at a time (see Fig. 1.2.5).

Fig. 1.2.5



Damage Repairs

If necessary, repair all damage to the protection system that may have occurred. Please refer to Section 1.4 for details.

Single Pipes

When single pipes are supplied or bundles are split see Table 1.2.2 for dimensions and weight.

Water pipes DN80-300 are fitted with protective plastic end caps on both the socket and spigot ends. These should be removed if padded hooks are used for lifting and replaced when off-loaded and for storage.

Off-loading Pipes

Single pipes should be handled using either chains with padded hooks, slings or a forklift.

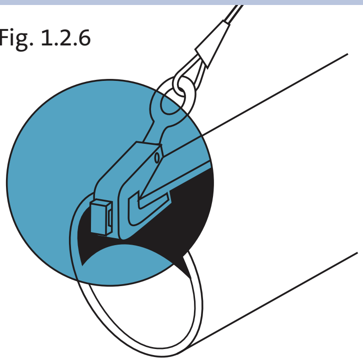
Never attempt to lift more than one pipe at a time unless it is in a bundle.

Off-loaded pipes should be re-located onto timber battens placed 600mm from the pipe ends (see Fig. 1.2.4).

Chains and Hooks

Use padded hooks that are of the correct size and shape to locate positively in the pipe ends (see Fig. 1.2.6) and work from a stable lifting area.

Fig. 1.2.6



Always use padded hooks for protection of the coating and lining.

Use chains and hooks that are able to cope with load and use a spreader bar wherever possible (see Fig. 1.2.7).

Fig. 1.2.7

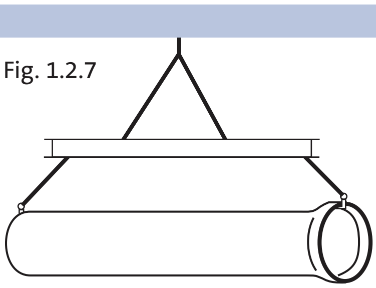
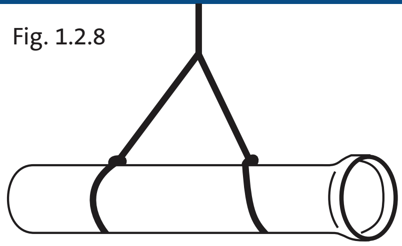


Table 1.2.3: Dimensions and weights of single pipes - Water

	WATER			SEWER	
DN	Pipe class	Average Pipe Weight (Kg/m)	Pipe Length (m)	Average Pipe Weight (Kg/m)	Pipe Length (m)
80	C40	12.0	5.5 or 6.0	13.0	6.0
100	C40	15.0	5.5 or 6.0	16.0	6.0
150	C40	22.0	5.5 or 6.0	23.5	6.0
200	C40	30.0	5.5 or 6.0	31.0	6.0
250	C40	42.0	5.5 or 6.0	40.5	6.0
300	C40	55.5	5.5 or 6.0	51.0	6.0
350	C30	69.0	5.5 or 6.0	66.5	6.0
400	C30	79.5	5.5 or 6.0	78.0	6.0
450	C30	94.0	5.5 or 6.0	92.5	6.0
500	C30	111.0	5.5 or 6.0	106.5	6.0
600	C30	150.5	5.5 or 6.0	138.0	6.0
700	C25/C30	188.0/217.9	6.0/5.5 or 7.0	201.0	6.0 or 7.0
800	C25/C30	213.0/267.0	7.0	243.5	7.0
900	C25/C30	260.0/279.0	7.0	291.5	7.0
1000	C25/C30	311.5/334.0	7.0	343.0	7.0
1200	C25	461.5	8.0	507.5	8.0
1400	C25	634.5	8.0	679.0	8.0
1600	C25	807.5	8.0	851.5	8.0
1800	C25	995.0	8.0	1036.5	8.0
2000	C25	1210.0	8.0	1242.0	8.0

Weights are provided for estimation purposes only and actual values may vary from those provided in this table

Fig. 1.2.8



Slings

Use two broad webbing slings made of Terylene, nylon or other synthetic material capable of withstanding the required loads (see Fig. 1.2.8).

Never attempt to utilise chains or wire ropes as slings as these might allow the pipes to slip, or cause damage to the external protection system. Never attempt to lift multiple loose pipes.

Forklift

Take care when lifting, using or removing slings from around the pipes, to avoid damage to the external protection system.

Ensure the forklift is operating on hard, level and stable ground.

With wrapped pipes, the forks of the forklift must be positioned under the protective bands. Where pipes have no protective band (as when breaking down bundles) extra care should be taken to avoid damage with the forklift blades.

Stacking Non-bundled Pipes

Where individual pipes are to be stacked in a central stock ground for storage and held pending further distribution, it is recommended that the parallel stacking method is used, using wooden battens between rows. The stacking area should provide a firm foundation with a suitable approach road for vehicles. Stacks should be arranged so as to provide safe vehicular and pedestrian access. During stacking and removal operations, safe access to the top of the stack is essential. In bad weather conditions, when pipe surfaces may become slippery, consideration should be given to the use of lightweight staging placed on top of the stacks. Pipes should be stacked on a base of raised wooden battens positioned approximately 600mm from each end of the pipe (see Fig. 1.2.9). The bottom layer of pipes should be securely anchored. Battens should also be placed across the pipes between each tier approximately 600mm from each end of the pipe. The sockets of pipes in each successive tier should be reversed and the battens should be of sufficient thickness to avoid metal-to-metal contact (see Fig. 1.2.10).

Fig. 1.2.10

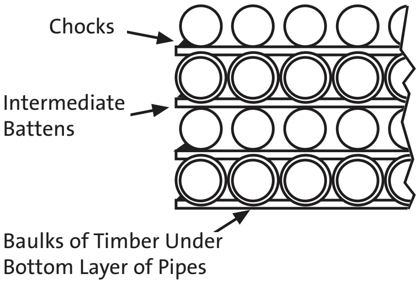
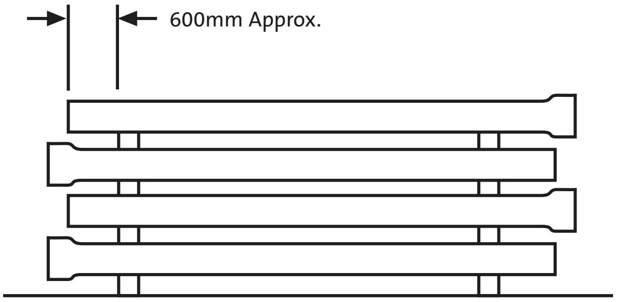


Fig. 1.2.9



An adequate number of chocks should be wedged under the outer pipes of each tier and nailed to the timber bearers to ensure stability (see Fig. 1.2.10). Pipes may be rolled into position along the battens, thus facilitating stacking or removal from the end of the stack, however, care must be taken to ensure correct alignment to minimise any possible coating damage.

The maximum recommended number of layers in a stack is given in Table 1.2.4. However, this may need to be reduced depending on site conditions and location.

If tape wrapped pipes are to be stacked then these stacks should not be more than 4 pipes high DN 80-800 and as Table 1.2.4. for pipes DN 900-2000.

Table 1.2.4.: Stacking of single pipes

Nominal size DN	Maximum recommended number of layers in stack
80-100	12
150	15
200	10
250-500	8
600-800	6
900-1200	2
1400-2000	1

Damage Repairs

If necessary, repair all damage to the protection system that may have occurred. Please refer to Section 1.4 for details.

Handling Wrapped Pipes

Polyethylene sleeving is applied to prevent corrosive attack from the soil environment. Penetration of groundwater through small perforations will not normally affect the performance of the protection but care must be taken to minimise damage. Tears or punctures must always be repaired as detailed in section 1.4.

When receiving factory wrapped pipes (tape wrap), care must be taken to ensure that any major damage is avoided. Tape wrap is applied to isolate the pipe from its surroundings. Penetration of groundwater must be prevented so all tears, holes or punctures must always be repaired as detailed in section 1.4.

When lifting wrapped pipes, do not permit the pipes to rub against each other or other objects.

Lifting can be carried out with crane hooks inside the ends of the pipe but they must be suitably protected to prevent damage to the coatings and internal linings (e.g. rubber coated).

When lifting wrapped pipes with slings, the slings should be two broad webbing slings, each capable of lifting the load with a minimum length of 14m and made of Terylene, nylon or other suitable synthetic fibres with a recommended width greater than 80mm.

If any other method is used, it is essential that some form of protection is used on the area of the pipe that will be in contact with the lifting tackle.

Ensure that pipes are not rolled off or dropped off the transportation and that contact of pipe sockets to pipe bodies is kept to a minimum.

Storage of Wrapped Pipes

The generally accepted methods of stacking can be used but more care should be taken when storing wrapped pipes.

It is essential that when releasing the bundle straps, the pipes are not used as a lever to break the straps.

Adequate foundations must be used to minimise movement of the stack on storage and when placed correctly on the ground to ensure that stones etc. are not pressing against the pipe.

Whilst stacking, ensure that the pipes do not rub against each other and are not dropped onto the stack.

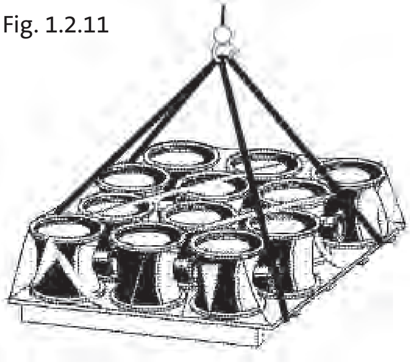
Tape wrapped pipes should not be stacked more than 4 pipes high DN80-600 and as Table 1.2.3 for pipes DN700-2000.

Storage of pipes on site

Care should be taken when stacking and storing pipes on site to ensure that there is no ingress of dirt, debris or groundwater into the pipe ends.

Loading and Off-loading Fittings

Fig. 1.2.11



Fittings are supplied either palleted or, for large diameter products, as singles.

Pallets by Excavator/Crane

The excavator/crane must be capable of lifting the total weight of the pallet and able to retain the load safely in case of power failure.

Use two webbing slings through the pallet (see Fig. 1.2.11). Ensure that the load is lifted on the level. ***Never attempt to lift more than one pallet at a time.***

By Forklift

Ensure that the forklift is operating on hard, level and stable ground.

The forklift must be capable of lifting the load. If not, the fitting should be off-loaded individually.

Stacking Pallets

It is recommended that pallets are stored with the shrink-wrap intact whenever possible. This is particularly important with epoxy coated fittings or valves as the coating may ‘chalk’ when exposed for prolonged periods in direct sunlight.

The ability to stack pallets is dependent upon the shape and size of the fitting or valve. It is not possible to give specific guidelines but the overriding consideration must be for the safety of stock ground personnel.

Off-loading Singles

By Excavator/Crane

The excavator/crane must be capable of lifting the total weight of the item and able to retain the load safely in case of power failure.

Use a webbing sling threaded through the bore of the item. Ensure that a safe balance is achieved before completing the lift. Avoid excess chafing between the sling and item as this may damage the coating.

Stacking

Fittings should be stacked according to type and diameter. They must not be in contact with the ground but on timbers or planks. Provide adequate wedging between each fitting in the base layer and at the sides (see Figs. 1.2.12 and 1.2.13).

Fig. 1.2.12

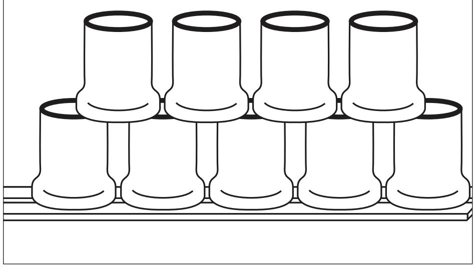
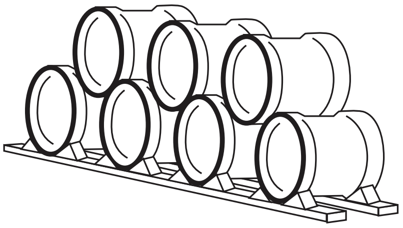


Fig. 1.2.13



Rubber Gasket

Rubber gaskets are supplied either pre-installed, with adequate protection, or in bags. Gaskets should be protected from sunlight, and contact with possible contaminants such as petrol, oil etc. must be avoided.

Gaskets should be examined carefully for damage before use. Additional guidance on the storage and protection of gaskets is given in BS 3574 (12).

Bolts and Nuts

Bolts and nuts are usually supplied ready packaged or may be factory fitted to specific items. Wherever possible these should be stored under cover in dry conditions.

1.3 Pipeline Protection

Application of site applied polyethylene sleeving

Certain precautions must be observed if the effectiveness of site applied loose polyethylene sleeving is not to be compromised by errors which may occur during installation.

Damage to the polyethylene film must be avoided at all stages during the sleeving process, i.e.

- when opening the lay-flat tubular film
- while drawing the sleeve over the pipe or fitting
- during backfilling

Note: - Pipes and fittings having additional polyethylene sleeving protection become very slippery in wet conditions.

All joints at or near fittings utilising thrust blocks should have external wrapping to prevent concrete from the thrust block from entering the joint during placement and curing.

Sleeved pipe should be lifted into the trench using padded slings or other lifting tackle that will not damage the sleeving. Any damage to the sleeving must be repaired before backfilling (see Section 1.4 for details). Care must also be taken during the placing of backfill materials to avoid sleeving damage.

It is essential to ensure that soil clods and other foreign materials are removed from the pipe or fitting surface prior to sleeving. It has been found that intense corrosion can occur beneath soil clods attached to the pipe or fitting surface, which have been over-wrapped during sleeving.

Loose polyethylene sleeving may fail to provide adequate protection if the pipe invert becomes exposed to flowing (ground) water, since this provides an effectively unlimited supply of fresh corrodent to sustain the corrosion reaction. This highlights the importance of sealing the ends of the sleeving and also the need to repair any sleeving damage incurred during installation.

Close fitting of the sleeving around the pipe barrel is very important to ensure maximum performance of the sleeving system. In the event of the sleeving being damaged allowing moisture ingress, a snug fit helps promote thin film conditions which reduce the effect of any corrosion cells which might be established.

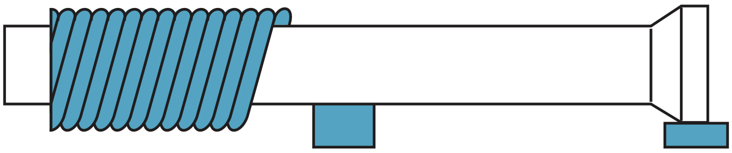
Where fittings are incorporated in a pipeline and these are surrounded wholly or partially by concrete anchor blocks, it is important that the sleeving is continued under the concrete and no areas of metal are left exposed to the surrounding backfill.

Note that joints on polyethylene sleeved iron mains should not be electrically over-bonded (e.g. as for cathodic protection) since this can stimulate localised galvanic corrosion at areas of bare metal, such as ground spigot surfaces.

Application - Pipes

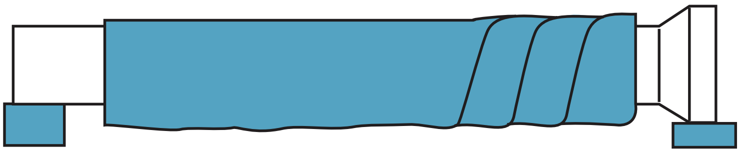
Cut a piece of sleeving approximately 0.5m longer than the length of the pipe, e.g. 6m for 5.5m pipes. Slide the sleeving onto the spigot end and bunch up behind spigot timber (see Fig. 1.3.1).

Fig. 1.3.1



Reposition the spigot timber at the spigot end, place pipe with timbers at ends and pull the sleeving over the full length of the pipe (see Fig. 1.3.2).

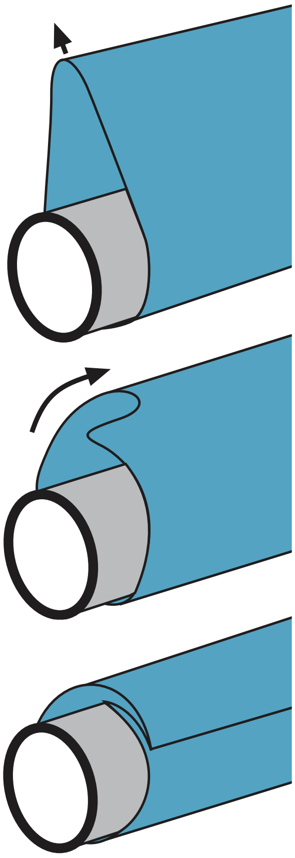
Fig. 1.3.2



As an alternative, small and intermediate diameter pipes may be supported using a specially fabricated padded ‘hairpin’ style lifting beam of appropriate design, inserted into one end of the pipe, allowing the sleeving to be pulled into position in one operation.

Ensure that the sleeving is correctly positioned relative to the spigot end. Pull the sleeving tightly around the pipe barrel and fold the surplus over the crown of the pipe to form a triple thickness layer (see Fig. 1.3.3).

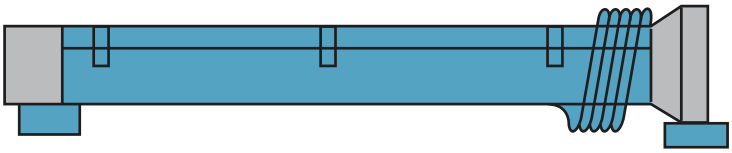
Fig. 1.3.3



Secure the fold in position using short strips of plastic adhesive tape as necessary along the length of the fold.

At the spigot end of the pipe, leave enough of the spigot exposed to make the joint (see Fig. 1.3.4).

Fig. 1.3.4



Then tape the end of the sleeving to the pipe body around the whole circumference ensuring that the tape overlaps the end of the sleeve onto the pipe. Where polyethylene sheets are used, both circumferential and longitudinal ends must be taped down. Pipes shorter than the standard length can be sleeved in a similar manner.

The excess sleeve at the socket end may be left pulled back from the socket, or alternatively it may be temporarily folded into the mouth of the socket to keep out extraneous material while positioning the pipe in the trench.

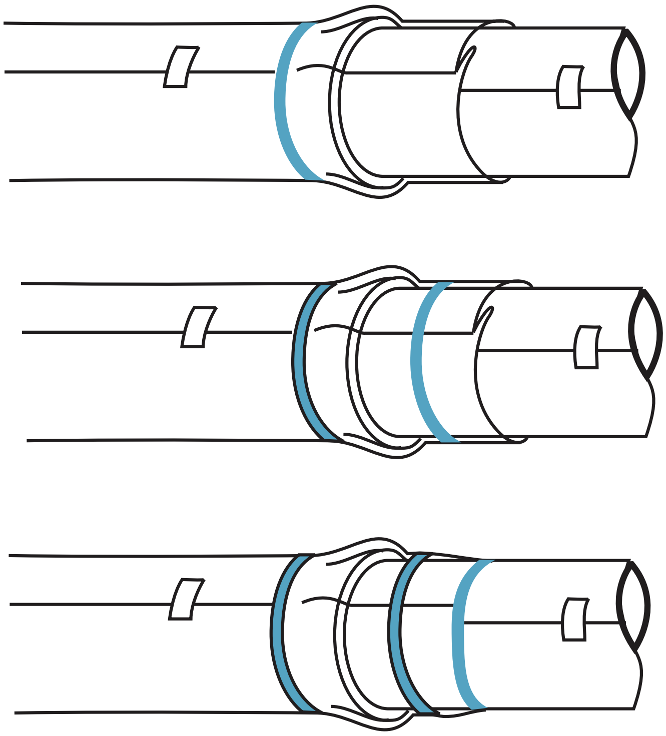
Lay the pipe in the trench with the triple layer of sleeving on the crown to provide a cushioning effect during backfilling and make the joint in the recommended manner (see Section 2.2). If the sleeving has been folded into the socket, ensure that this is removed prior to jointing. If hydraulic jointing tackle is being used an extra piece of sleeving placed between the pipe and the tackle will help to protect the sleeving around the pipe from damage.

After completion of the joint, any exposed portion of the spigot end between the sleeving and the face of the adjoining socket should be taped over using plastic adhesive tape. It should be ascertained that the sleeving or tape at the spigot end is not trapped under the gasket as this could impair the seal of the joint.

Draw the excess sleeve over the joint, fold it neatly and tape around the circumference of the pipe at the back of the socket. Make a second pass with the tape around the circumference immediately in front of the socket.

Finally, tape the end of the sleeve around the full circumference making sure that the tape overlaps onto the sleeve of the adjacent pipe to effect a seal (see Fig. 1.3.5).

Fig. 1.3.5



Damage Repairs

Should the polythene sleeving be damaged during pipe handling or installation it can easily be repaired on-site. Please refer to Section 1.4 for details.

Tape Wrapping

Application

The tape wrap is normally factory-applied to the pipe barrel leaving the socket and spigot area to be wrapped after jointing.

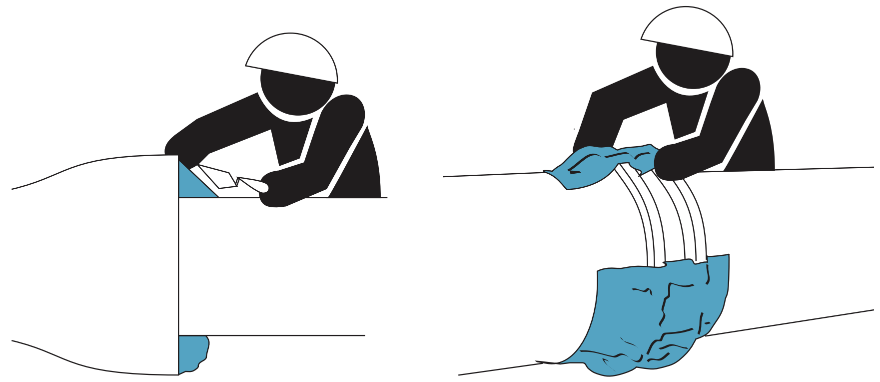
Site application is not normally recommended but can be achieved by spirally winding a hand wrap tape round the pipe barrel, overlapping the edges by 25mm or 55% depending on the pipeline environment. The tape should be pulled tight and smoothed over with a gloved hand to ensure adhesion and eliminate any air bubbles or voids may be left between the pipe and the tape.

Joint Protection

The metal area of the pipe and adjoining tape wrapping on the pipe barrel should be dry and clean.

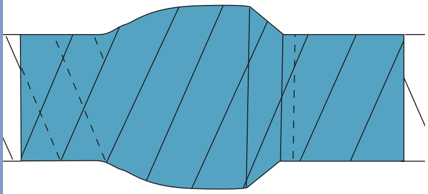
The clean, dry prepared surface should then be brush primed. ***The primer is classified as a hazardous substance and the manufacturers' instructions should be followed. If in doubt refer to manufacturers COSHH sheets.***

Fig. 1.3.6



Once dry, press a mastic blanket or LD mastic firmly into position so that full contact is made with the primed metal and a smooth profile is built up to the socket face (see Fig. 1.3.6).

Fig. 1.3.7



Using a hand grade tape, spirally wrap the joint area from the back of the socket to the spigot of the adjacent pipe, using sufficient tension to ensure conformability to the joint profile.

Joint wrapping should extend a minimum of 50mm onto the pipe barrel protection. End tape overlap between adjoining rolls should be a minimum of 150mm (see Fig. 1.3.7).

Rapid Ve Joint (Mechanical)

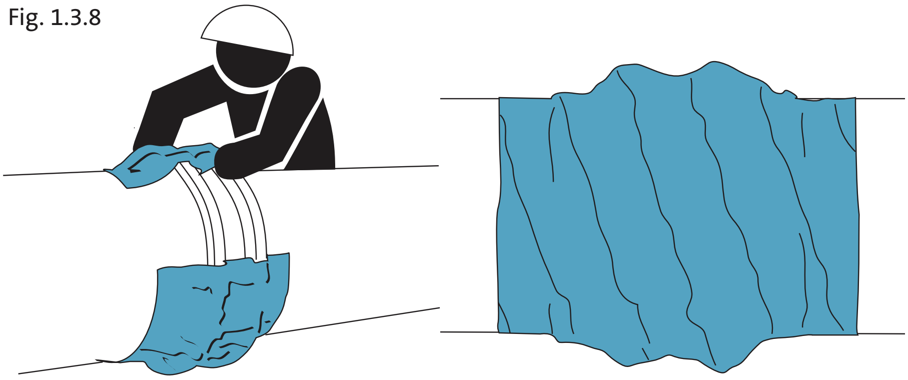
There are two methods recommended for protecting Rapid Ve joint (Mechanical) in a tape wrapped pipeline.

Method 1: Petrolatum Tape

All surfaces of the joint and adjacent area should be cleared. The clean, dry prepared surface should then be brush primed with a coat of petroleum primer. ***The primer is classified as a hazardous substance and the manufacturers' instructions should be followed. If in doubt refer to manufacturers COSHH sheets.***

A petrolatum blanket, of appropriate size for the joint, should then be placed equidistant around the invert of the joint and pushed well home around its profile to eliminate voids. Further blankets, as required, should be similarly applied extending upwards to the crown of the pipe. All overlaps should be a minimum of 75mm, with the upper blanket always overlapping the one below (see Fig. 1.3.8).

Fig. 1.3.8



Apply 150mm wide tape wrap in a spiral fashion over the joint area, commencing and finishing a minimum of 150mm onto the adjacent protective coating. Position the first 75mm of tape onto the pipe and smooth over with a gloved hand to secure adhesion. Wrap spirally over the joint employing sufficient tension to obtain conformability to the joint profile. Smooth over as before to ensure overall adhesion. The circumferential overlap should be 55% and end laps a minimum of 150mm.

Method 2: Shrink Sleeves

An alternative method of providing protection at joints is by the use of heat shrink sleeves.

All surfaces of the joint and adjacent area of the pipe should be thoroughly cleaned. Fit the appropriate size sleeve in accordance with the manufacturers' instructions, taking care not to damage the protection system already in place when applying heat to the sleeve.

Once the sleeve is shrunk around the joint, each end should be sealed by over-wrapping from the sleeve onto the pipe body, using medium duty PVC tape, to prevent the ingress of ground water.

1.4 Coating Repairs

Pipes and Fittings

The method of surface preparation required for repair of coating damage depends upon the severity and extent of that damage.

Where the damage does not expose the iron substrate or where the damage exposes less than 25 cm^2 of bare iron substrate AND the width of the damage is less than 5 mm, roughen the surface of the coating and any bare metal surfaces using a wire brush or abrasive paper. Remove all traces of rust and dust or other non-adherent material. The exposed area can be preheated to around 40°C (i.e. "hand-hot") to aid curing, using a gentle flame played over the area avoiding damage to adjacent coating. **Repairs should not be attempted in temperatures less than 5°C.**

Apply the appropriate paint i.e. two-pack solvent based epoxy paint, mixed and prepared according to the manufacturers instructions supplied with the paint, or bitumen paint, by brush in criss-cross passes until it is up to the level of the original coat and overlapping the edges. Allow to dry.

Where the damage exposes more than 25 cm^2 of bare iron substrate, or the width of the damage is greater than 5 mm, shot blast the surface of the damaged area, overlapping slightly onto coating in good condition, or thoroughly wire brush the surface to remove all traces of rust, dust or other non-adherent material. The prepared surface should be uniformly grey with a slight metallic sheen. Again the exposed area can be preheated to around 40°C (i.e. "hand-hot") using a gentle flame played over the area avoiding damage to adjacent coating.

Prime the exposed surface with two pack zinc rich epoxy primer (this should contain a minimum of 90% zinc solids by mass of dry film), mixed and prepared in accordance with the manufacturers instructions supplied with the paint to a minimum dry film thickness of 50 microns. Allow to dry in accordance with the manufacturers instructions. Apply the appropriate paint i.e. a two-pack solvent based epoxy paint, mixed and prepared according to the manufacturers instructions supplied with the paint, or bitumen paint, using a brush in criss-cross passes until it is up to the level of the original coat and overlapping the edges. Allow to dry.

PAM Integral pipes DN80-2000 and PAM Natural pipes DN80-800 should be painted with a two-pack solvent based epoxy paint of the relevant colour. Water pipes DN800-2000 should be painted with black bitumen paint.

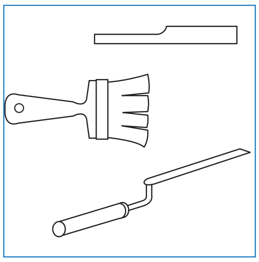
PAM Integral and PAM Natural fittings uti DN400 should be painted with a two-pack solvent free epoxy paint of the relevant colour. Fittings >DN400 should be painted with a two-pack solvent based epoxy paint of the relevant colour.

NOTE: To build up the correct coating thickness on fittings it may be necessary to use a spatula rather than a brush.

For outdoor repair in cold climates the bitumen paint may be thick and difficult to apply unless it is warmed. Warming the paint may be carried out by storing in a warm room or by lowering the paint can partially into a large container of hot water. **On no account should heat be applied directly to the bitumen paint container.** During repair the pipe must be kept dry, even to the extent of erecting a canopy.

Zinc rich paint, epoxy paints and bitumen paints are classified as a hazardous substances and the safety instructions provided by the manufacturers of the material used for repair should be carefully followed. If in doubt refer to manufacturers COSHH sheets.

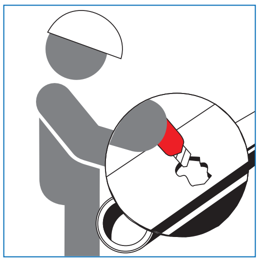
1) PEC external coating (DN80-700)



Equipment required

- Cuter
- Paint brushes
- Putty knife
- Gas torch

Repair kit: patches and mastic.

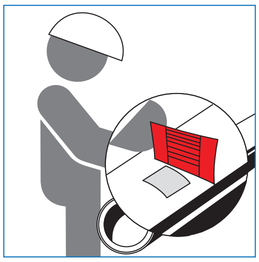


Procedure

Cut and remove the damaged PE.

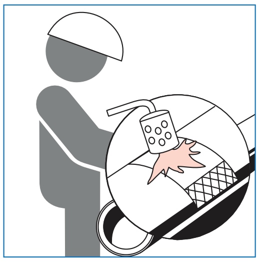
Clean and dry the exposed area.

Heat to about 60 °C.



Apply the mastic, smooth with a putty knife.

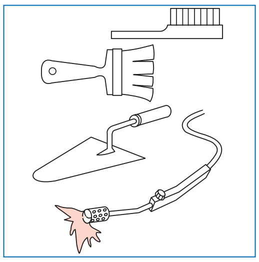
Apply the repair tape overlapping 50 mm over the edges of the cut area.



Warm the tape with the gas torch until the heat sensitive paint changes colour.

Press down the tape with a suitable glove.

2) PUX external coating (DN800-2000)

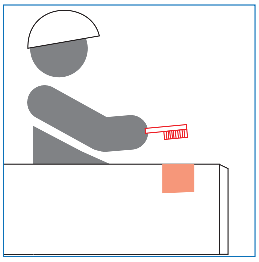


Equipment required

- Brush
- Paint brushes
- Spatula
- Gas torch

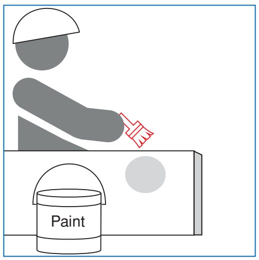
Paint ref.*:

- EUROKOTE 4820 Ivory: 1 kg (Ref. 158254) • 50 ml (Ref. 184727)



Procedure

Brush, clean and dry the surfaces to be coated.



Apply the epoxy paint with a paint brush or spatula, respecting the proportions of the components indicated on the products.

Site Applied Polyethylene-wrapping Repairs

If the polyethylene sleeving is damaged during pipe handling or installation it can easily be repaired on-site.

Wipe clean and dry the damaged area. Any torn sleeving can be either smoothed down or cut off. Cut a sheet of polyethylene of sufficient size to cover the damaged area and pass around the circumference of the pipe. Plastic adhesive tape should be applied circumferentially to form a seal at both ends of the repair and also to the longitudinal seam.

Repairs to Spirally Tape Wrapped Pipes

Where spiral tape wrapping is damaged, the following repair procedure should be followed:

- Remove punctured or disbonded tape using a sharp knife, forming a circular or oval cut shape (avoid angular cuts). Care should be taken to ensure that the edges are smoothly finished.
- Ensure that the cleared area is free from debris or contaminants.
- Apply primer to the cleared area, and allow to dry.

Note: The primer is classified as a hazardous substance and the manufacturers' instructions should be followed. If in doubt refer to manufacturers COSHH sheets.

- Apply hand-applied tape to the cleared and primed area, using sufficient tension to ensure good conformability.

1. Wrapping should be made in the same direction as the existing tape coating.
2. Wrapping should commence and finish on the opposite side of the pipe to where the damage has been sustained.
3. Wrapping should be made with a 55% overlap.
4. Wrapping should extend a minimum of 75mm either side of the damaged area.

- Tape width should be appropriate to the diameter of the pipe.

1. Use 100mm width tape for pipes DN80-150.
2. Use 150mm width tape for pipes DN200-2000.

Care should be taken at all stages to ensure that no air bubbles are entrapped underneath the tape wrapping.

Cement Mortar-lining Repairs

In the event that an area of cement mortar lining is damaged, repairs can be simply made by using the following procedure.

Saint-Gobain PAM UK's recommended repair mortar is approved by the DWI and is suitable for water and sewer pipes. If this is not available then, for water pipes, an OPC or Blast Furnace cement should be used and for sewer pipes an HAC cement should be used.

Do not attempt a lining repair if the ambient temperature is ≤5°C.

If possible position the pipe or fitting with the damaged area at invert level (see Fig. 1.4.1).

Carefully chip out the damaged lining. Undercut the edges of the surrounding sound lining to form a 'key' for the repair (see Fig. 1.4.2).

Clean away all loose debris (see Fig. 1.4.3).

Thoroughly wet the exposed metal surface and the edges of the lining around the exposed area (see Fig. 1.4.4).

Prepare the mortar for the repair. This should be stiff and consist of one part cement to approximately 1.5 parts dry washed coarse sand (by mass) and be mixed with fresh potable water.

Place the mortar with a hand trowel (or float for large areas), and work it well into the edges of the existing lining (see Fig. 1.4.5).

Build up the repair to a thickness just above that of the original lining and finally smooth down to the required thickness using a piece of wood against the pipe end, if appropriate, to produce a square end.

Leave to cure for one day. On hot days cover with a wet sack, or similar, to prevent rapid evaporation until the mortar is sufficiently hardened.

On completion of the repair, check that the cement mortar has been allowed to cure correctly, that it is firmly bonded to the pipe and is free from excessively wide cracks (see Table 1.9.1).

Note: For System XL pipes, it is only necessary to repair damage to the cement. No attempt should be made to repair the seal coat itself.

Fig. 1.4.1

Fig. 1.4.2

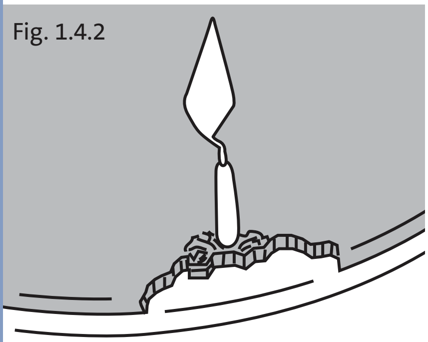


Fig. 1.4.3

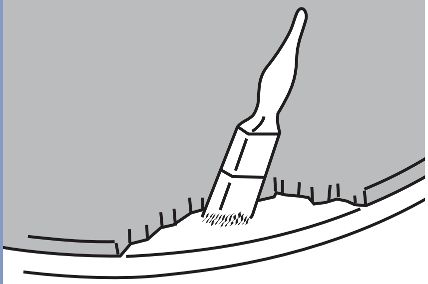


Fig. 1.4.4

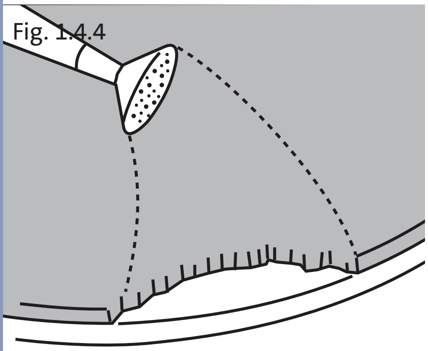
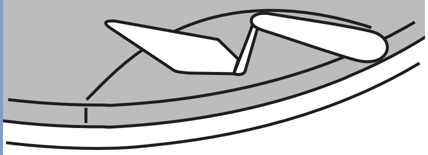


Fig. 1.4.5

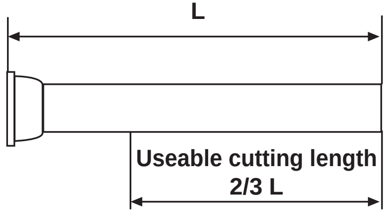


1.5 Cutting Ductile Iron Pipes

It is essential that cutting of pipes be entrusted to persons who are fully trained in such operations and are fully aware of the danger of personal injury in all aspects of pipe cutting. Persons who use abrasive wheels should be aware of the statutory regulations in force in relation to their use.

Pipes Suitable for Cutting

Fig. 1.5.1



Pipes DN80-300:

All full length Saint-Gobain pipes DN80-300 are manufactured suitable for cutting on-site **up to a maximum of 2/3 of the length of the pipe length measured from the spigot end** (see Fig. 1.5.1).

Pipes DN350-2000:

Pipes DN350-2000 required to be suitable for cutting on-site must be specifically requested on order. Pipes supplied as being suitable for cutting will be marked with the initials 'SFCOS' on the socket face and sometimes also with a tape around the socket marked SFC (see Fig 1.5.2). These are suitable for cutting onsite up to a maximum of 2/3 of the length of the pipe length measured from the spigot end.

Fig 1.5.2

Successful joint assembly cannot be guaranteed using cut DN>300 pipes that are not marked as 'sutiable for cutting'.

Procedure Cutting Pipes

All pipes: - Use a diameter tape or flat tape to check the external diameter of the pipe at the proposed point of the cut. **Tip - Measure twice cut once.** The dimension must comply with the limits specified in Table 1.5.1.

Pipes DN350-2000: - After cutting the pipe check the cut end, where this is found to be oval, locate and mark the major axis.

Measure the length of the major axis. Only where this exceeds the dimension specified in Table 1.5.1, will ovality correction be required prior to jointing (please refer to Section 1.6 for details).

Table 1.5.1: Average external diameter of pipe and maximum major axis of spigot ends

Nominal Size DN	Measured Circumferentially with Standard Tape		Measured Circumferentially with Diameter Tape		Max. Major Axis of Spigot
	Max. (mm)	Min. (mm)	Max. (mm)	Min. (mm)	
60	245	236	78	75.3	78
80	311	302	99	96.2	99
100	373	364	119	116.1	119
125	455	446	145	142	145
150	537	527	171	167.9	171
200	700	690	223	219.7	223
250	863	853	275	271.5	274.5
300	1027	1015	327	323.3	326.6
350	1189	1179	378.5	375	378.5
400	1349	1338	429.5	426	429.5
450	1509	1498	480.5	477	480.5
500	1673	1661	532.5	528.5	532.5
600	1996	1982	635.5	631	635.5
700	2321	2307	739	734.5	739
800	2648	2632	843	838	843
900	2972	2955	946	940.5	946
1000	3295	3277	1049	1043	1049
1100	3619	3597	1152	1145.1	1152
1200	3944	3924	1255.5	1249	1255.5
1400	4594	4572	1462.5	1455.5	1462.5
1500	4920	4893	1566	1557.5	1566
1600	5242	5217	1668.5	1660.5	1668.5
1800	5892	5864	1875	1866.5	1875.5
2000	6544	6511	2083	2072.5	2083

Pipe Cutting

Ductile iron pipes can be cut by a number of methods. Where flexible joints are to be made, the cut ends must be trimmed with a file or grinder to remove the burr formed during cutting and, unless the joint is to be made with couplings or adaptors, a chamfer must be provided (see Fig. 1.5.3 and Table 1.5.2).

Power driven abrasive disc

These cutters should only be used by properly trained personnel. This is one of the most widely used methods for cutting ductile iron pipe. It has the advantage of being suitable for all sizes. There is no need for adjustment to suit pipe or attach machinery to the pipe. The abrasive discs are fitted to suitable hand held power tools usually driven by compressed air or small internal combustion engines. It is important when ordering disc cutting equipment to state that it is for use with ductile iron pipe and to ensure that the disc type and size and the spindle speed of the equipment are compatible.

Semi rotary wheel cutter

A number of semi rotary wheel type cutters are available, ranging from the standard chain link cutters to more sophisticated tools employing a rigid hinged frame. With this type of equipment it is important to ensure that wheels specifically designed for use with ductile iron are employed. This type of cutter is normally used on pipes in the smaller diameter range.

Rotary and orbital pipe cutters

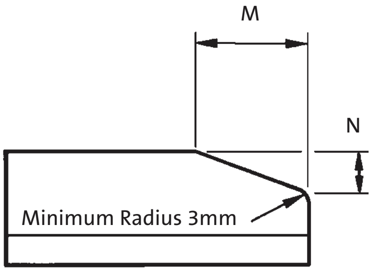
Cutting tools of either the simple lathe or milling saw type respectively are available throughout the diameter range. Whichever type of cutter is employed the machine is attached to the pipe and the cutting tool is driven around the pipe by means of gears on a chain link track. The orbital type cutters have the advantage on the larger sizes of ductile iron pipe in that they are capable of accommodating the ovality which is sometimes present. These types of machinery are usually driven mechanically, e.g. by compressed air motor – although for pipes in the smaller diameters a hand-operated windlass may be employed. In machines using lathe type cutting tools, the cutter heads must have a 7° front rake.

Reciprocating power saws

These may also be used for cutting ductile iron pipe. These tools are usually electrically driven and for this reason they are principally used in depots or workshops where a power supply is available.

End Preparation of Cut Pipe for Jointing

Fig. 1.5.3



Any burrs or sharp edges left after cutting must be trimmed off by filing or grinding. Where Rapid joints are to be used, the cut ends should be chamfered by filing or grinding to give a radius of 3mm and a chamfer profile similar to the original spigot ends (see Fig. 1.5.3 and Table 1.5.2).

Table 1.5.2: Chamfer details

Nominal Size DN	All dimensions in mm	
	M	N
60 - 600	9 - 12	3
700 - 1200	15 - 20	5
1400 - 1600	20 - 25	7
1800 - 2000	20 - 25	8

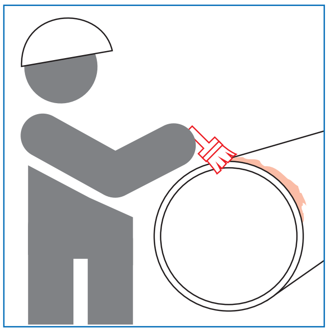
Cutting Pipes with Tape Wrap

Please note that the tape wrap is a medium duty protection system and removal may prove very difficult. It is recommended that at the time of ordering, you advise us of the number and positions of cuts so that the pipes can be wrapped accordingly.

Marking insertion depths

The cut pipe end should be marked with the appropriate minimum and maximum insertion depths (see Fig. 2.2.6, Fig. 2.2.7 and Table 2.2.1).

Repairing the coating



The cut pipe end should be recoated.

For Natural coating:
- EUROKOTE 448 (1Kg, Ref. 228604)

For Integral coating:
- EUROKOTE 4820 (1Kg, Ref. 184653)

For Black coating:
- ENDOLAC 245-30 (1Kg, Ref. 158134; 5Kg, Ref. 158131)

1.6 Ovality Correction

Fig. 1.6.1

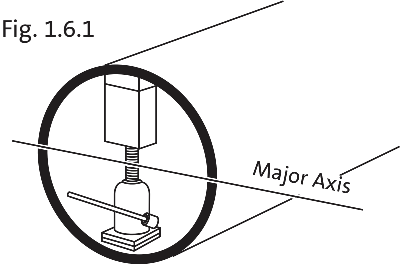
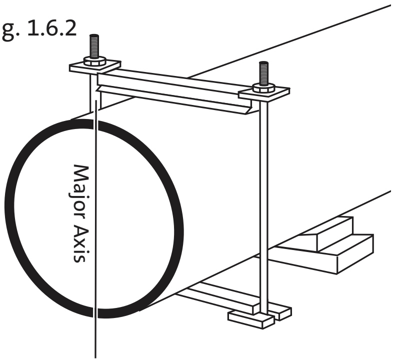


Fig. 1.6.2



Where pipes have been cut on site, the following procedures should be carried out in order to check and correct the ovality of the new spigot end.

- Measure the length of the major axis. Only where this exceeds the dimension specified in Table 1.5.1 will ovality correction be required prior to jointing.
- Spigots to be jointed into sockets must be chamfered to give a similar profile as the original spigot end (see Table 1.5.2).

Method A

The use of this method is recommended where it is possible to remove the tackle after ovality correction and subsequent jointing.

Position the timber strut and jack (approximately 5 tonnes capacity) 100mm – 200mm inside the spigot end and at 90° to the major axis.

Rubber pads should be placed in position to prevent possible damage to the pipe lining (see Fig. 1.6.1).

Extend the jack until the major axis has been reduced to the appropriate limit specified in Table 1.5.1. Complete the jointing operation with the major axis of the spigot vertical. After jointing, remove the tackle.

Note: In some instances, e.g. jointing into couplings, it may be necessary to use two jacks in order to obtain a 'round' profile.

Method B:

The use of this method is recommended where it is not possible to remove the tackle described in Method A, after ovality correction and subsequent jointing.

Place the tackle around the spigot end of the pipe at a position approximately 450mm from the pipe end with major axis of the spigot vertical (see Fig. 1.6.2).

Where pipes are sleeved or tape wrapped, rubber pads or similar should be placed between the re-rounding tackle and the protection system to prevent damage.

Tighten the two nuts evenly until the major axis has been reduced to the appropriate limits specified in Table 1.5.1. Complete the jointing operation with the major axis of the spigot vertical. After jointing remove the tackle.

Note: Where the pipes are to be concreted into a structure they should, if necessary, be re-rounded before this is done and left until the concrete has set before removing the re-rounding tackle.

1.7 Moving Pipes & Fittings Onsite

When transporting pipes and fittings on site, the load should be properly secured to the vehicle. Should it be necessary to travel for a short distance with a suspended load, this should be carried as near to the ground as practicable and steadied by ropes to prevent any pendulum motion.

Pipes and fittings should not be placed in positions where they could be damaged by mechanical equipment or vehicles moving about the site or there is a risk of contamination by the ingress of soil, animals, fuel oils, chemicals etc. End caps may be used to help prevent accidental contamination.

Pipe Stringing

When stringing pipes alongside the trench, dropping the pipes is to be avoided at all times, they should also be wedged or pinned to prevent accidental movement.

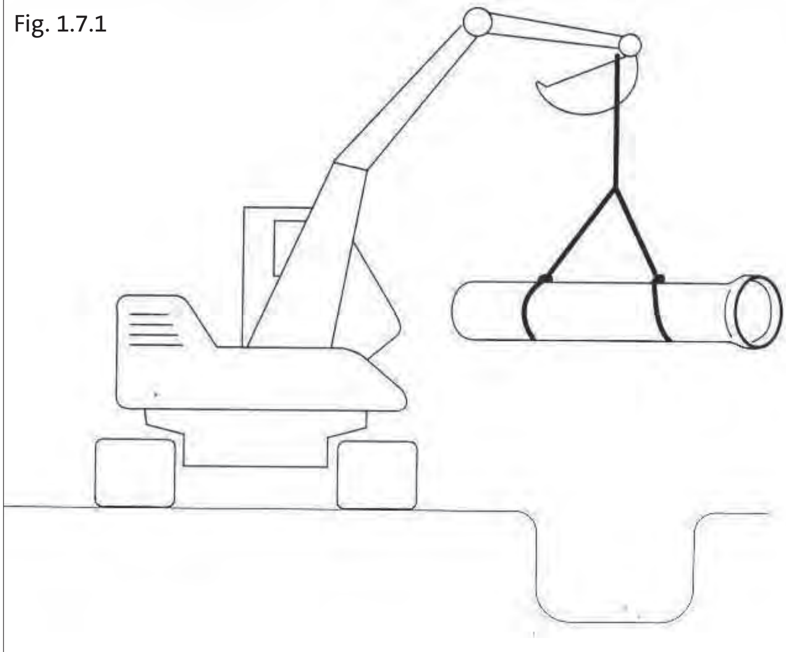
Pipes should not be dragged or placed on stones or other objects that may damage the protective coating or sleeving and they should be supported evenly along their length. Where there is a risk of damaging the protective coating, especially factory applied polyethylene sleeving, timbers should be placed beneath the pipes to raise them clear of the ground. When stringing pipes in a road or on other hard surfaces the pipes should be completely supported on timbers clear of the surface.

Lowering Pipes and Fittings into Trench

Pipes and fittings should be placed into the trench by crane, or excavator backhoe (see Fig. 1.7.1). Broad webbing slings should be used, which are made of Terylene, nylon or other synthetic material capable of withstanding the required loads. Never attempt to utilise chains or wire ropes as slings as these might allow the pipes to slip, or cause damage to the external protection system.

Where a crane with single sling is used, the balance of the pipe should be checked with the pipe just clear of the ground. Smaller diameter pipes can be hung with a single sling from an excavator backhoe. Site safety rules should be observed at all times.

Fig. 1.7.1



1.8 Trenching

The following publications give recommendations regarding standards of good practice for trench excavation:

- Civil Engineering Specification for the Water Industry (3)
- BS8010 (5)
- Sewer for Adoption (6th Edition) (6)
- BS EN 805 (13)
- BS 6031 (14)
- Report R97, `Trenching Practice' published by CIRIA (15)
- Technical Note TN95 `Proprietary trench support systems', published by CIRIA (16)
- Specification for the Reinstatement of Openings in Highways (the HAUC specification) (17)

Trenching is a very hazardous operation. It requires specialised civil engineering skills and knowledge of the detailed statutory regulations that govern this operation. These instructions give guidance to ensure that the quality of pipes and fittings is not impaired during installation. The contractor should not rely on these instructions for any other purpose than maintaining the quality of pipes and fittings installed for underground use.

Trench Widths

The Contract will usually contain detailed requirements for trench widths and the information below is for guidance only.

The width of trench should be as narrow as practiable, taking into consideration the type of native soil and backfill and the compaction equipment required. Where mechanical compaction is required for sidefill, the trench should only be wide enough to accommodate the equipment.

Where mechanical compaction is not required, the width of trench should be 300mm greater than the pipe outside diameter, but may be reduced where narrow trenching techniques are employed.

Where utilising the lateral deflection available from flexible joints to make a change in direction, the trench should be cut to give sufficient room for the joint to be made with the pipes in line, the pipe being deflected after the joint has been made (see Table 2.2.2 and Table 2.7.2).

1.9 Pre-installation Inspection

Ductile iron pipes are not normally susceptible to handling and transport damage but mishandling can damage protective coatings, wrapping and linings or bruise and deform jointing surfaces and may create ovality.

The following checks should be undertaken shortly before lowering the pipes and fittings into the trench:

- Deformation of the pipe
- Loss of any mortar lining.

Note: mortar linings may contain small shrinkage cracks and areas of disbondment which should not affect the stability and effectiveness of the lining, permissible crack widths are shown in Table 1.9.1.

- Cuts or tears to the wrapping
- Loss of epoxy/bitumen coating
- Spigot jointing surfaces for correct chamfer, protrusions in socket and paint build up in socket area
- check that no foreign matter has entered pipes

Any defective pipes or fittings should be identified and stored away from the compliant pipes and fittings. For minor coating/lining repairs please refer to Section 1.4.

Table 1.9.1: Permissible crack widths and radial displacement

Nominal Size DN	Maximum crack width & radial displacement (mm)	
	Water pipes & fittings	PAM Integral pipes & fittings
60 - 300	0.4	0.6
350 - 600	0.5	0.7
700 - 1200	0.6	0.8
1400 - 2000	0.8	0.8

Section 2

Pipe Laying

2.1 Pipe Laying

When stringing pipes out along the line of the main, avoid dragging or dropping the pipes and check the ground for sharp objects which might cause damage to the coating or wrapping. Where possible a timber support under the spigot end is recommended.

Before laying, check each pipe for any damage to the external protection system and carry out such repair work as necessary (see Section 1.4 for details).

Working in trenches and lifting are hazardous operations. These instructions are designed to ensure that the quality of pipes and fittings is not impaired during installation. **It is essential that these operations are entrusted to persons who are skilled in such work. The work must be properly supervised and appropriate regard paid to the relevant health and safety regulations.**

Pipes should only be lifted into the trench using webbing slings or padded hooks and care should be taken when removing these that the protection system is not damaged in the process.

The pipes should not be rolled in from the side of the trench. To prevent damage to the pipes or coatings, contact with sharp objects should be avoided. Rolling the pipe along the ground should not be permitted.

Pipes which have protective wrappings around them for transportation and handling purposes should be laid with these still in position.

Joint holes should be formed in the bedding material or excavated final surface for each socket to ensure that each pipe is uniformly supported throughout the length of its barrel and to enable the joint to be made. Where pipes are required to be bedded directly on the trench bottom, the final surface should be trimmed and levelled to provide even bedding of the pipeline, and should be free from all extraneous matter that may damage the protective coating.

Ensure adequate clearance is excavated under the joints to allow for the joint to be checked and if required, the joint protection to be properly applied.

When entering the pipe spigot into the next socket, do so in a straight line. Excessive dragging of the pipe along the trench bottom should also be avoided to prevent damage to the protective coating.

Do not lever against the side of the pipe to align pipes after jointing unless a suitable protective pad is used between the pipe and the lever.

Backfill should be placed around the pipe in a reasonable manner and not dropped onto the crown of the pipe from an excessive height, to ensure that the protective coating remains undamaged. The trench bottom should be free of any object that is likely to cause damage to the protective coating, as should the pipe surround material in the immediate proximity of the pipes. Backfill should be carefully placed and care taken when compacting to avoid damage to the protective coating.

All construction debris should be cleared from the inside of the pipe either before or just after a joint is made. This can be done by passing a pull-through along the pipe, or by hand, depending on the diameter of the pipe. When laying is not in progress, a temporary end-closure should be fitted securely to the open end of the pipeline. This may make the pipes buoyant in the event of the trench becoming flooded, in which case the pipes should be held down either by partial re-filling of the trench or by temporary strutting.

No protective cap, disc or other appliance on the end of a pipe or fitting should be removed permanently until the pipe or fitting which it protects is about to be jointed.

Thrust Blocks

Any additional excavation required to accommodate thrust blocks should be carried out after the bend or branch is in position. The thrust face should be trimmed back to remove all loose or weathered material immediately prior to concreting.

Thrust blocks should be allowed to develop adequate strength before any internal pressure is applied to the pipeline.

Pipe Bedding, Surround and Backfill

Bedding for pipes should be laid by spreading and compacting suitable granular bedding material over the full width of the pipe trench. After the pipes have been laid, additional material should, if required, be placed and compacted equally on each side of the pipes under the pipe haunches, and where practicable, this should be done in sequence with the removal of the trench supports to prevent the formation of voids.

Fill material should, where required, be placed and compacted over the full width of the trench in layers not exceeding 150mm before compaction to a finished thickness of 250mm above the crown of the pipes.

The layers of backfill, up to 250mm above the crown of the pipe, should be placed and compacted with due care being taken not to damage the pipe or protective coatings. Special care should be taken to ensure that there are no large stones or other objects in the backfill that may damage the protective coating during compaction.

Wherever possible, in order to minimise misalignment of the bed with resulting shear across the joint, backfill material should not be placed on a pipe until the succeeding pipe is laid and jointed. If joints are to be individually inspected during hydrostatic testing, it is not practicable to backfill the trench completely. It is important, however, to backfill over the barrel of each pipe and compact the backfill or take other such measures to prevent movement of pipes during the testing processes and, in some situations, to avoid flotation.

On pipes greater than DN500, special attention should be given to the compaction of the backfill material under the haunch of the pipe.

The bedding and surround will be specified in the contract, but the contractor should ensure that consideration has been given to protecting the pipe coatings and sleeving from being damaged during pipe laying. In particular the use of angular granular material 20mm or greater in size for bedding and sidefill should be avoided.

For detailed information on bedding and surround, see Water Industry Specification Information and Guidance Notes 4-08-01, 4 (18) and 4-08-02, 15(19) .

Where pipes are installed with concrete protection, to maintain flexibility, the concrete protection should be interrupted over its full cross-section at each flexible pipe joint by compressible filler.

In highways the backfill should meet the requirement of the HAUC specification.

2.2 Rapid Joint

Basic conditions which should be ensured for all types of joint are:

- Make sure the socket and spigot to be jointed are in good condition.
- Appropriate chamfer and radius on spigot (see Fig. 1.5.3 and Table 1.5.2).
- Cleanliness of all parts.
- Correct location of components.
- Correct lubrication of joint components.
- Centralisation of spigot within socket.

The inside of sockets and the outside of spigots should be clean for at least the insertion depth of each joint. Glands and gaskets should be wiped clean and inspected for damage.

The spigot ends of all pipes should be checked for ovality. Where found to be oval, but within the limits set out in Table 1.5.1 the maximum axis should be buried vertically so the weight of the soil acts to re-round the pipe. If the ovality exceeds the limits set out in Table 1.5.1, please see Section 1.6.

Where lifting gear has been used to place the pipe in the trench it should be used to support the pipe and assist in centralising the spigot in the socket. Where the pipeline is suspected to be subject to movement due to ground settlement or temperature variation, a suitable gap should be left between the end of the spigot and the bottom of the socket.

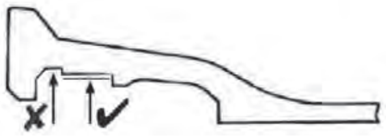
If pipes are laid on a steep gradient where the soil/pipe friction is low, care should be taken to ensure that no excessive spigot entry or withdrawal occurs. As soon as the joint assembly has been made, the pipe should be held in place and the trench backfilled over the barrel of the pipe.

Unless the gradient is 1:2 or steeper, anchorage is not normally necessary. However, for these very steep gradients, self-anchoring joints or anchor blocks at each socket are recommended.

For pipelines laid above ground on steep gradients, self-anchoring joints should be used.

Jointing Instructions

Fig. 2.2.1



General instructions for jointing are listed below, followed by the various methods for making the joint.

Before assembly, the outside of the spigot and the inside of the socket of the two pipeline components to be joined must be thoroughly cleaned. Where there are no minimum and maximum insertion depths on the pipe, these should be marked according to Table 2.2.1.

Insertion of the gasket may, if necessary, be facilitated by the prior application of a thin film of lubricant to the sealing chamber of the socket only (see Fig. 2.2.1).

When using anchor gaskets do not apply any lubricant on the inside of the socket or the outside of the gasket.

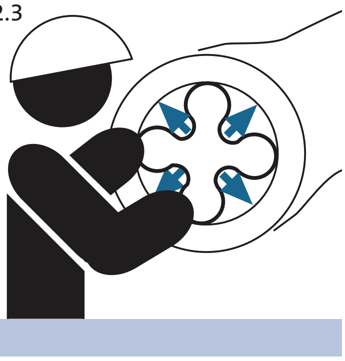
Note: Please follow the Health and Safety guidance specified on the lubricant packaging. If in doubt refer to manufacturers COSHH sheets.

The gasket should be inspected to ensure it is not deformed or damaged. The rubber gasket should be cleaned, flexed and then placed in the socket. Care must be taken to ensure that the gasket is correctly seated in the socket. Make sure the joint ring fits evenly around the whole circumference and smooth out any bulges which would prevent the proper entry of the spigot end (see Fig. 2.2.2).

Fig. 2.2.2

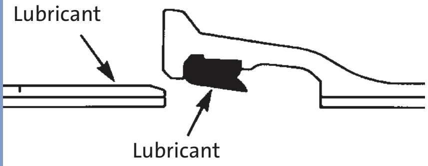
In the larger diameters this operation may be assisted by forming additional loops in the ring opposite the first, then pressing the loops flat one after the other (see Fig. 2.2.3).

Fig. 2.2.3



Apply a thin film of lubricant to the inside surface of the joint ring, where it will come into contact with the entering spigot. The spigot should also be covered with a thin film of lubricant for a distance of 75 mm from the end for pipes DN60-600 and 120mm for pipes DN700-2000 (see Fig. 2.2.4).

Fig. 2.2.4



The incoming spigot must be aligned and entered carefully into the socket until it makes contact with the joint ring. Final assembly of the joint is completed from this position. Do not ‘hook’ the spigot into the socket and lower the pipe into place as this may dislodge the gasket during jointing.

The joint is then made by forcing the spigot of the entering pipe past the gasket of the receiving pipe, thus compressing the gasket, until the socket face is positioned between the recommended and the minimum insertion marks (see Fig. 2.2.5).

Fig. 2.2.5

Note: Insertion of the spigot past the recommended insertion mark can lead to damage to the cement lining and reduction in angular deflection and consequently may result in joint failure.

Pipes DN700-1200 will be marked with three insertion marks. The first two marks from the spigot end should be used when jointing into fittings, the second two marks should be used when jointing into pipes. This is because on pipes the socket chamber is longer for greater joint deflection.

Fig. 2.2.6

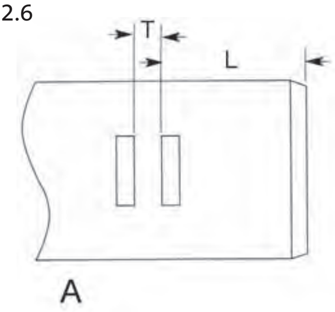
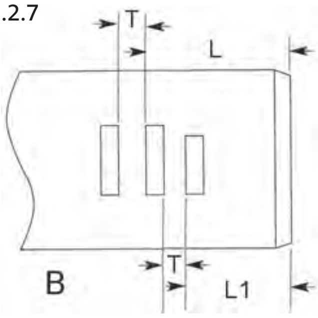


Fig. 2.2.7



L = **Minimum spigot insertion depths for pipes and fittings (except fittings DN700-1200)**

L1 = **Minimum spigot insertion depths for fittings DN700-1200**

T = **Maximum spigot insertion depth (L+T) or (L1+T)**

Table 2.2.1: Minimum and maximum insertion depths

Drawing ID	Nominal Size DN	Insertion Depth Rapid Pipes & Fittings		
		L mm	L1 mm	T mm
A	60	67		10
	80	70		10
	100	72		10
	125	75		10
	150	78		10
	200	84		10
	250	84		10
	300	84		10
	350	88		10
	400	90		10
	450	93		10
	500	95		10
	600	105		10
B	700	159	120	15
	800	160	130	15
	900	160	135	15
	1000	160	135	15
	1100	178	153	15
	1200	185	158	15
A	1400	194		20
	1500	210		20
	1600	209		20
	1800	216		20
	2000	235		20

Note: Insertion depths for anchor joints are different - see Section 2.4, 2.7 and 2.8 for details.

If this final assembly cannot be attained by the application of reasonable force, the spigot should be withdrawn and the position of the joint ring examined and replaced if necessary. Where necessary the spigot can be withdrawn from the bottom of the socket by moving the far end of the pipe upwards and sideways for a distance of about 150mm, and then returning to the straight position.

Having successfully inserted the spigot, the joint should then be checked to see if the gasket is correctly seated. This is done by inserting a metal rule into the socket gap (see Fig. 2.2.8). The depth of penetration should be equal around the whole circumference. If a difference is found the gasket may have been displaced and the joint should be dismantled and re-made.

Assembly of the joint is quick and simple, and may, according to size and local conditions, be carried out by any of the methods described in Section 2.9.

Fig. 2.2.8

Joint Deflection

Long radius curves may be negotiated by deflecting the joints (see Fig. 2.2.9). The pipes should be jointed straight and then pulled to the required deflection θ. This deflection should not exceed the recommended deflection for offsets as shown in Table 2.2.2. The remaining flexibility is required for any subsequent pipeline settlement or ground movement.

Fig. 2.2.9

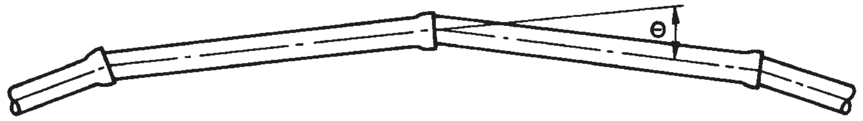


Table 2.2.2 Allowable pipe deflections at flexible joints

Nominal size DN	Rapid Vi (anchor)			
	Max. allowable Deflection		Recommended Deflection for Offsets	
	Degree	mm per m length of pipe	Degree	mm per m length of pipe
80-300	5	87	3	52.5
350-1200	4	70	2	35
1400-1600	3	52.5	1.5	26
1800	2.5	43.5	1.25	21.5
2000	2	35	1	17.5

2.3 Anchor Gaskets

Please note that the test and working pressures are restricted on anchor gaskets (see Table 2.3.1).

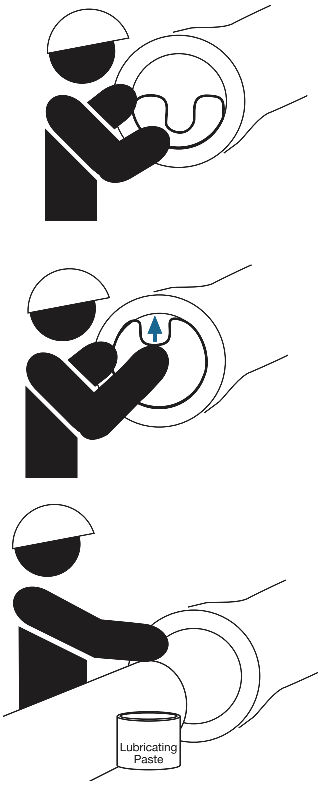
Table 2.3.1: Working pressure (PFA) for anchor gaskets

DN	Rapid Vi (anchor)		
	Water		Sewer
80	C40	22	16
100	C40	16	16
150	C40	16	16
200	C40	16	16
250	C40	16	12
300	C40	16	12
350	C30	16	12
400	C30	16	12
450	C30	13	11
500	C30	11	9
600	C30	10	8

Note.-
Allowable test pressure (PEA) and allowable maximum operating pressure (PMA) for the above pipes can easily be calculated by using the following formulas:
PMA = PFA x 1.2
PEA = PMA + 5 bar

Joint Preparation

Fig. 2.3.1



Thoroughly clean the spigot, interior of socket and gasket. **These gaskets should be inserted into the socket dry. Do not lubricate.**

Fold the gasket as shown in Fig. 2.3.1, taking care to position the inner loop between teeth and insert the gasket into the socket.

Apply a thin film of lubricant to the surface of the gasket and to the outside surface of the spigot. **Warning: Extra care should be taken as the anchor teeth are very sharp.**

Note: Please follow the Health and Safety guidance specified on the lubricant packaging. If in doubt refer to manufacturers COSHH sheets.

Joint Assembly

The jointing method for pipes and fittings using anchor gaskets is the same as for pipes and fittings using normal gaskets, and all forms of jointing tackle described in Section 2.2 can be used. However, with anchor gaskets extra care should be taken to make sure the joint is made ‘in line’.

With anchor gaskets a certain amount of axial withdrawal occurs as anchorage is taken up. Care must be taken to ensure that the pipe layout is such that this movement does not cause excessive deflection at any other joints.

On buried mains the anchored joint on fittings and pipes must be buried before pressure testing, in order to minimise movement. Where mains are not to be buried all of the necessary securing and strapping of the pipework appropriate to its final installation must be carried out before pressure testing, for the same reason.

Joint Dismantling

The dismantling procedure for joints with anchor gaskets is described in Section 2.13.

2.4 PAM Universal Rapid Vi

Carefully clean the socket chambers. Pay particular attention to the gasket seat and the anchoring ring seat. Clean the spigot of the pipe to be jointed and the gasket and anchoring ring. If the pipe has been cut it is essential to remake the chamfer and mark the jointing depth (see Fig. 2.4.1 and Table 2.4.1). Insert the gasket and anchoring ring into their seats in the socket.

Fig.2.4.1

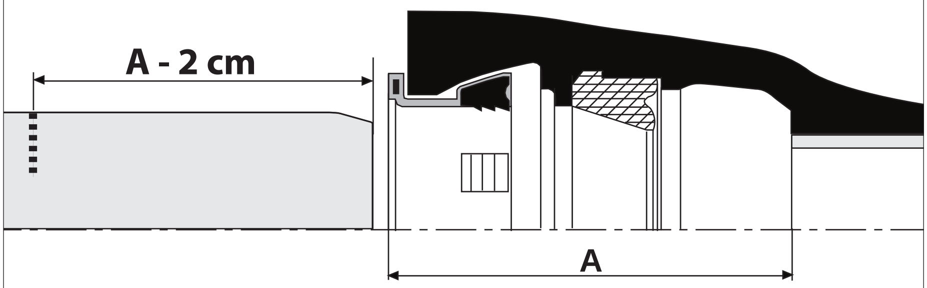


Table 2.4.1: Dimension of A

DN	80	100	150	200	250	300
A(mm)	112	140	148	155	166	180
DN	350	400	450	500	600	
A(mm)	184	176	190	20	209	

Apply lubricant to the exposed surface of the gasket and the spigot end and chamfer. Centre the spigot in the socket and joint using one of the methods previously described.

Note: Check the insertion depth on all pipes. The insertion depth is deeper when using the Universal socket due to the double chamber. The pipes should be jointed straight, any deflection can be made once the joint has been completed.

Joint Dismantling

The dismantling procedure for joints with PAM Universal Rapid Vi joint is described in Section 2.13.

2.5 PAM Universal Rapid Ve

Fig. 2.5.3

Fig. 2.5.4

Fig. 2.5.5

Fig. 2.5.6

Fig. 2.5.7

Equipment Needed

To joint the PAM Universal Rapid Ve Joint the following equipment will be required:-

1. Locking ring insertion tool (Fig. 2.5.1)
2. Spacer (Fig. 2.5.2)

Fig. 2.5.1

Fig. 2.5.2

Carefully clean the socket chambers. Pay particular attention to the gasket seat and the anchoring ring seat. Clean the spigot of the pipe to be jointed and the gasket and locking ring.

Fit the gasket into the first chamber (innermost) of the socket as per normal ductile iron pipe installation (see Fig. 2.5.3).

Insert the prongs on the locking ring insertion tool into the holes on the locking ring (see Fig. 2.5.4).

Rotate the insertion tool so the locking ring is compressed (see Fig. 2.5.5).

Fit the locking ring into the second chamber (nearest to socket face) of the socket (see Fig. 2.5.6).

Fit spacer into the gap in the locking ring. This is to ease the insertion of the spigot into the locking ring (see Fig. 2.5.7).

Centre the spigot into the socket and use one of the methods described in Section 2.9 to enter the spigot into the locking ring and remove the spacer (see Fig. 2.5.8). Push the spigot down to the bottom of the socket. The weld bead pushes through the locking ring and holds the spigot in the socket (see Fig. 2.5.9).

Fig. 2.5.8

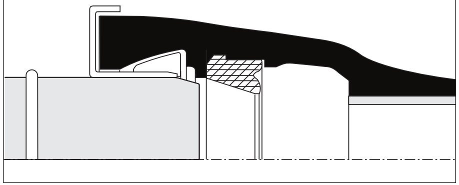
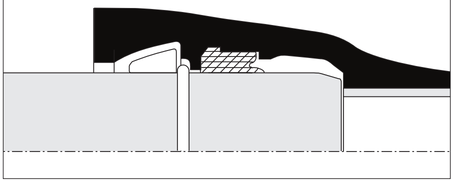


Fig. 2.5.9



Note:- There are four types of looking rings available. The information contained in this page relates to the locking ring for DN250-350. For information on the installation of the other three types (DN100-200, DN400-700 & DN800-1200) please contact our Technical Department, Tel. 0115 930 0700.

Joint Dismantling

The dismantling procedure for joints with PAM Universal Rapid Ve joints is described in Section 2.13.

2.6 PAM Direxional

Fig. 2.6.1

Fig. 2.6.2

Fig. 2.6.3

Fig. 2.6.6

Equipment Needed

To joint the PAM Direxional pipes the following equipment will be required:-

1. Rubber protective collar (Fig. 2.6.1)
2. Collar (Fig 2.6.2)
3. Pulling head (Fig. 2.6.3)
4. Locking ring insertion tool (Fig. 2.6.4)
5. Spacer (Fig. 2.6.5)
6. Dismantling Shims (Fig. 2.6.6)

Fig. 2.6.4

Fig. 2.6.5

Method

Ensure that the rubber protective collar is on the spigot end of pipe (Fig. 2.6.7) to be jointed (pulled back slightly from the joint) and that the metal sheet is fitted via the spigot end of the jointing pipe and pulled adjacent to the socket (Fig. 2.6.8).

Fig. 2.6.7

Fig. 2.6.8

Carefully clean the socket chambers. Pay particular attention to the gasket seat and the anchoring ring seat. Clean the spigot of the pipe to be jointed and the gasket and locking ring.

Fit the gasket into the first chamber (innermost) of the socket as per normal ductile iron pipe installation (see Fig. 2.6.9).

Fig. 2.6.9

Fig. 2.6.10


Fig. 2.6.11


Fig. 2.6.12


Fig. 2.6.13

Insert the prongs on the locking ring insertion tool into the holes on the locking ring (see Fig. 2.6.10).

Rotate the insertion tool so the locking ring is compressed (see Fig. 2.6.11).

Fit the locking ring into the second chamber (nearest to socket face) of the socket (see Fig. 2.6.12).

Fit spacer into the gap in the locking ring. This is to ease the insertion of the spigot into the locking ring (see Fig. 2.6.13).

Lubricate the gasket and the spigot and push the spigot end of pipe into the socket (see Fig. 2.6.14).


Fig. 2.6.14


Fig. 2.6.15

Cover the joint with the rubber protective collar. Position the metal sheet over the rubber protective collar and Hammer the metal sheet at edges to ensure it remains in place (see Fig. 2.6.15).

The pipe is ready to be pulled into drilling channel.

Note.- There are four types of looking rings available. For information on the installation of the other three types please contact our Technical Department, Tel. 0115 930 0700.

Fitting the Pulling head

When fitting the pulling head some of the cement coating will have to be removed on the leading pipe only. This is so that the dismantling shims can be inserted to remove the pulling head when the pipes have been installed.

Firstly, use one of the shims (see Fig. 2.6.16) to mark from the edge of the cement coating (see Fig. 2.6.17).

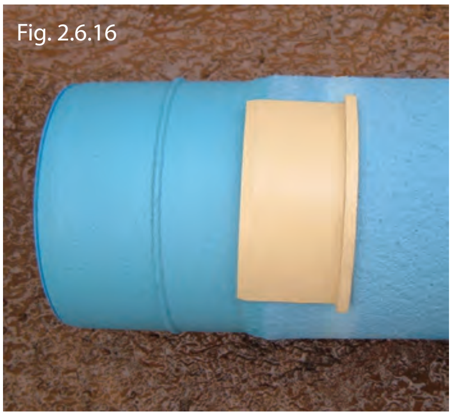


Fig. 2.6.16


Fig. 2.6.17

Fig. 2.6.18

Use a hammer and chisel to remove the cement coating up to the score mark (see Fig. 2.6.18).

Fig. 2.6.19

Fig. 2.6.20

Fit the gasket and locking ring and lubricate the gasket and spigot (see Fig. 2.6.19 and Fig. 2.6.20).

Place the pulling head onto spigot of pipe and use the digger bucket (or jointing tackle) to push the locking ring over the welded bead (see Fig. 2.6.21).

Fig. 2.6.21

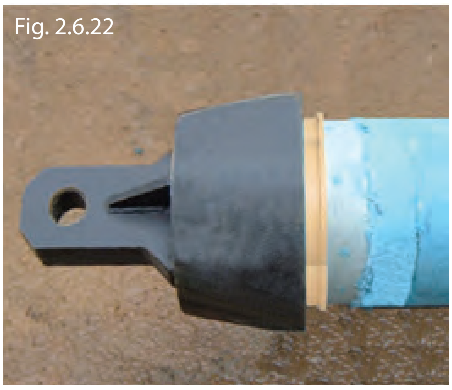


Fig. 2.6.22

To remove the pulling head use a hammer to knock the dismantling shims under the locking ring up to the welded bead (see Fig. 2.6.22). The pulling head can now be removed.

Jointing to ‘normal’ mains

PAM Direxional pipes can be jointed as normal with PAM Natural and PAM Integral pipes and fittings.

Dismantling

To Dismantle, use the method described for removing the pulling head.

2.7 Rapid Ve Joint (Mechanical)

Preparation

Anchorage using the Rapid Ve joint (Mechanical) DN80-1200 is achieved by pushing a spigot into a socket, then holding it in position with an anchoring system comprising a locking ring and bolted gland (see Fig. 2.7.1).

Fig.2.7.1

If a pipe has been cut on site, the spigot will require the correct chamfer and radius (refer to Section 1.5) and the anchor bead will have to be welded on (refer to Section 2.10).

Fit the Locking Ring and Gland

Fig.2.7.2

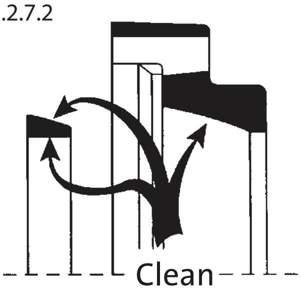
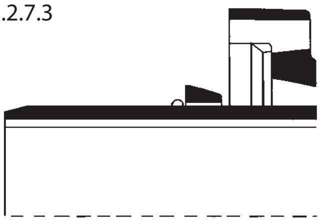


Fig.2.7.3

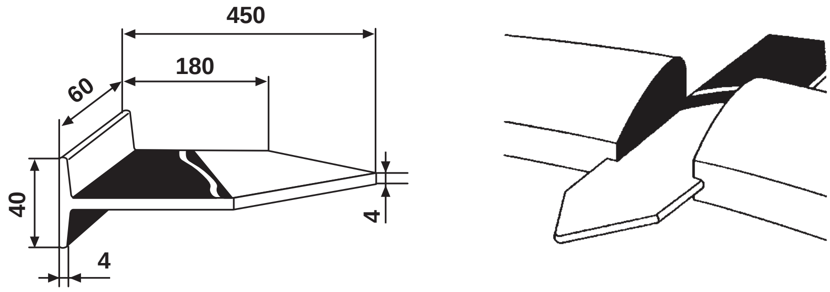


Carefully clean the locking ring and gland, particularly at the points indicated in Fig. 2.7.2.

Place the gland and ring on the spigot of the pipe to be jointed, behind the welded bead. The slope of the outer face of the locking ring needs to correspond to the slope of the inner face of the gland ring, i.e. thick end towards the welded bead (see Fig. 2.7.3).

DN350-700 one-piece locking ring. The ring has to be opened by prizing with a wedge, crowbar or similar, inserted into the opening (see Fig. 2.7.4). **The spring of the locking ring is strong and care must be taken when prising the locking ring open not to trap fingers.**

Fig.2.7.4



Note: This wedge is not supplied by Saint-Gobain PAM UK.

DN800-1200 Segmented locking ring. For larger diameters the locking ring consists of several segments, joined together by rubber connecting pieces which are held in place by two pins (see Fig. 2.7.5).

Fig. 2.7.5

Fig. 2.7.6

The slope of the rubber connecting pieces should face the same way as that of the locking ring segments (see Fig. 2.7.6).

Fig. 2.7.7

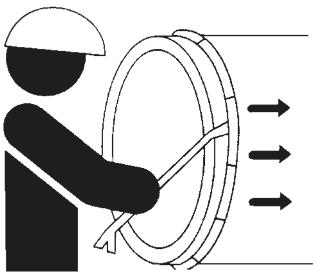
Place a connecting piece in one end of the segment by inserting it into the notch in the plane face of the ring. Using a suitable drift, insert a pin, previously coated with jointing lubricant. Orientate the pin so that the sloping face corresponds with that in the elastomer lining then hammer it home (see Fig. 2.7.7).

The remaining links are assembled in the same way to form a complete ring. The number of links required for each diameter are:

- 7 for DN800
- 8 for DN900
- 9 for DN1000
- 11 for DN1200

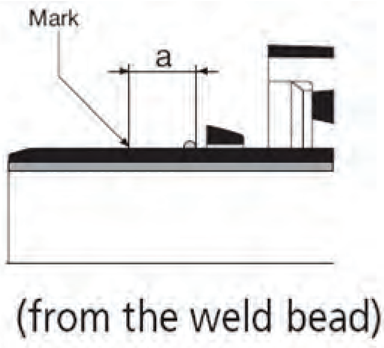
Pipe Jointing

Fig. 2.7.8



Using a wedge, crowbar or similar, lever the locking ring onto the pipe spigot and position it behind the weld bead, ensuring a correct fit (see Fig. 2.7.8).

Fig. 2.7.9



Mark the spigot insertion depth at a distance ‘a’ from the welded bead on the pipe spigot being laid (see Fig. 2.7.9). The value of ‘a’ is indicated in Table 2.7.1.

Make sure the gasket and socket are clean and insert the gasket into the socket and lubricate the exposed surface of the gasket and the pipe spigot and chamfer, using jointing lubricant.

Table 2.7.1 : Spigot insertion mark for Rapid Ve joint.

DN	80 - 100	150 - 200	250 - 500	600 - 1000	1200
a (mm)	20	25	30	35	25

Fig. 2.7.10

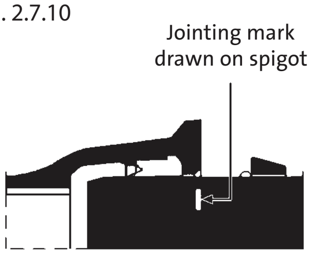


Fig. 2.7.11

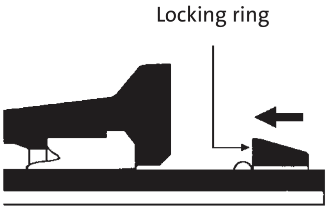
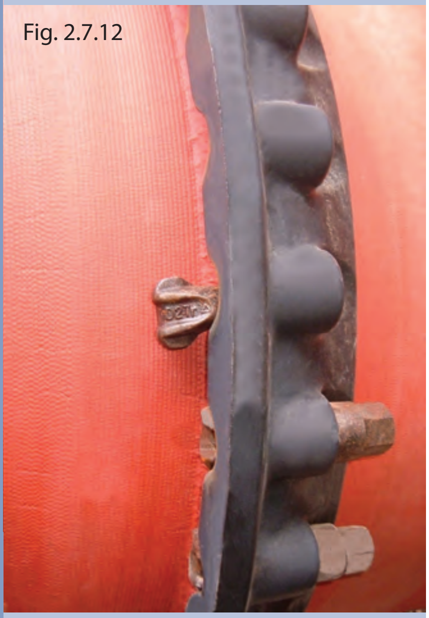


Fig. 2.7.12



Using the methods described in Section 2.2, insert the spigot, checking the alignment of the assembled components until the jointing mark on the spigot is in line with the socket face (see Fig. 2.7.10).

Do not go beyond this point, to avoid the pipe making contact with the lining and to allow the possibility of joint deflection.

Bring the locking ring into contact with the welded bead. Check that it fits snugly on the pipe spigot and against the weld bead (see Fig. 2.7.11).

Place the gland in contact with the ring and centre it.

Clean, lubricate and insert the bolts and screw on the nuts by hand until they contact the gland (see Fig. 2.7.12).

Tighten the nuts until there is gland-socket face contact (this is when there is a rapid increase in tightening torque). The nuts must be tightened diametrically opposite one another to 50Nm.

If lifting tackle is used it must not be removed until the joint is completely assembled.

The pipes must be jointed in a straight line. After assembly, the joint can be deflected if required, within the permissible limits (see Table 2.7.2).

Note: With Rapid Ve joints, a certain amount of axial withdrawal occurs as anchorage is taken up. Care must be taken to ensure that the pipe layout is such that this movement does not cause excessive deflection at any flexible joints or excessive bending moments at any flanged joint.

Where self-anchored mains are buried, the required backfill and embedment must be in place before pressure testing in order to minimise any movement caused by the pipeline 'snaking'. Where mains are not to be buried, all the necessary securing and strapping of the pipework appropriate to its final installation must also be carried out before pressure testing.

The bolts and joint area of this system will require extra protection. The minimum protection should be petrolatum tape/mastic blanket and PE sleeving, or, if necessary, a protection system equal to the protection system applied to the pipes.

Table 2.7.2 Allowable pipe deflections

Nominal size DN	Mechanical anchor joint			
	Max. allowable Deflection		Recommended Deflection for Offsets	
	Degree	mm per m length of pipe	Degree	mm per m length of pipe
80-150	5	87	3	52.5
200-300	4	70	2.5	43.5
350-600	3	52.5	1.5	26
700-800	2	35	1	17.5
900-1200	1.5	26	0.5	8.5

Joint Dismantling

Once the Rapid Ve bolts have been removed, the dismantling procedure is as for the Rapid joint, see Section 2.13.

2.8 PAMLOCK

PAMLOCK is the mechanical anchor system for water and sewer pipes DN1400-2000.

Equipment Needed

To joint the PAMLOCK pipes the following equipment will be required:-

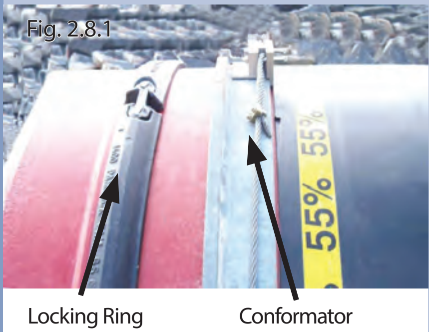
1. Conformator (Fig. 2.8.1)
2. Segmented locking ring (Fig 2.8.1)
3. Wire rope, clips & turnbuckle (Fig. 2.8.2)
4. Conformator gauge (Fig. 2.8.6)
5. Hydraulic jack (Fig. 2.8.7)
6. Conformator clamp (Fig. 2.8.8)
7. Conformator wedge (Fig. 2.8.8)
8. Shot reservoir and shot (Fig. 2.8.9)
9. Pneumatic vibrator and compressor (Fig. 2.8.9)

Carefully clean the socket chambers. Pay particular attention to the gasket seat and the anchoring chamber. Clean the spigot of the pipe to be jointed and the gasket and locking ring.

Fit the gasket into the first chamber (innermost) of the socket as per normal ductile iron pipe installation.

Fit the conformator on the spigot of the pipe to be jointed and position behind, but clear of the welded bead with the lip towards the next socket and the gap at the top (see Fig. 2.8.1). Next fit the segmented locking ring behind the welded bead. The locking ring consists of several segments, joined together by rubber connecting pieces which are held in place by two pins.

Fig. 2.8.1



Measure and mark the insertion point (see Table 2.8.1).

Table 2.8.1 Pamlock insertion point

DN	1400	1600	1800	2000
Insertion Point (mm)	280	295	305	330

Fit the turnbuckle and wire rope round the conformator and tighten the turnbuckle to pull the conformator close to the pipe spigot (see Fig. 2.8.2).

Fig. 2.8.2

Fig. 2.8.3

Fig. 2.8.4

Centre the spigot into the socket and push the spigot into the socket until the insertion point is reached (see Fig. 2.8.3). The conformator should be just outside the socket (see Fig. 2.8.4).

Fig. 2.8.5

Fig. 2.8.6

Fig. 2.8.7

Fig. 2.8.8

Fig. 2.8.9

Using a hammer, carefully position the conformator into the socket (see Fig. 2.8.5). Remove the wire rope and turnbuckle and use the gauge to check the correct depth of the conformator (see Fig. 2.8.6).

Fit the conformator clamps and jack apart using the hydraulic jack (see Fig. 2.8.7).

Use wedges to hold the conformator clamps in place (see Fig. 2.8.8) and lock using grub screw.

Attach the shot reservoir to one of the conformator clamps and the pneumatic vibrator in the middle of the conformator clamps (see Fig. 2.8.9). The shot is used to fill the gap between the conformator lip and the inside of the socket face. Connect the vibrator to the compressor and fill the reservoir with shot. Switch the vibrator on and the shot will run down into the joint. The shot must be topped up when required.

When no more shot is being used remove the reservoir from the conformator clamp and position it in the other conformator clamp and repeat the process for the other side. Careful examination of the gap between the socket face and conformator ring will reveal small holes that can be used for inserting a wire gauge to assess the level of the shot inside the joint.

The conformator clamps stay in place on the joint after assembly.

2.9 Jointing Methods

Trench excavator method - DN80-2000

This is by far the most widely used system. Where the trench is being prepared by using a backhoe type excavator, this machine may also be used to push the spigot home. A timber header should be placed between the pipe and the backhoe bucket to prevent damage to the pipe (see Fig. 2.9.1). **The operation should be carried out with great care to avoid the over insertion of the spigot.**

Fig. 2.9.1

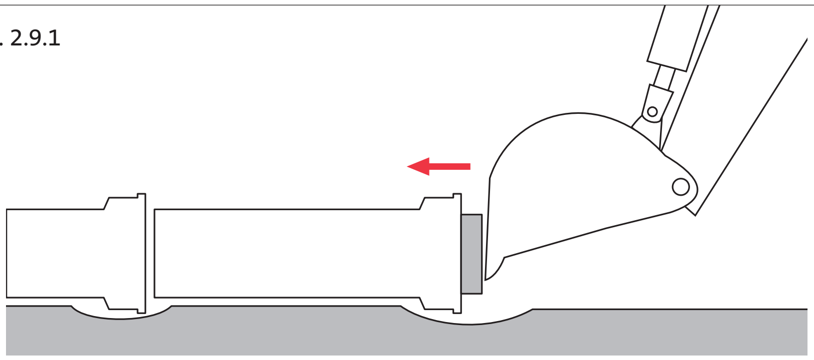
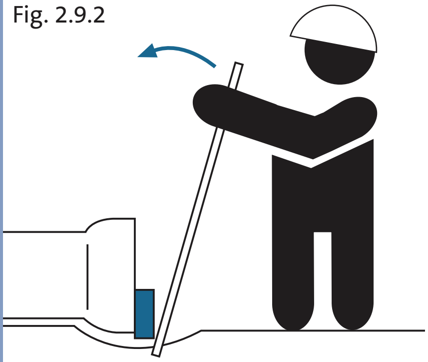


Fig. 2.9.2



Crowbar method - DN80-100

For joints DN80 and 100 complete entry of the spigot into the socket may be achieved by pushing with a crowbar or suitable lever against a timber held against the face of the socket of the entering pipe (see Fig. 2.9.2).

Fork tool method - DN80-200

For joints DN80 to DN200 a fork type tool may be used for assembly.

Enter the spigot into the socket until contact with the gasket is made. Place the fork over and behind the socket of the last pipe laid and attach the eye of the wire rope to the hook on the fork tool. Thread the plain end of the rope through the rope grip on the socket hook and place the hook into the socket of the pipe to be jointed. Take up the slack in the rope and pull on the fork tool to complete the joint (see Fig. 2.9.3).

Reasonable force only should be used.

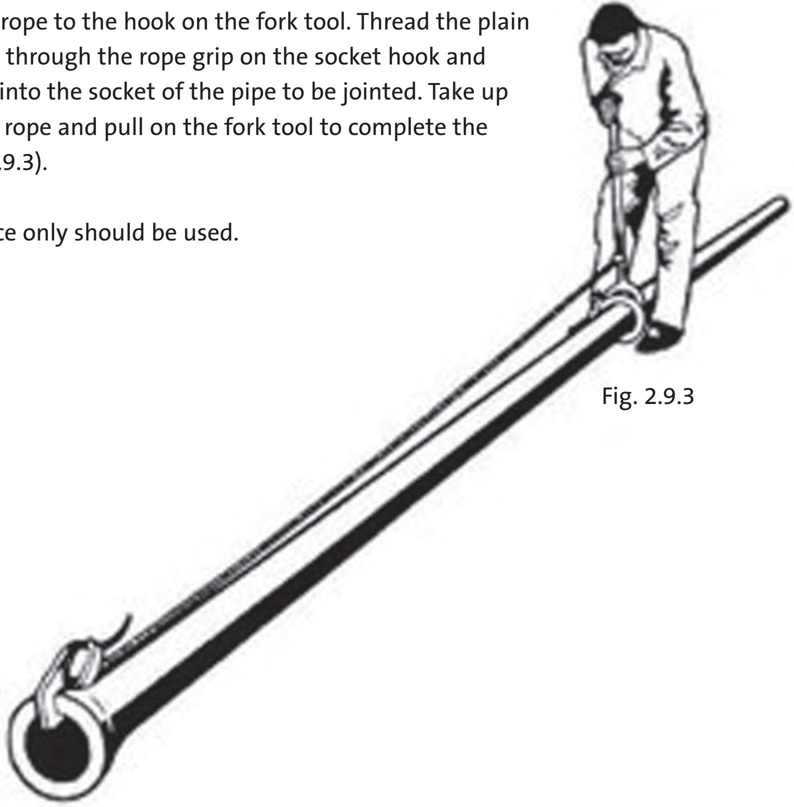


Fig. 2.9.3

Side link jointing tackle - DN80-400

Fig. 2.9.4

The side link jointing tackle set comprises a socket frame, a spigot clamp and two levers/ spanners. See Fig 2.9.4

Please note that each set of jointing tackle is size specific, e.g. a 250mm set will only joint a 250mm pipe.

Method

Enter the spigot into the socket until contact with the gasket is made.

Mount the socket frame immediately behind the socket of the installed pipe (see Fig. 2.9.5).

Secure with the chain (see Fig. 2.9.6).

Place the spigot clamp loosely around the spigot with the lugs towards the socket face (see Fig. 2.9.7).

Position the slots in the side links of the socket frame onto the lugs of the spigot clamp and tighten the clamp onto the pipe (see Fig. 2.9.8).

Draw the spigot into the socket by turning the nuts on the lugs with the levers, taking care to exert an even pull on each side to prevent uneven entry (see Fig. 2.9.9).

If jointing anchor gaskets, on completion of the joint, the levers should be pushed sharply in the opposite direction to check that anchorage is effective.

On tape wrapped pipe it is often necessary to remove the wrapping at the spigot end in order to get the spigot clamp into position. Any damage to the coating or protection system must be repaired before reinstatement. Please refer to Section 1.4.

Fig. 2.9.5

Fig. 2.9.6

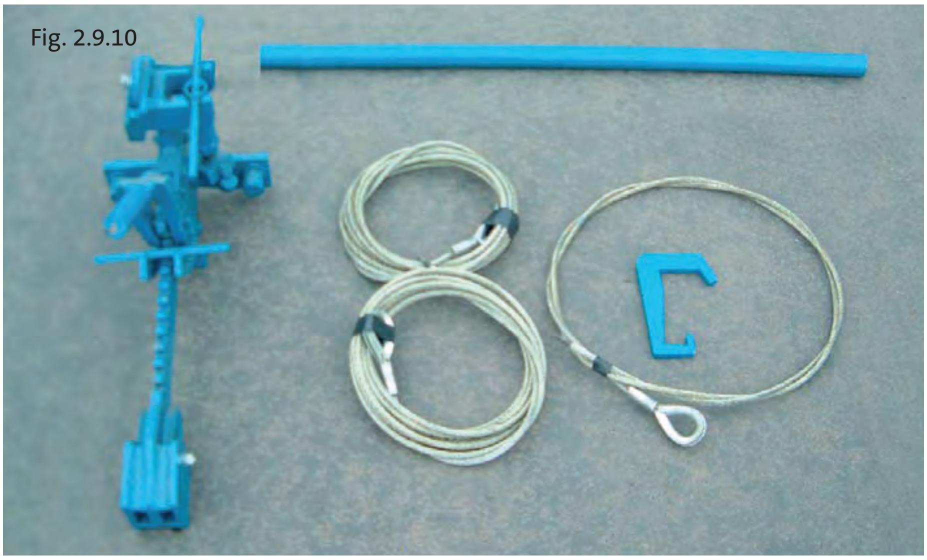
Fig. 2.9.7

Fig. 2.9.8

Fig. 2.9.9

Rack and lever method - DN80-450

Fig. 2.9.10



The rack and lever jointing set comprises a rack with hook bolt, two long wire ropes, a short wire rope, a extension tube and a socket hook. See Fig. 2.9.10

Fig. 2.9.11

Fig. 2.9.12

Fig. 2.9.13

Fig. 2.9.14

Method

Pipes:

Enter the spigot into the socket until contact with the gasket is made. Place the rack assembly on the socket of the installed pipe and fully extend the rack (see Fig. 2.9.11).

Screw the hook bolt to its lowest position and attach the eye of the short wire rope (see Fig. 2.9.12).

Pass the rope under the pipe making sure it is positioned behind the guide lugs and thread the plain end up through one side of the rope grip (see Fig. 2.9.13).

Pass the rope over the top of the rope grip and down the other side (see Fig. 2.9.14).

Fig. 2.9.15

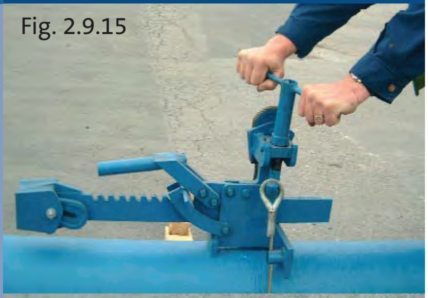


Fig. 2.9.16

Fig. 2.9.17

Fig. 2.9.18

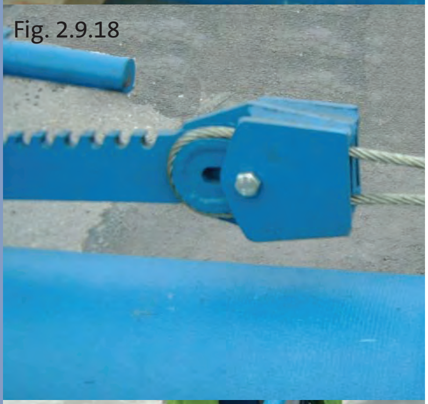


Fig. 2.9.19

Take up the slack and secure in the rope grip. Tighten the nut on the hook bolt until the rack assembly is secure (see Fig. 2.9.15).

Attach the eye of one long wire rope to the socket hook and place the socket hook over the end of the pipe (see Fig. 2.9.16).

Thread the plain end of the rope through the rope grip on the rack (see Fig. 2.9.17).

Take up the slack in the rope and pass the rope round the rope grip and back through the taper to secure the rope grip (see Fig. 2.9.18).

Fit the extension tube to the lever on the rack assembly and operate to complete the joint (see Fig. 2.9.19).


Fig. 2.9.20


Fig. 2.9.21

Fittings:

Attach the rack assembly as described. Form loops in the two long wire ropes by passing the plain ends through the eyes (see Fig. 2.9.20).

Position the loops behind the socket of the fitting with the eyes diametrically opposite and on the horizontal centre line (see Fig. 2.9.21).

Thread the plain ends of the ropes through the rope grips on the rack. Take up the slack ensuring that both ropes are equally taught (see Fig. 2.9.22).

Operate extension tube to complete the joint.

To dismantle the tackle, release tension on ropes by moving handle and ratchet back (see Fig. 2.9.23).

To release the ropes strike the rope grip with hammer (see Fig. 2.9.24).


Fig. 2.9.22

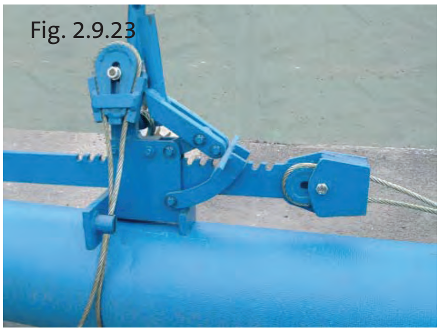


Fig. 2.9.23

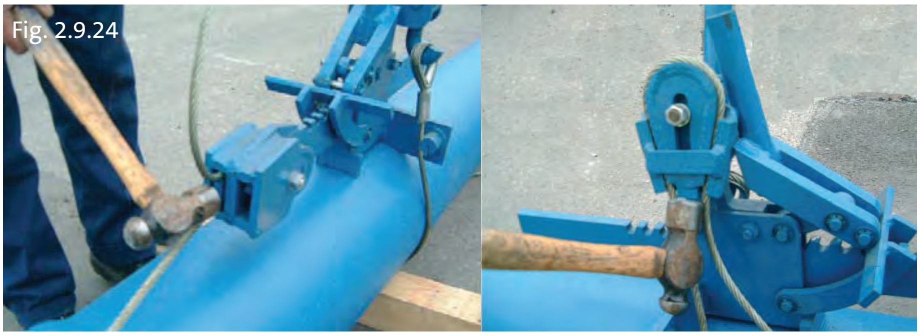


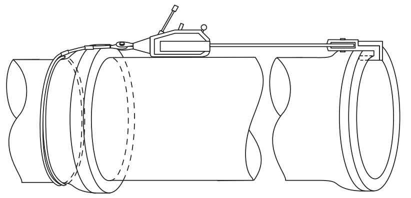
Fig. 2.9.24

Tirfor Method - DN80-2000

Tirfor winching equipment is available with both mechanical and hydraulic winches. Manufacturers operating instructions should be followed.

Pipes

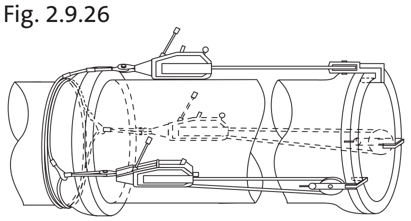
Fig. 2.9.25



Enter the spigot into the socket until contact with the gasket is made.

The wire rope should be looped and positioned behind the socket, the free end should then be attached to the Tirfor. The second wire rope can then be threaded through the winch and, using a hook, the joint is now made by operating the winch (see Fig. 2.9.25).

Fig. 2.9.26

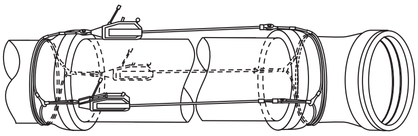


Larger pipes and fittings will require the use of more than one Tirfor (see Fig. 2.9.26). Ensure that the joints are kept straight whilst jointing.

DN80-300: One Tirfor 516 winch.
DN350-600: One Tirfor 532 winch.
DN700-1200: Two Tirfor 532 winches, diametrically opposite.
DN1400-2000: Three Tirfor 532 winches, 120° apart.

Fittings

Fig. 2.9.27



The wire rope should be looped and positioned behind the socket, the free end should then be attached to the Tirfor. The second wire rope should be looped and positioned behind the socket of the fitting. The joint is now made by operating the winch (see Fig. 2.9.27).

Jointing Tackle - DN450 -600

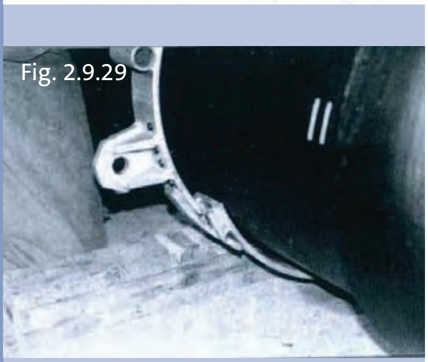
This jointing tackle was designed for jointing pipes and fittings using anchor gaskets but may be used for ordinary gaskets aswell. The equipment supplied by Saint-Gobain PAM UK is shown in Fig. 2.9.28. For each DN there is a socket harness and a spigot clamp. The bolt sets are common for these three sizes. In addition to the tackle supplied the following is required: 150Nm torque wrench, 30mm extension socket and 30mm AF spanner. Joint assembly is most efficient with two people, each with a wrench and spanner.

Fig. 2.9.28

Method

Locate the spigot in the socket and make sure that the pipes are in line. When jointing fittings, always ensure the socket face is square with the pipe axis.

Fig. 2.9.29



Assemble the spigot clamp around the spigot, with the bolt lug adjacent to the two clamping bolts at the top of the pipe. This is easier if the female end of the clasp is fed under the pipe first (see Fig. 2.9.29).

Locate the two spigot clamp bolts (220mm in length) and loosely fit the nuts with washers (see Fig. 2.9.30).

Fig. 2.9.30

Remove the locking pin from the socket harness and locate the harness behind the socket with the locking pin housing away from the socket face. Replace the locking pin (see Fig. 2.9.31).

Fig. 2.9.31

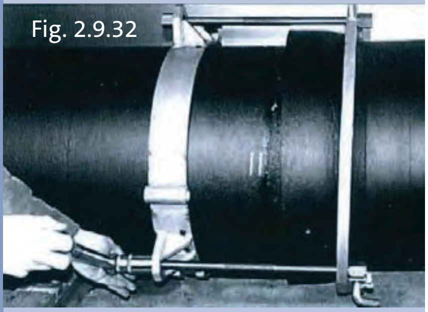
Push the socket harness up onto the socket and locate the three threaded bars. Adjust position of spigot clamp to give full thread engagement with the nuts. The nuts are domed at one end for location in the chamfered bolt-holes.

Clamp spigot clamp to spigot with a torque of 150 Nm.

Check that the threaded bar bolt-holes are in line by making sure that the top threaded bar is square to the socket clamp and the spigot harness.

To make the joint, tighten the domed nuts equally until the correct insertion is achieved. Check that the socket face remains square during tightening (see Fig. 2.9.32).

Fig. 2.9.32



Remove the socket harness and threaded bars. If jointing anchor gaskets, locate the two 180mm bolts in the spigot clamp tubes and tighten the bolts to engage the anchor teeth. Remove spigot clamp and repair any coating damage. Please refer to Section 1.4.

Note: If the pipes are tape wrapped the spigot clamp can be further restrained by tightening the grub screws positioned at each bolt lug, after tightening the two spigot clamp bolts. Do not over tighten the grub screws. On completing the joint repair any coating damage (please refer to Section 1.4). Before using the spigot clamp again, unscrew the grub screws so that they are flush with the inside of the clamp ring. Keep bolt sets clean and well lubricated.

2.10 Anchor Bead Application

Fig. 2.10.1

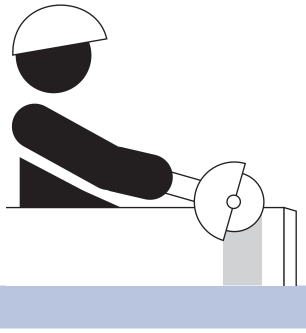


Fig. 2.10.2

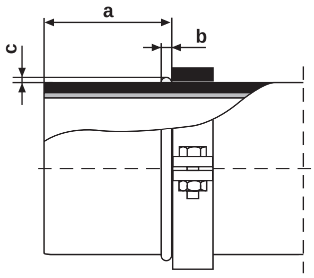


Fig. 2.10.3

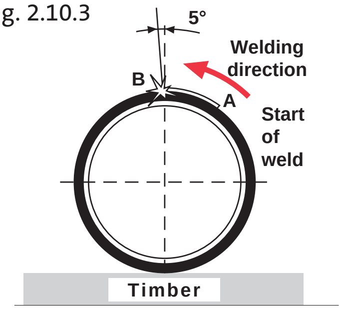
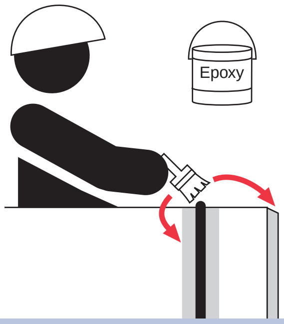


Fig. 2.10.4



When the mechanical anchoring system or Universal Rapid Ve joint is used the pipes are supplied with a factory applied welded bead. However, where the pipe is cut on site, the following procedure should be followed for on site bead welding.

All site welding must be undertaken by a skilled welder. High nickel welding rods will be needed. The recommended welding rods are 'Gricast 31', Eutectic 'Xuper 2240' or equivalent. A copper guide ring will also be required which can be ordered through Saint-Gobain PAM UK.

Carefully grind/linish the area for bead application over a width of 25mm. The grinding/linishing must not affect the pipe thickness (see Fig. 2.10.1).

Position and clamp the copper ring behind the weld position, paying attention to dimension 'a' in Table 2.10.1. The ring must fit the pipe snugly. Tap it lightly with a hammer if necessary to obtain a good fit (see Fig. 2.10.2).

Deposit the weld bead against the copper ring, to give a flat face vertical to the pipe surface. The bead must be applied in a single pass by an experienced welder using 3.2mm diameter electrodes.

Work preferably between positions 'A' and 'B' (see Fig. 2.10.3). Keep to this working area by rotating the pipe.

Table 2.10.1: Key dimensions of weld bead

Nominal Size DN	a		b		c		No. of Passes
	Nominal mm	Tolerance mm	Nominal mm	Tolerance mm	Nominal mm	Tolerance mm	
80	85	±3	7	±1	3	±1	1
100	90	±3	7	±1	3	±1	1
125	95	±3	7	±1	3	±1	1
150	95	±3	7	±1	3	±1	1
200	100	±3	7	±1	3	±1	1
250	110	±3	7	±1	3	±1	1
300	115	±3	7	±1	3	±1	1
350	114	±3	7	±1	3.5	±1	1
400	113	±3	8	±1	3.5	±1	1
450	120	±3	8	±1	3.5	±1	1
500	125	±3	8	±1	4	±1	1
600	135	±3	8	±1	4	±1	1
700	158	±3	8	±1	4	±1	1
800	150	±3	8	±1	4	±1	1
900	155	±3	9	±1	4	±1	1
1000	165	±3	9	±1	4	±1	1
1100	165	±3	9	±1	4	±1	1
1200	170	±3	9	±1	6	±1	1

For Dimensions on DN1400-2000 please contact our Technical Sales Department, Tel: 0115 930 0700.

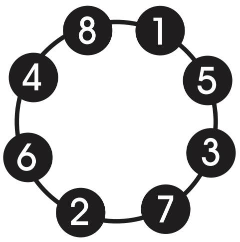
It is important to keep to the 'b' and 'c' bead dimensions given in Table 2.10.1.

Remove the copper ring and clean the weld bead using a wire brush. A brush can then be used to apply a solvent based epoxy (see Fig. 2.10.4) on the bead as well as on the chamfer (if pipe has been cut). For details of radius and chamfer see Section 1.5.

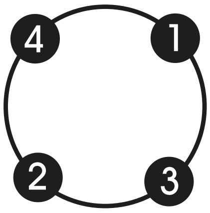
It is essential that any protection system is repaired, see Section 1.4 for details.

2.11 Flanged Joints

Fig. 2.11.1

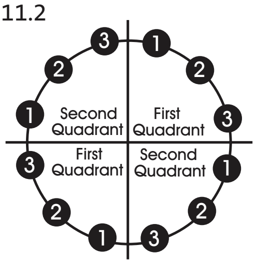


8 Bolts



4 Bolts

Fig. 2.11.2



12 Bolts or more

Fixed flanged joints

The following tasks should be performed in sequence in order to bolt a flanged joint.

- Ensure that the faces of the flanges are flat, clean and free from dirt or particles of foreign matter.
- Use only undamaged rust free bolts, nuts and washers. Lubricate the bolt threads and all mating surfaces of nuts, washers and flanges using a suitable lubricant (when used on pipes intended for use with potable water, the lubricant should have WRc approval. For use on pipes intended for use with sewage and waste water, an automotive oil or grease will be satisfactory).
- Location bolts may be inserted in the first four positions as shown in Fig. 2.11.1.
- Use only 3mm thick, 80 IRHD hardness synthetic rubber gaskets to EN681-1 (20) and with dimensions to suit the flange rating.
- Position the gasket on the location bolts.
- Offer the adjoining flange to bolts.
- Lightly tighten the four location bolts in the order as shown in Fig. 2.11.1 to secure the adjoining flange.
- Insert the remaining bolts and, using a torque wrench, tighten in the correct sequence (see Fig. 2.11.1). Where flanges have more bolts than shown follow the principle of tightening diametrically opposite bolts.
- Tighten gradually and ensure that a sufficient number of circuits are undertaken to achieve the specified bolt torque (see Table 2.11.1).
- Because of potential gasket creep, leave for one hour, check and, if necessary, re-tighten bolts. Repeat the checks until the bolts will not tighten any more.

For sizes having 12 bolts or more it is recommended that two jointers work simultaneously on diametrically opposite bolts. Each jointer tightens the first nut in the first quadrant, then the first nut in the second quadrant, returns to the second nut in the first quadrant and so on (see Fig. 2.11.2).

Bolting torque

Table 2.11.1 indicates the approximate bolting torque required to seal flanged joints against internal pressure. Where the installation is such that high bending moments could be induced at these joints, please contact our Technical Sales Department, Tel 0115 930 0700.

The relationship between applied torque and the actual load imparted by the bolts is not precisely predictable, therefore the values given in the charts are an approximate guide.

Table 2.11.1: Approximate bolting torque for PN16, PN10 and PN25 fixed flanges

Nominal Size DN	Approximate Bolting Torque in Nm for Fixed Flanges										
	PN 16 Flanged Joints				PN 10 Flange Joints			PN 25 Flanged Joints			
	To Seal at 10 bar	To Seal at 16 bar	To Seal at 20 bar	To Seal at 25 bar	To Seal at 5 bar	To Seal at 10 bar	To Seal at 16 bar	To Seal at 20 bar	To Seal at 25 bar	To Seal at 30 bar	To Seal at 35 bar
80	70	70	75	75	70	70	70	80	85	85	85
100	75	80	80	80	70	75	80	120	125	130	130
150	115	120	125	135	110	115	120	180	185	195	210
200	110	115	120	130	120	130	140	170	180	190	205
250	155	165	175	180	110	120	130	230	250	275	305
300	165	180	190	210	120	130	145	220	235	265	295
350	160	175	185	200	115	125	135	290	330	375	415
400	200	220	235	270	155	170	185	380	435	495	555
450	195	215	230	260	150	165	180	355	410	470	525
500	240	270	295	345	155	170	195	415	485	555	625
600	305	365	425	505	200	225	275	595	700	800	905
700	350	465	540	635	200	230	295	675	795	915	1040
800	470	630	735	870	250	300	405	965	1150	1330	1510
900	475	645	760	900	250	300	415	990	1185	1375	1565
1000	605	835	985	1175	300	390	535	1355	1620	1885	2155
1100	610	850	1005	1205	300	395	550	1380	1655	1930	2205
1200	810	1140	1360	1630	360	495	695	1610	1940	2265	2595
1400	915	1300	1555	1875	420	590	840	1980	2395	2805	3215
1600	1180	1690	2035	2460	530	765	1095	2265	2745	3225	3705

Note: The need to seal a flanged joint at a pressure greater than the flange PN rating is only for site hydrostatic test purposes. Flanged joints should not be operated at these higher values.

On flanged joints using elastomeric gaskets some relaxation of the gasket will be experienced and it should be ascertained that the bolting torque required to effect a seal at the appropriate pressure, as shown in the charts, are effective at the time of pressure testing. Bolt torques do not have to be restricted to those applicable for a specific test pressure and higher torque can be applied up to the maximum rated test pressure of the appropriate flange.

On certain sizes of concentric tapers the bolt hole patterns differ at either end. In these cases there is a raised triangle between two bolt holes. This mark should be at the top of the taper when fitted.

For other flange ratings please contact our Technical Sales Department, Tel 0115 930 0700. Please note that when bolting to valves, some of the valve flanges are grey iron and will require longer bolts.

Adjustable flanges

The following tasks should be performed in sequence in order to bolt a flanged joint with rotating flanges.

- Ensure that the faces of the flanges are flat, clean and free from dirt or particles of foreign matter.
- Location bolts may be inserted in the first four positions as shown in Fig. 2.11.1.
- Position the gasket on the location bolts.
- Align and offer the adjoining flange to bolts.
- Lightly tighten the four location bolts in the order as shown in Fig. 2.11.1 to secure the adjoining flange.
- Insert the remaining bolts and, using a torque wrench, tighten in the correct sequence (see Fig. 2.11.1). Where flanges have more bolts than shown follow the principle of tightening diametrically opposite bolts.
- Tighten gradually and ensure that a sufficient number of circuits are undertaken to achieve the specified bolt torque (see Table 2.11.2).

Table 2.11.2: Approximate bolting torque for PN10, PN16, PN25 rotating flanges and fixed flanges using gaskets with metal inserts

Metal Reinforced Gaskets			
DN	Approximate Bolting Torque in Nm for Rotating Flanges		
	PN 10	PN 16	PN 25
60	40	40	40
80	40	40	40
100	40	40	40
125	40	40	60
150	60	60	80
200	60	60	80
250	60	80	80
300	60	80	120
350	60	80	120
400	80	120	150
450	80	120	180
500	80	150	180
600	120	180	300
700	120	180	400
800	150	300	500
900	150	300	500
1000	180	400	600
1100	180	400	600
1200	300	500	600
1400	400	500	700
1600	500	600	700
1800	500	600	800
2000	500	700	800

Note: Adjustable flanges utilise different bolt lengths to fixed flanges, please contact our Technical Sales Department, Tel 0115 930 0700.

The bolt torques given here are for lubricated bolt threads.

Bolt tightening is only for gasket compression and should not exert any tractive force on the pipeline components.

For other flange ratings please contact the Technical Sales Department.

2.12 Couplings and Adaptors

These instructions are for couplings and adaptors supplied by Saint-Gobain PAM UK and should not be applied to any other manufacturers' product range. Where other manufacturers product ranges are to be used the manufacturers' instructions should be followed.

Note – These couplings and adaptors are not designed to take thrust. Adequate restraint will be required to prevent end load of the fitting.

PAM uLINK NG couplings DN50-300

The following should be checked prior to the fitting of the unit:-

- The pipe ends should be clean and free from weld spatter, heavy score marks, dents and protrusions which would prevent an adequate seal to be made.
- The pipe outside diameter is within the range of the coupling.
- The deflection of the pipes is within the maximum of 6° per pipe, 12° in total.

1. Measure the length of the coupling, loosen the gland nuts and push the coupling onto one of the pipe sections.

2. Offer up the pipe ends ensuring there is a general gap of 7mm to 16mm between the two ends.

3. Measure and mark the pipe from the joint, for half the length of the coupling – this will aid centering the coupling over the pipe ends.

4. Place the coupling body over the joint and tighten the gland nuts progressively in a diametrically opposite sequence until a torque of 53Nm to 61Nm (40 to 45 lbf.ft) is achieved.

PAM uQUICK NG flange adaptors DN50-300

The following should be checked prior to the fitting of the unit:-

- The pipe ends should be clean and free from weld spatter, heavy score marks, dents and protrusions which would prevent an adequate seal to be made.
- The pipe outside diameter is within the range of the adaptor.
- The deflection of the pipes is within the maximum of 6°.

1. Loosen the gland nuts and push the adaptor onto the pipe.

2. Offer up the pipe end to the mating flange ensuring there is a general gap of 7mm to 16mm between the two units.

3. Ensure the gland bolts are correctly aligned within the recess of the flange face and offer up the pipe end to the mating flange. Insert the sealing gasket between the two flanges and fit flange bolts.

4. Tighten the gland nuts progressively in a diametrically opposite sequence until a torque of 53Nm to 61Nm (40 to 45 lbf.ft) is achieved.

PAM Dedicated GS LINK coupling DN350-1200

The following should be checked prior to the fitting of the unit:-

- The pipe ends should be clean and free from weld spatter, heavy score marks, dents and protrusions which would prevent an adequate seal to be made.
- The pipe outside diameter is within the range of the coupling.

1. Measure the length of the coupling then dismantle to ease fitting.

2. Present the 2 pipe ends to be joined, one to the other, to check concentricity is within acceptable limits.

3. Measure and mark the pipe from the joint, for half the length of the coupling – this will aid centering the coupling over the pipe ends.

4. Place one gland over each pipe clear of the working area. Lubricate and fit the gaskets.

5. Place the coupling body over one pipe. Offer up the pipe ends ensuring there is a general gap of 10mm to 12mm between the two ends.

6. Place the coupling body over the joint. Position gaskets and glands and fit bolts.

7. Tighten the gland nuts progressively in a diametrically opposite sequence until the correct torque is achieved.

- 53Nm to 61Nm (40 to 45 lbf.ft) for 12mm bolts
- 88Nm to 95Nm (65 to 70 lbf.ft) for 16mm bolts

PAM Dedicated GS QUICK flange adaptor DN350-1200

The following should be checked prior to the fitting of the unit:-

- The pipe ends should be clean and free from weld spatter, heavy score marks, dents and protrusions which would prevent an adequate seal to be made.
- The pipe outside diameter is within the range of the adaptor.

1. Dismantle the adaptor to ease fitting.

2. Place the gland over the pipe clear of the working area. Lubricate and fit the gasket.

3. Offer up the pipe end to the mating flange ensuring there is a general gap of 15mm to 20mm between the two units.

4. Ensure the gland bolts are correctly aligned within the recess of the flange face and offer up the pipe end to the mating flange. Insert the sealing gasket between the two flanges and fit flange bolts.

5. Position gaskets and glands and fit bolts.

6. Tighten the gland nuts progressively in a diametrically opposite sequence until the correct torque is achieved.

- 53Nm to 61Nm (40 to 45 lbf.ft) for 12mm bolts
- 88Nm to 95Nm (65 to 70 lbf.ft) for 16mm bolts

2.13 Dismantling Joints

When dismantling a joint it is important to avoid dislodging other joints further along the pipeline. Joints in the middle of a pipeline will require cutting out and couplings will be required to make the pipeline complete. Joints that are at the end of pipelines can be dismantled as follows.

Rapid joints can usually be separated by using lifting equipment appropriate to the size of the pipe.

Secure a webbing sling, of suitable size and strength, around the pipe near the end furthest from the joint to be dismantled. This is then attached to the lifting equipment and the pipe is raised and lowered, within the specific limitations, whilst at the same time exerting a slight pulling force, so that the spigot is 'walked' out of the socket.

If the pipes adjacent to the one being disjointed are in an uncovered situation (i.e. not backfilled), the next 2 joints along must be carefully checked to ensure that they are not disturbed unduly by the operation.

Dismantling joints with anchor gaskets and the Universal Rapid Vi joint

If the joint has been pressurised, use the jointing tackle to pull the joint together, as previously described. This will help to partially release the anchor teeth from the pipe spigot.

Insert an extractor shim in the carrying anvil and smear lubricant over the leading edge (see Table 2.13.1 for tackle requirements).

Table 2.13.1: Anchor gasket and Universal Rapid Vi joint dismantling – tackle requirements

Nominal Size DN	Anchor Joint Dismantling - Tackle Requirements	
	Anvil Type	No. of Shims
80	1	4
100	1	4
150	2	6
200	2	8
250	3	10
300	3	12
350	4	13
400	4	15
450	5	15
500	5	17
600	5	19

Fig. 2.13.1

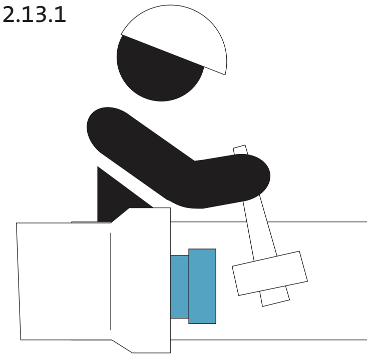


Fig. 2.13.2

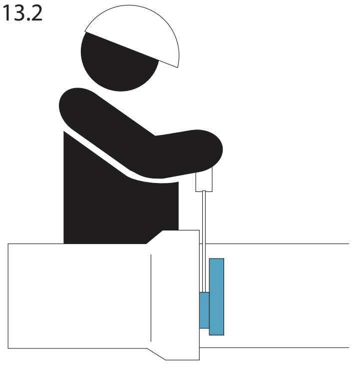
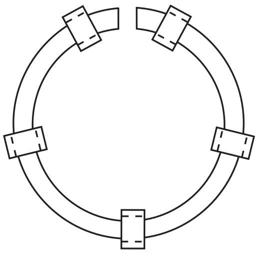


Fig. 2.13.3

Fig. 2.13.4



Note: Safety glasses must be worn

Commencing at the bottom of the joint, drive the shim under the gasket by striking the anvil (see Fig. 2.13.1).

Prise the anvil off the shim (see Fig. 2.13.2). Continue driving shims under the gasket around the whole circumference of the joint keeping the gaps between the shims to a minimum. The final shim inserted will overlap the shims on either side.

DN80-400 - Side link jointing tackle

Attach the socket frame and spigot clamp, as described in jointing section 2.9, but with the lugs on the nut assemblies pointing away from the socket face.

Draw the spigot out of the socket by turning the nut assemblies with the levers, taking care to exert an even pull on each side (see Fig. 2.13.3).

After dismantling the joint, **do not re-use the gasket.** If the pipes are to be re-used and have been pressurised ensure the spigot is suitable for re-use. A thorough inspection should be made of the spigot jointing area and all sharp edges removed.

Dismantling joints with the Universal Rapid Ve joint

Push the spigot into the bottom of the socket to free the locking ring. Open the locking ring by inserting 5 wedges between the pipe barrel and the ring (see Fig. 2.13.4). This enables the weld bead to slide under the locking ring. The spigot can then be pulled from the socket.

Section 3

Post Installation

3.1 Cleaning and Testing

Cleaning

Before a pipeline can be considered ready for service it should be cleaned internally as thoroughly as possible to ensure that no foreign matter remains inside the pipe. Pigs of suitable design, e.g. polyurethane swabs, may be used provided that the pipeline has been constructed to allow the passage of such pigs. Where the pipeline is to be tested with water, the filling and emptying of the pipeline may to some extent cleanse the line.

Testing

The following guidance is intended to complement current Codes of Practice and Safe Working Systems for testing ductile iron pipes and should not be taken to represent a detailed explanation of testing methods. Site safety regulations should be followed at all times. It is recommended that anyone involved with the testing of pipelines should familiarise themselves with relevant accepted procedures and safety regulations.

All pipelines should be tested before being bought into service to check for:

- Leak tightness
- Soundness of any construction work, particularly anchorage.

The type of test will depend upon the fluid which the pipeline will eventually convey and may be a hydrostatic test or a low pressure (100mm water gauge) pneumatic test, or both. The hydrostatic test is safer to carry out and can be made more stringent as regards the strength of a completed pipeline. With the exception of testing non-pressure pipelines at very low pressures (100mm water gauge), pneumatic testing is to be avoided, if possible, because of the hazards inherent in containing large volumes of compressed air. However, there may be occasions when hydrostatic testing is not possible and air is the only medium available for applying a test pressure. It is recommended that testing is carried out in accordance with BS 8010.

The contractor and personnel carrying out these tests must satisfy themselves that it is safe to do so prior to commencement of test.

The specific contract will usually contain detailed requirements for pressure testing and the information provided below is for guidance only.

Hydrostatic test

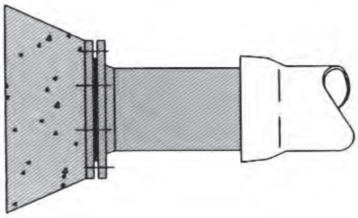
It is recommended that testing be carried out in accordance with BS 8010 or BS EN 805.

BS8010 specifies that the site test pressure for ductile iron pipes, fittings and flanged joints should not be less than:

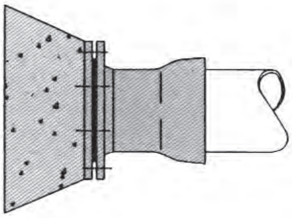
- Working pressure + 5 bar;
- Maximum pressure under surge conditions; but should not exceed the test pressure rating (PEA) of the pipeline components.

Note. Anchor gaskets and some types of fitting have a restricted test pressure rating. Please refer to the relevant product catalogue or to the Technical Sales Department for details.

Fig. 3.1.1



Flange Spigot and Blank Flange



Flange Socket and Blank Flange

Before carrying out a hydrostatic test the following should be checked:

- All anchorage is in position and the section of the pipeline to be tested is properly blanked off, for example by one of the methods illustrated in Fig. 3.1.1.
- All concrete should have developed adequate strength before testing begins.
- All air is released from the pipeline.
- Where joints are left uncovered during the test, ensure that sufficient backfill has been placed over the barrels of the pipes to prevent movement at exposed joints.
- Where unrestrained closure pieces are used, adequate temporary restraint should be put in place to prevent movement at exposed joints.

NOTE. It may often be economical to provide a concrete anchor block which has subsequently to be demolished, rather than risk movement of temporary stop ends during testing. Hydraulic jacks may be inserted between temporary anchors and stop ends to take up any horizontal movement of the temporary anchors. If self-anchored joints are to be used, it is essential that the correct length of anchorage is calculated to determine the required number of anchored joints.

- Where restrained closure pieces are used (i.e. with self anchored joints) care must be taken to ensure that all personnel are kept a safe distance away from the section under test.
- Sufficient time is allowed, after the pipeline has been filled, for absorption of water into cement mortar linings. At least 24 hours should be allowed.

Test Procedure

The completed pipeline may be tested either in one length or in sections.

Fill the pipeline with clean water (semi treated water can be used for sewage pipelines), ensuring that all air is removed, pressurise to working pressure and leave until stable conditions are achieved.

Steadily increase pressure until the test pressure is reached at the lowest point of the section being tested. If pressure measurements are not made at the lowest point of the section, an allowance should be made for the static head between the lowest point and the point of measurement to ensure that the maximum permissible pressure is not exceeded at the lowest point.

Maintain pressure for one hour, by pumping if necessary.

Disconnect pump for one hour.

Note the pressure and restore to the test pressure by pumping. Stop pumping on reaching the test pressure and draw off water until the pressure equals the noted value.

If using anchor gaskets with closure pieces to test a section of pipeline, after dismantling following testing, ensure that the gasket is disposed of and not reused.

Test Results

The generally accepted standard of loss to absorption in ductile iron pipelines is:-

- 0.02 litres/mm of nominal bore per km per 24 hours per bar pressure.

Fault Finding

In the event of an unsatisfactory test and where joint leakage is suspected various methods may be used to detect the leak:

- Visual inspection of pipeline, especially each joint, if not covered by the backfill;
- Aural inspection, using a stethoscope or listening stick in contact with the pipeline;
- Use of electronic listening devices including leak noise correlators which detect and amplify the sound of any escaping fluid; actual contact between the probe and the pipe may or may not be essential;
- Use of a bar probe to detect signs of water in the vicinity of joints, if backfilled;
- Introduction of a gas compound into the test water, using a gas detection device to detect the presence of any gas that has escaped through the leak.

Where there is difficulty in locating a fault, the section under test should be subdivided and each part tested separately.

Once the cause of the apparent loss has been identified and rectified the test should be repeated.

NOTE. It is important to ensure that proper arrangements are made for the disposal of water from the pipeline after completion of hydrostatic testing and that all consents which may be required from land owners and occupiers and from river, drainage and water authorities have been obtained.

Pneumatic Test

Pneumatic testing should generally be avoided except for testing non-pressure pipelines using very low test pressures (100mm water gauge). A low pressure air test may be carried out at regular intervals (daily) to help narrow any search areas should a problem arise.

Air is 20,000 times more compressible than water and this means that a pipeline under high air pressure contains considerable potential energy which could be released explosively in the event of the failure of a pipeline component.

The contractor and personnel carrying out pneumatic tests must satisfy themselves that it is safe to do so prior to commencement of test.

If a pneumatic test is to be carried out please refer to:

- BS 8010 (5)
- IGE/TD/3 (21)

3.2 Commissioning

Individual water utilities will have their own procedures for commissioning water mains. There are no special procedures for sewers other than pressure testing.

Disinfected water used for disinfection of the pipeline should receive treatment to neutralise or dilute the disinfectant to an acceptable level before discharge to sewer or watercourse.

3.3 Service Connections

Recommended types of service connections

Table 3.3.1 identifies the recommended type of connections that should be used for given mains pipe sizes.

Table 3.3.1 : Recommended service connections

Connection Inlet size (in)	Class 40 (EN545:2010)						Class 30 (EN545:2010)	
	Nominal size DN							
	80	100	150	200	250	300	350	400+
0.5	▓	■	■	■	▒	▒	▒	▒
0.75	▓	▓	■	■	▒	▒	▒	▒
1	▓	▓	▓	▓	▒	▒	▒	▒
1.25	▓	▓	▓	▓	■	▒	▒	▒
1.5	▓	▓	▓	▓	▓	▒	▒	▒
2	▓	▓	▓	▓	▓	▓	■	▒

▒ Conventional or external seal type

■ External seal type

▓ Use saddles, tees, etc only

Drilling and tapping machines

Fitting service connections to ductile iron pipes is carried out using purpose-designed drilling and tapping machines. There are two basic types of machine; those for making connections to dead (non-pressurised) mains and those for making connections to live (pressurised) mains. It is good practice to protect the pipe coatings and sleeving from being damaged.

Service connections

Service connections in common use on ductile iron water mains are of two types; the `Conventional' type which depends on the screw thread on the inlet for sealing and anchorage onto the pipe and the `External-seal' type which incorporates separate sealing components, the screw thread being used primarily for anchorage.

Fig. 3.3.1

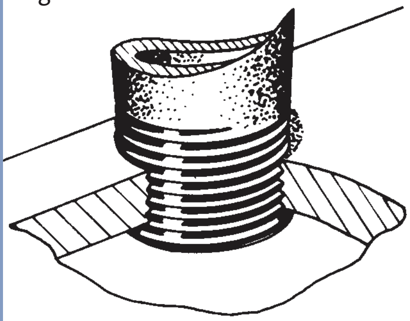
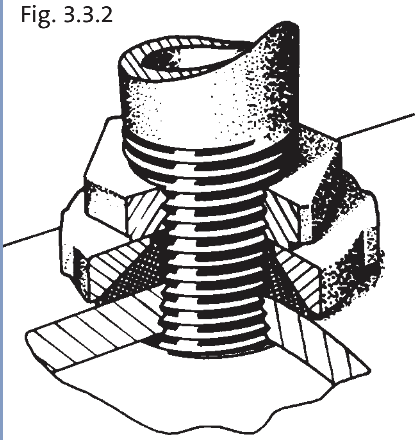


Fig. 3.3.2



Conventional type connections

The inlets of 'Conventional' type connections have taper screw threads. The angle of taper and type of screw threads may vary on the connections of different manufacturers.

When fully tightened, the threaded inlet of the connection provides both the anchorage and a leak-tight seal (see Fig. 3.3.1).

This type of connection is obtainable in a number of materials in the form of tees or swivel balance ferrules and the outlet may have screwed compression or flexible joints.

External seal type connections

The thread on the inlet of `External-seal' type connections is used primarily for anchoring and both parallel and taper screw threads are used.

The pressure seal is achieved by compressing a gasket of elastomeric material onto the pipe body and the inlet stem of the connection (see Fig. 3.3.2). The required compressive load is applied by tightening a backing nut onto a suitable shaped saddle.

In common with the `Conventional' type, `External' type connections are available in a number of materials in the form of tees or swivel balance ferrules and the outlet may have screwed, compression or flexible joints.

Service connections to pipes with factory-applied wrapping

The following tasks should be performed to make the service connections to pipes with factory applied wrapping:

- Prior to making the service connection, place the saddle of the tapping machine on the pipe in the correct position. Mark around the saddle.
- Remove the saddle and carefully cut away the wrap in the area marked.
- Proceed with the tapping in the normal way.
- Once the connection is made, complete the protection by the application of waterproof tape over all exposed metal surfaces, including the ferrule.

3.4 References

1. BS EN 545: 2010. Ductile iron pipes, fittings accessories and their joints for water pipelines. Requirements and test methods.
2. BS EN 598: 2007. Ductile iron pipes, fittings, accessories and their joints for sewerage applications. Requirements and test methods.
3. Civil Engineering Specification for the Water Industry (CESWI). 7th Edition. WRc Publications.
4. Standard Specification for Water and Sewerage Schemes (applicable in Scotland and Northern Ireland.
5. BS 8010 Pt 2 – Codes of Practice for 'Pipelines on land: design construction and installation. Section 2.1 Ductile Iron'.
6. Sewers for Adoption 6th edition
7. Regulation 31. Water supply regulations for England and Wales.
8. The Water Supply (Scotland) Regulations 1990.
9. Health and safety guidance note PM42. Excavators used as cranes.
10. Exemption certificate number CON(LO)1981/2 Excavators, Loaders and Combined Excavator/Loaders.
11. Health and Safety Executive Code of Practice L113. Safe use of lifting equipment. Lifting Operations and Lifting Equipment Regulations 1998.
12. BS 3574: 1989 (1996) Specification for the controlled storage and packaging of vulcanised rubber and rubber products.
13. BS EN 805: 2000 Water supply - Requirements for systems and components outside buildings
14. BS 6031: 1981 Code of Practice for Earthworks.
15. Report R97: Trenching Practice. Published by CIRIA.
16. Technical Note TN95: Proprietary trench support systems. published by CIRIA
17. Specification for the Reinstatement of Openings in Highways. June 1992 (the HAUC specification).
18. IGN No. 4-08-01 (4), 1994. Imported Granular and selected As-Dug Bedding and Sidefill Material for Buried Pipelines. WRc Publications.
19. IGN No. 4-08-02 (15), 1994. Bedding and Sidefill Material for Buried Pipelines. WRc Publications.
20. BS EN 681-1: 1996: Elastomeric seals – Material requirements for pipe joint seals used in water and drainage applications.
21. IGE/TD/3. Institution of Gas Engineers. Recommendations on Transmission and Distribution Practice. Second Edition 1983.
22. COSHH sheets can be obtained from the product manufacturer. If any problems are experienced in obtaining this data please contact our Technical Sales Department.
23. BS EN 1514-1: 1997: Non-metallic flat gaskets with or without inserts.

3.5 Contacts

Saint-Gobain PAM UK
Technical Sales Department
Tel: +44(0)115 930 0700
technical.pipes.uk.pam@saint-gobain.com

Pipe supports and straps etc.
Carpenter and Patterson
Tel: +44(0)1938 552061
info@cp-ltd.co.uk
www.cp-ltd.co.uk

Lifting hooks
Parsons Chain Company
Tel: +44 (0)1384 563700
www.parsonchain.co.uk

Pipework & Welding Services Ltd
Tel: +44 (0)1488 674138
www.pipeworkwelding.co.uk

Brochure Hotline
Tel:+44(0)800 028 2134
Fax:+44(0)115 932 9513
brochures.uk.pam@saint-gobain.com

Technical Enquires
Tel:+44(0)115 930 0700

Sales Enquires
Tel:+44(0)115 930 0630
sales.uk.pam@saint-gobain.com

Head Office
Lows Lane, Stanton-by-dale, Ilkeston,
Derbyshire, DE7 4QU
Tel:+44(0)115 930 5000
Fax:+44(0)115 932 9513

Products and services available from Saint-Gobain PAM UK:

Blutop™

A small diameter, push fit water pipe system compatible with plastic pipe made from ductile iron. It has the added advantages of a corrosion resistant exterior coating and the innovative Ductan lining to prevent the risk of corrosion.

Natural™

A new generation of potable water pipeline products available DN80 to DN800 with a new revolutionary system of external protection, fully compliant with the requirements of BS EN 545.

Large diameter water pipes

Large diameter water pipeline products available DN900 to DN2000, fully compliant with the requirements of BS EN 545.

Integral and Integral Plus™

A complete range of sewerage pipeline products available from DN80 to DN2000, fully compliant with the requirements of BS EN 598.

Valves

A comprehensive range of valves and accessories suitable for water and sewerage applications. All valves are supplied in compliance with WRAS requirements where applicable, and manufactured in accordance with ISO 9001.

- Gate valves, resilient and metal faced DN50 to DN300
- Non return valves DN80 to DN300
- Tidal flap valves DN80 to DN600
- Air valves
- Fire hydrants
- Butterfly valves DN50 to DN2000
- Control valves

Couplings and flange adaptors

Accommodating a wide range of external diameters and pipe materials in accordance with British, European Standards and ISO 9001 requirements. A diversified range from wide tolerance fittings to dedicated products.

Induct Plus™

An installation accreditation scheme, designed to give peace of mind and confidence to water utilities and contractors in the knowledge that the ductile iron pipeline that they have purchased will be installed effectively and in its optimum condition.

Access covers and gratings

A comprehensive range of ductile iron access covers and gratings. For high performance products which meet the increasing demands from traffic to a purpose designed range for low density applications, Saint-Gobain PAM UK access cover products provide targeted solutions for the key civil engineering, utility and infrastructure sectors.

PAM Estate™

Designed to meet the requirements and expectations of the housing and commercial sectors.

Ensign™

Cast iron above and below ground drainage system BSI Kitemark approved to BS EN 877.

Used for soil and waste, rainwater, suspended, buried and bridge drainage applications, providing lifetime service for commercial and public buildings.

Ensign EEZI-FIT™

A new range of cast iron push-fit fittings and couplings in 100 diameter, Kitemarked to BS EN 877 for gravity sanitary installations.

Timesaver™

Cast iron above ground system BSI Kitemark approved to BS 416 part 2, used for soil and waste refurbishment, and external soil stacks for traditional appearance.

Cast iron below ground system BSI Kitemark approved to BS 437, favoured for under building drainage, and unstable ground conditions due to its superior strength performance.

Classical – Classical Plus™

Cast iron rainwater and gutter systems to BS 460 BBA certified. Seven gutter profiles and circular and rectangular downpipes systems supplied in a black primer coat. Classical Plus is a standard range of gutters and downpipes available in a factory applied semi-gloss black finished coat for immediate installation.

EPAMS™

A complete syphonic rainwater system, consisting of steel syphonic roof outlets and cast iron pipework to BS EN 877 BBA certified.

Visit: www.saint-gobain-pam.co.uk

Your local stockist is:

Quality Assurance

Quality Management Systems BS EN ISO 9001:2008
(Registered firm: 12908)

Environmental Standard

Environmental Management Systems BS EN ISO 14001:2004
(Register firm: EMS83973)