



Contaminated land

The complete barrier system
handbook for Protecta-Line

Our vision and values

GPS **PE PIPE SYSTEMS**

GPS PE Pipe Systems are a market leading range of high-performance fluid handling solutions, that provide the safe delivery of gas and clean drinking water to homes and businesses across the world.

**MANUFACTURING
IN THE UK**

**BESPOKE
SERVICES
FOR COMPLEX
PROJECTS**























**CLOSE
COLLABORATION
WITH
UK UTILITY
COMPANIES**



The GPS PE Pipe range forms part of the leading Aliaxis portfolio of sustainable pipework systems for water, gas and energy. We are experts in fluid management solutions, leading our industry in a way that anticipates the rapidly evolving needs of our customers, ensuring peace of mind for future generations.

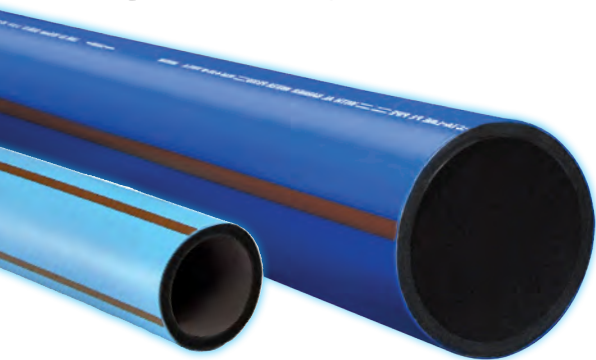


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Complete polyethylene pipe solutions for **Contaminated Land**



Protecta-Line is the UK leading, award winning fully integrated barrier pipe and fittings system for safe transportation of water through contaminated land.

With an increasing number of brownfield sites being used for development, it is important that appropriate water supply pipes are selected to provide long term protection to both water quality and structural integrity of pipes.

Certain plastic supply pipes can be permeable to hydrocarbons such as petrol, diesel, heating fuel and white spirits. To ensure that a safe water supply is maintained through contaminated land, a material, which is not permeable to hydrocarbons, such as ductile iron, copper, plastic coated copper or aluminium lined polyethylene pipe (ALPE) needs to be used.

GLOSSARY (AS PER UKWIR)

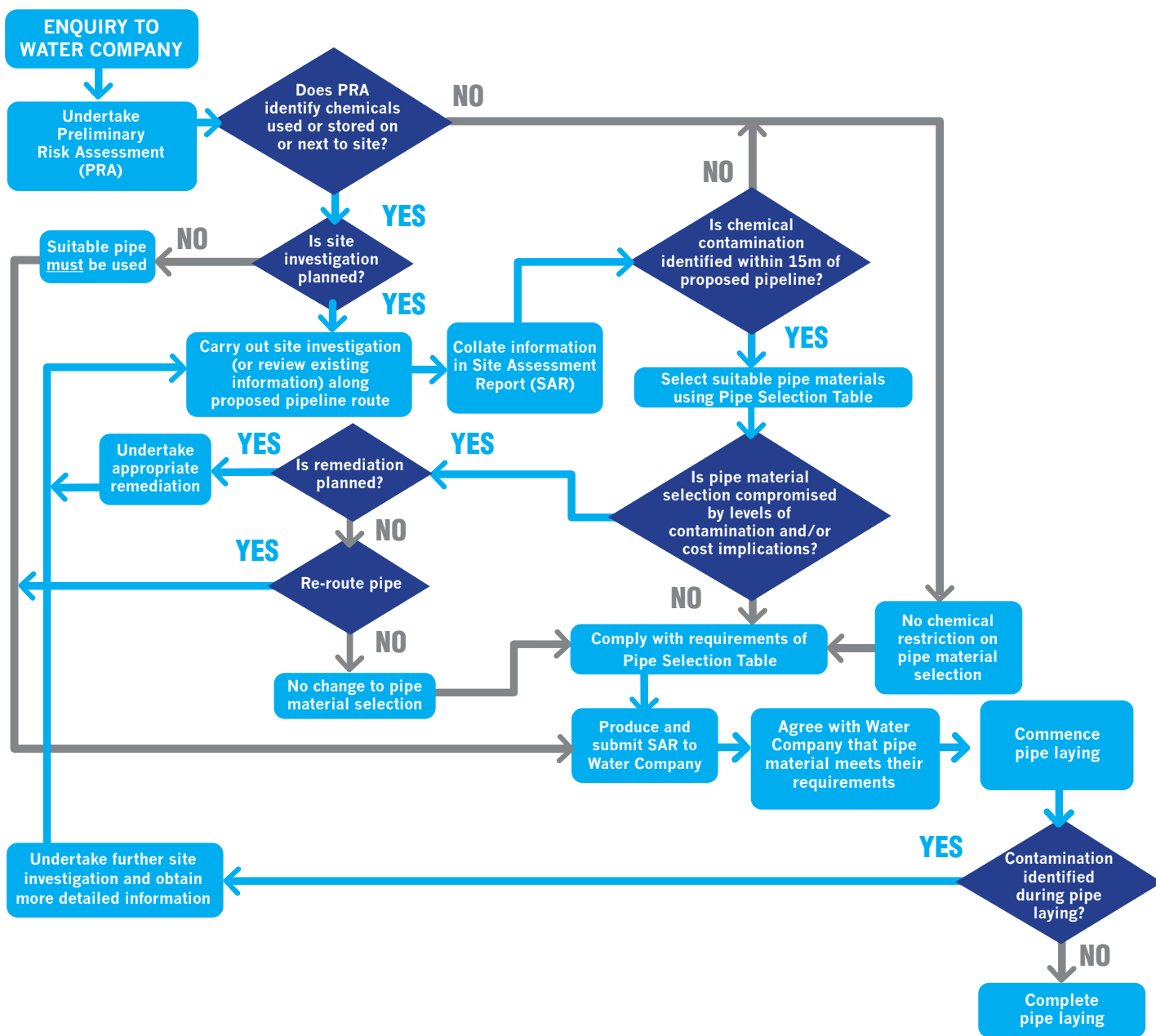
Brownfield Sites	Land or premises that have previously been used or developed. They may also be vacant, or derelict. However, they are not necessarily contaminated.
Contaminated Land	A parcel of land affected by soil contamination from one source or another, for example hydrocarbons, which has been polluted with harmful substances to the point where it has implications for the future use of the site.

There are a number of key concerns regarding the installation of pipe systems in contaminated land;

- Permeation of hydrocarbon based substances through pipework (ingestion).
- Pipe failure (environmental stress crackling, swelling of plastic pipes, corrosion of metal pipes).
- Effect of compounds on the health and safety of employees working in the ground (skin irritation).

In response to concerns by water companies in 2010, UKWIR has compiled a guide for water companies 'Guidance for the selection of water supply pipes to be used in Brownfield sites'. This document suggests a risk assessment is completed in the following stages:

Stage 1 – For each site the developer will need to undertake a preliminary risk assessment (PRA) as per the flowchart below.



Stage 2 – If identified as necessary at Stage 1, the developer should undertake a Site Investigation (SI). The analysis on SI shall be in accordance with the methodologies in part 2.1 of the UKWIR ‘Guidance for the selection of water supply pipes to be used in Brownfield sites’.

Upon receipt of PRA and SI, water companies can then assess the data to confirm the most appropriate pipe material, considering the defined trigger levels in the Pipe Selection Table as follows.

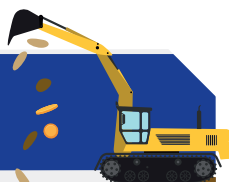
PIPE SELECTION TABLE

CONTAMINANTS		PIPE MATERIAL					
Parameter group		Protecta-Line Barrier Pipe	PE	PVC	Wrapped Steel	Wrapped Ductile Iron	Copper
1	Extended VOC suite by purge and trap or head space and GC-MS with TIC	PASS	0.5	0.125	PASS	PASS	PASS
1a	+ BTEX + MTBE	PASS	0.1	0.03	PASS	PASS	PASS
2	SVOCs TIC by purge and trap or head space and GC-MS with TIC (aliphatic and aromatic C5-C10)	PASS	2	1.4	PASS	PASS	PASS
2e	+ Phenols	PASS	2	0.4	PASS	PASS	PASS
2f	+ Cresols and chlorinated phenols	PASS	2	0.4	PASS	PASS	PASS
3	Mineral oil C11-C20	PASS	10	PASS	PASS	PASS	PASS
4	Mineral oil C21-C40	PASS	500	PASS	PASS	PASS	PASS
5	Corrosive (Conductivity, Redox and pH)	PASS	PASS	PASS	Corrosive if pH <7 and conductivity >400µS/cm	Corrosive if pH <5, Eh not neutral and conductivity >400µS/cm	Corrosive if pH <5 or >8 and Eh positive
Specific suite identified as relevant following site investigation							
2a	Ethers	PASS	0.5	1	PASS	PASS	PASS
2b	Nitrobenzene	PASS	0.5	0.4	PASS	PASS	PASS
2c	Ketones	PASS	0.5	0.02	PASS	PASS	PASS
2d	Aldehydes	PASS	0.5	0.02	PASS	PASS	PASS
6	Amines	PASS	FAIL	PASS	PASS	PASS	PASS



² Taken from the UKWIR publication ‘Guidance for the selection of water supply pipes to be used in Brownfield sites’

DID YOU KNOW?



SAVE ON LAND FILL

If you wish to use traditional (standard) water pipes in contaminated land IT costs approx £120 / tonne to remove the contaminated soil to land fill (£82 / tonne landfill tax)



→ GPS Protects New Community

The Wixams development is being constructed on a 750 acre brownfield site, formerly known as the Elstow Storage Depot, and is expected to be the one of the largest developments created in the UK since WWII.

Transforming the site into a new community, Wixams will ultimately consist of four villages offering new homes, jobs, amenities and educational facilities, and, once completed, will be home to 4,500 families who will benefit from 121 hectares of landscaped parkland and facilities.

The first village, Lakeview, has been occupied since 2009 but the infrastructure for villages two – four has now commenced. As with any new residential project, the utility infrastructure is central to the development and Anglian Water is responsible for installing the water mains distribution pipe network for the scheme. With the site previously used as a munitions works, a detailed soil report was undertaken and, when analysed by Anglian Water, it was revealed to contain elevated levels of ground contamination.

Due to potential risks of water contamination, Anglian Water stipulated that barrier pipe must be installed for the water mains, and, due to previous difficulties with ductile iron in the construction of Lakeview, Anglian Water has turned to us for the next three villages. As a result, more than 4km of Protecta-Line barrier pipe is being installed by Anglian Water's approved contractors, Achiva Limited, to cater for all of the water distribution needs for the development.

More than 3km of a mix of larger diameter 450mm and 355mm Protecta-Line has been installed through the spine of the development, with smaller spurs of 225mm and 180mm coming off into the housing estates, before dropping down to 90mm as it goes into the cul-de-sacs to supply each individual property.

Currently all open field land, there was no space or logistic restrictions with the installation, which has allowed the pipeline to be installed using an open cut installation and butt fusion jointing technique, which offered a quick and simple installation process.

Commenting on the scheme, Simon Pink, Project Engineer at Anglian Water, said: "We had some issues with the ductile iron that we used for the first village on this development, which caused us some delays and resulted in some necessary repair and replacement work and so we wanted a smoother installation for the second phase.

"We have used Protecta-Line successfully on other schemes, so we knew that it would provide a reliable and safe solution for Wixams. The pipe system was much easier to handle on site, compared with ductile iron, and offered us a much quicker and simpler installation process."

Available in sizes up to 630mm, Protecta-Line is a fully approved integrated barrier pipe and fittings system. Its tough multi-layer construction incorporates an impermeable aluminum barrier layer wrapped onto a central core of PE80 or Excel (PE100) pipe. Its innovative design ensures that any contaminants remaining in brownfield sites and former industrial land cannot permeate into the water supply.

For over 20 years, water companies, contractors and self-lay organisations have trusted Protecta-Line with maintaining the long term safety and quality of the water supply.

Its tough multi-layer construction ensures that any contaminants remaining in brownfield sites and former industrial land cannot permeate into the water supply. The Protecta-Line system offers complete performance assurance thanks to its second-to-none approval status and Kitemark to WIS 4-32-19. It is also the most comprehensive PE barrier pipe system available, incorporating a full range of pipes and dedicated, approved fittings.

It is an established favourite in the UK and abroad, and with a wealth of approval, installation and cost benefits, it remains the market leader.

FEATURES

- Prevents the tainting that can be caused by through-wall permeation by hydrocarbons and related chemicals that might be present in contaminated land
- Proven protection against all recognised brownfield contaminants, both organic and inorganic, even in their maximum reported concentrations
- Suitable for corrosive conditions
- Second-to-none approval status for total peace of mind to the highest standards of safety demanded by water companies and other installers
- Fully integrated range of pipe and approved dedicated fittings
- May be used for trenchless installations or subjected to cold bending as standard polyethylene pipes

DID YOU KNOW?



**SAVE COSTS ON
AVERAGE OF
£1,500...**

**...BY NOT UNDERTAKING A TYPICAL SOIL
SAMPLE ON A BROWNFIELD SITE. WITH
PROTECTA-LINE YOU DONT NEED TO!**



COMPLETE PRO

BENEFITS

- All the installation advantages of conventional PE pipe – a lightweight, flexible pipe in longer lengths that is fast and easy to install
- Reduced leakage
- Long-term security of supply
- Avoids the need for expensive soil sampling and remediation
- Lower cost of installation than metallic pipe and is significantly less disruptive
- Excellent lifetime cost savings
- Fully kitemarked system

APPROVALS

WRAS approved
1606501
1302025
1511343
1505514



Kitemarked to
WIS 4-32-19
(KM514626)

Kitemarked to
BS EN 12201-2
(508224)



DESIGN

Introduced to the UK market in 1996, Protecta-Line won the IWEX Innovation Award for its design, which prevents any chemicals left in the land from damaging the pipe wall, ensuring preservation of long-term strength, many years of usage and whole-life cost savings.

The double bonded five-layer construction comprises of an internal standard PE host pipe (PE80 or PE100 conforming to BS EN 12201) for carrying water, an impermeable aluminium barrier layer to stop the ingress of contaminants, an outer polyethylene protection layer and two adhesive tie-layers.

APPLICATIONS



- Drinking water distribution in contaminated land (brownfield sites)
- Drinking water distribution in sites with potential future contamination issues (eg: new petrol station forecourts).



Health, Safety, Quality & ENVIRONMENT

HEALTH & SAFETY

At GPS PE Pipe Systems, we are committed to ensuring that health and safety is at the very top of our agenda in all of our activities. We look both within and beyond our immediate environment to ensure that we contribute to the highest possible standards of health and safety for all our stakeholders.

Our Commitment

- Active support and participation in the creation of a positive health and safety culture at all levels within the Company, particularly at Senior Management level
- Maintain safe and healthy working places and systems of work and to protect all employees and others, including the public in so far as they come into contact with foreseeable work hazards
- Provide and maintain a safe and healthy working environment for all employees with adequate facilities and arrangements for their welfare
- Provide all employees with the information, instruction, training and supervision that they require to work safely and efficiently, and methods to assure employees understand and retain the knowledge
- Develop safety awareness amongst all employees and, as a result of this, create individual responsibility for health and safety at all levels
- Provide a safe environment for all visitors to the Company's premises, bearing in mind that these visitors may not necessarily be attuned to certain aspects of the Company's environment
- Control effectively the activity of all outside contractors when on the Company's premises. It is the intention of the Company that, apart from routine supervision and control of contractors, this aim will be achieved in part by demanding copies of the contractors' Safety Policies at the Tender stage, where appropriate
- Encourage full and effective two-way involvement and consultation on health and safety matters at all levels in the Company by utilising the management structure of the Company and the committees/forums already existing
- Ensure that this Policy is used as a practical working document and that its contents are publicised fully
- Review the details of this Policy on an annual basis and/or in line with regulatory and legislative changes
- Establish and publish specific, additional annual health and safety objectives which are realistic and measurable
- Develop an organisation which specifies the health and safety accountability of Directors, Managers, Supervisors and Employees

USER GUIDELINES

GPS polyethylene products have been installed and used safely in large volumes over many years. However, good working practice is vital to ensure safety; our products should be handled and processed in accordance with the British Plastics Federation guidelines*.

All PE80 and Excel® (PE100) pipe systems contain trace quantities of process residues and may also contain other materials such as pigments, antioxidants and UV stabilisers. Chemically unreactive, PE is regarded as being biologically inert, though some pipe materials contain low levels of additives which may be toxic.

GPS polyethylene products have been installed and used safely in large volumes over many years.

INGESTION



Ingestion of PE should be avoided. Some pipe materials may contain additives which are harmful if swallowed. Materials specified for purposes other than carrying water may contain pigments which are not suitable for use with potable water. These materials may be hazardous if ingested in large quantities.

INHALATION



PE does not release harmful fumes at ambient temperature. The threshold limit value for PE dust is 10mg/m³ (8-hour time-weighted average in the working environment), but the generation of such levels when working with PE pipe and/or fittings is extremely unlikely.

PHYSICAL CONTACT



PE is not considered to be a skin irritant. Where PE dust is generated by cutting or machining pipe or fittings, powder particles of PE dust may cause eye irritation by abrasion.

FIRE CHARACTERISTICS



When PE is heated in air, melting will occur at 120- 135°C and decomposition will commence at approximately 300°C. Above this temperature PE will pyrolyse oxidatively to produce carbon dioxide, carbon monoxide, water and various hydrocarbons. These gases may ignite and provide heat which may accelerate the pyrolysis of more PE in the vicinity.

In burning, molten droplets of material may be released which could ignite adjacent inflammable materials. Actual cooling conditions in a real fire will be influenced by many factors such as location and oxygen availability, which will determine the progress and combustion products of the fire.

Combustion of PE may release toxic materials. Avoid inhalation of smoke or fumes. Also, do not allow PE dust to accumulate, since there may be a risk in exceptional circumstances of dust explosion, and consider carefully the siting of potential heat sources such as electrical equipment.

In case of fire with PE Pipes, any fire extinguisher may be used. Powder extinguishers are very effective in quenching flames. Water sprays are especially effective in rapid cooling and damping down a fire, but are not recommended in the early stages of a fire since they may help to spread the flames. Other factors will also influence the selection of fire extinguishers eg. proximity of live electrical equipment. Please refer to specific classifications of firefighting extinguishers.

HANDLING OF MOLTEN MATERIAL



During the fusion welding of PE pipe and fittings molten PE is formed. If allowed to have contact with skin it will adhere strongly and cause severe burns. Such molten material has a high heat content and will remain hot for some time. Gloves should be worn where there is any risk of skin contact.

Small quantities of fumes may be given off by molten PE – these are more pronounced at higher temperatures and greater care must be taken where there is a risk of PE adhering to heated surfaces, such as heating plates used for welding. Ventilation must be provided to ensure safe working conditions.

* www.bpf.co.uk

QUALITY

GPS operates a quality assurance system in accordance with the requirements of BS EN ISO 9001. This is audited twice a year by BSI.



The quality assurance system imposes stringent standards of control throughout design, development and subsequent manufacturing and inspection processes. as shown on the photo below

Quality assurance
BS EN ISO 9001



PRODUCTS ARE SUBJECTED TO A RANGE OF DIMENSIONAL, MECHANICAL AND DESTRUCTIVE TESTS carried out on a sample basis in accordance with the requirements of GPS Product Quality Plans

DID YOU KNOW?

WE CONSTANTLY MONITOR OUR BUSINESS ACTIVITIES WITH THE AIM OF MINIMISING THEIR IMPACT ON THE ENVIRONMENT.

Quality assurance
BS EN ISO 14001

UPON AGREEMENT, THESE QUALITY PLANS CAN BE AMENDED to incorporate specific customer inspection and test requirements

DETAILED RECORDS are kept of dimensional and performance tests for each production batch

01224567 1890002

EACH BATCH IS GIVEN A UNIQUE IDENTIFICATION NUMBER that is reproduced on every fitting and pipe

This enables traceability to be maintained from raw material to finished products and for the provision of certificates of conformity, if required.

WATER STANDARDS

Standard/Approval	Title	Applicable to GPS Products
Regulation 31/27/30	The Water Supply (Water Quality) Regulations 2000/2001/2007 (England/Scotland/NI)	All drinking water pipes
The (Water) Regulators Specification & The Water Supply (Water Fittings) Regulations 1999	The (Water) Regulators Specification & The Water Supply (Water Fittings) Regulations 1999	All pipe materials. All fitting materials. All PE100 fittings and matching pipes. All Protecta-Line fittings and matching Protecta-Line pipes
BS 6920 Part 1	Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on water – Part 1: Specification	All pipe materials. All fitting materials. All PE100 fittings and matching pipes. All Protecta-Line fittings and matching Protecta-Line pipes All pipe materials. All fitting materials.
BS 6920 Part 2	Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on water – Part 2: Methods of test	All PE100 fittings and matching pipes. All Protecta-Line fittings and matching Protecta-Line pipes. All pipes
BS 6920 Part 4	Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on water – Part 4: Method for the GCMS identification of water leachable organic substances	All pipes
BS EN 12201	Plastics piping systems water supply, and for drainage and sewerage under pressure – Polyethylene (PE)	Blue and black PE80 and PE100 pipes and fittings in sizes up to 1200mm
WIS 4-32-19	Polyethylene pressure pipe systems with an aluminium barrier layer for potable water supply in contaminated land sizes	25mm to 630mm – Protecta-Line pipe and fittings
BS 8588	Polyethylene pressure pipe with an aluminium barrier layer and associated fittings for potable water supply in contaminated land	25mm to 630mm - Protecta-Line pipe and fittings
ISO 4427	PE pipes for water supply	Blue and black PE80 and PE100 pipes and fittings
BS EN 15494	Specifications for polyethylene components and systems	Blue and black PE80 and PE100 pipes and fittings up to 1200mm
BS EN 805	Water supply – requirements for systems and components outside buildings	External water supply installations
BS EN 681-2	Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Thermoplastic elastomers.	Seals and flange gaskets
BS 5306 – Part 2	Fire extinguishing installations and equipment on premises	Blue and black PE80 and PE100 for external buried fire mains
WIS 4-22-02	Specification for ferrules and ferrule straps for underground use	Protecta-Line ferrules
WIS 4-24-01	Specification for mechanical fittings and joints including flanges for polyethylene pipes for the conveyance of cold potable water for the size range 90 to 1000mm including those made of metal or plastics or a combination of both	Stub flanges, SlimFlange and Protecta-Line Mechanical Fittings
WIS 4-32-08	Specification for the fusion jointing of polyethylene pressure pipeline systems using PE80 and PE100 materials	Butt fusion and electrofusion jointing of blue and black PE80 and PE100 pipes and fittings
DIN 8074	Pipes of high density polyethylene (HDPE) type 2 – dimensions	Black PE80 and PE100 pipes in sizes up to and including 1200mm
DIN 8075	Pipes of high density polyethylene (HDPE) type 2 – testing	Black PE80 and PE100 pipes in sizes up to and including 1200mm
DIN 16963	Part 1 – High density polyethylene (HDPE) fittings dimensions, type 2	Black PE80 and PE100 spigot and electrofusion fittings up to and including 1200mm

ENVIRONMENT

GPS operates an environmental management system in accordance with the requirements of BS EN ISO 14001. The system is audited twice a year by the BSI.

GPS continually monitors its business activities with the aim of minimising their impact on the environment. A number of on-going waste minimisation projects have been implemented in areas such as energy usage, product packaging and landfill waste.

A continual improvement culture is promoted within the company by setting environmental targets and objectives that are regularly monitored and reviewed.



Polyethylene pipe design

AND INSTALLATION

PRESSURE RATINGS

Various ISO/CEN working groups have considered the design factors that should be used to determine the maximum operating pressures of polyethylene water and gas systems. ISO/DIS 12162 classifies types of polyethylene, by the minimum required strength (MRS).

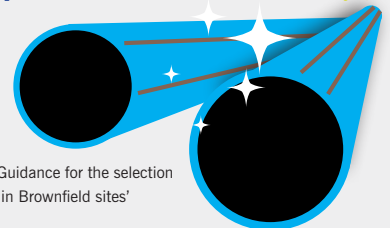
This is the value of the lower prediction limit of the 50 year hoop stress in MPa obtained by extrapolation of data from stress rupture tests on completely water filled pipe samples under various internal pressures and temperatures. In the UK MDPE is classified as MRS 8 and HPPE is classified as MRS10, but these two types of polyethylene are referred to as PE80 and PE100. Maximum working pressures for polyethylene pipes are determined by the application of safety factors to these MRS values in accordance with UK Water Industry Standards. For water applications, GPS recommend derating the pressure rating of large diameter mitred bends to 0.8 x the pipe rating from which they are made. Bends incorporating 30° mitres should also be de-rated in sizes below 355mm. Thus 10 bar 30° mitres made into a mitred bend would be rated at 8 bar, and 16 bar 30° mitres would make a 12.8 bar fitting and so on. The fittings are fabricated from pipe complying with BS EN 12201-2 or BS EN 13244.

PRESSURE TESTING

Pipe Pressure testing should be according to BS EN 805 or IGN 4-01-03, "Pressure testing of pressure pipes and fittings for use by public water suppliers".

DID YOU KNOW?

Protecta-Line provides protection against all known contaminants meaning no expensive soil sampling is required*.



*As per the UKWIR publication 'Guidance for the selection of water supply pipes to be used in Brownfield sites'

BURYING PIPE

The dimensions of a trench line opening are normally governed by the pipe diameter, method of jointing and site conditions. Guidance should be sought on the selection and use of materials suitable for providing structural support to buried pipelines (IGN 4-08-01 (Bedding and Side fill Materials for Buried Pipelines) and WIS 4-08-02 (Specification for Bedding and Side fill Materials for Buried Pipelines). Normal minimum depth of cover for mains should be 900mm from ground level to the crown of the pipe. Trench width should not normally be less than the outside diameter of the pipe plus 250mm to allow for adequate compaction of side fill unless specialised narrow trenching techniques are used and/or specially free flowing and easily compacted side materials are employed.

MAXIMUM CONTINUOUS OPERATING PRESSURES AT 20° FOR STANDARD PE PIPES

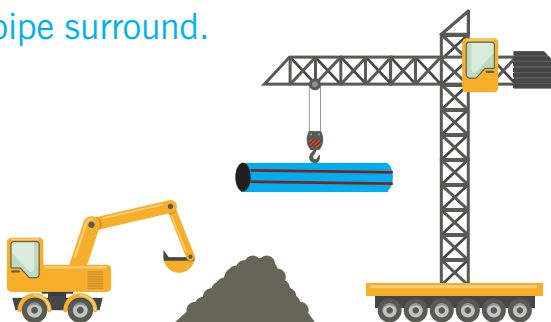
Pipe Size/OD <small>*Pipes specifically sized for insertion lining applications</small>	SDR 11		SDR 17
	PE80	Excel (PE100)	Excel (PE100)
25mm	12.5	-	-
32mm	12.5	-	-
50mm	12.5	-	-
63mm	12.5	-	-
75mm	-	16.0	10.0
90mm	-	16.0	10.0
110mm	-	16.0	10.0
125mm	-	16.0	10.0
160mm	-	16.0	10.0
180mm	-	16.0	10.0
200mm	-	16.0	10.0
225mm	-	16.0	10.0
250mm	-	16.0	10.0
280mm	-	16.0	10.0
315mm	-	16.0	10.0
355mm	-	16.0	10.0
400mm	-	16.0	10.0
450mm	-	16.0	10.0
500mm	-	16.0	10.0
560mm	-	16.0	10.0
630mm	-	16.0	10.0

"In line with UK water industry recommendations, GPS de-rate large mitred bends by 0.8x the rating of the pipe from which it was made – please contact our Technical Support department for further information."

The values in the above table do not address any other safety-related issues associated with pipeline design.

Protecta-Line Pipe O/D range is between 25mm to 630mm

Finest fill and pipe surround – Cohesive or granular materials which are free from sharp stones shall be used for the pipe surround.



Normal sidefill & backfill requirements

For minor roads, excavated material can often be returned to the trench and compacted in layer thicknesses specified by the Utility Company. Relevant Water Industry specifications. e.g. WIS 4-08-02, permit much coarser material for the side and backfill for PE pipelines than is normally recommended for the bedding. However, heavy compaction equipment should not be used until the fill over the crown of the pipe is at least 300mm.

STRUCTURAL DESIGN OF BURIED PE PIPES

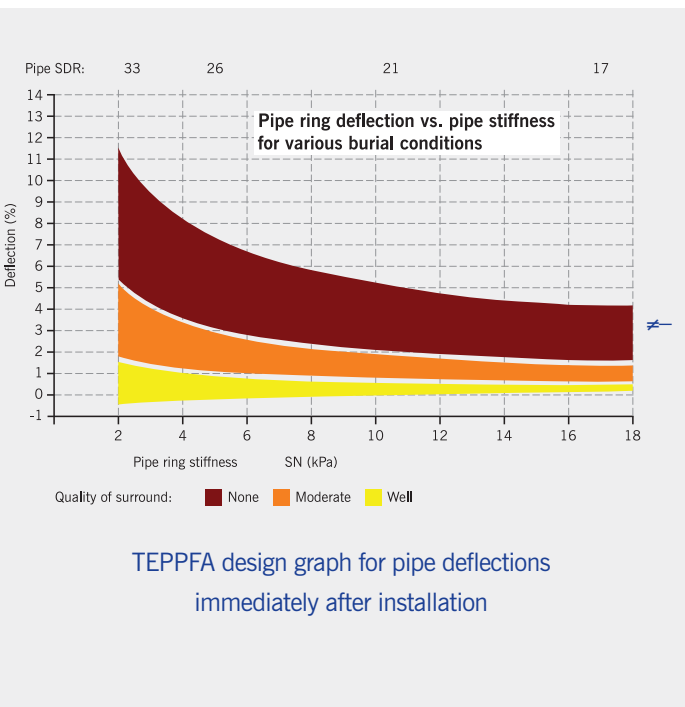
There is often a requirement to provide proof of design security for buried pipelines.

The UK method was developed before PE was used extensively as a pipe material, and does not properly allow for the composite PE pipe/soil system. Values for long term safety factors against buckling and the total ('combined') stress equations are now recognised to be overly conservative. The latest version of the BS reflects this.

The European Plastic Pipes and Fittings Association (TEPPFA) and the Association of Plastics Manufacturers in Europe (APME) have sponsored extensive field trials from which an empirically based graph has been developed to aid PE pipe structural design (see below).



The graph gives the short term vertical pipe deflections that will occur for various burial conditions (materials used, plus degree of care taken) and pipe stiffness (SDRs), with long term deflection values determined by adding prescribed amounts.



Long and short term pipe ring stiffness values are dependent upon the pipe's flexural modulus of elasticity, which is time, temperature and material dependent.

Assuming that the correct pressure rating of pipe is chosen for the specified duty, the total stress in the wall when the pipe is buried will always be less than the rated value (ref BS EN 1295-1:1997). The pipeline designer will simply need to decide how much deflection is acceptable in the particular circumstances (e.g. a higher value would be satisfactory in a field than under a road), and then select the PE pipe and type of surround accordingly. Note that long term deflections of up to 12.5% - 15% are completely safe for PE pipes.

Long and short term pipe ring stiffness values are dependent upon the pipe's flexural modulus of elasticity, which is time, temperature and material dependent.

There is currently no international consensus about the best values of modulus to use in every situation, but the following are generally considered appropriate at ambient temperature (20°C).

Type	Es (Short Term Modulus of Elasticity)	EI (Long Term Modulus of Elasticity)
PE80 (MDPE)	900 MPa	130 MPa
PE100 (HDPE)	1100 MPa	160 MPa

ENTRY TO STRUCTURES

Polyethylene is unaffected by the constituents of concrete and the pipe can be partially or completely surrounded; however, protection should be afforded to the pipe surface to prevent the risk of fretting damage by wrapping the pipe in a heavy-duty polyethylene membrane prior to forming the concrete surround. The wrapping should extend beyond the concreted area. Should anchorage also be required, then a polyethylene 'puddle' flange may be incorporated. Achieving a water-tight seal where polyethylene pipes pass through concrete structures is difficult due to the materials natural flexibility; however provision may be made for external sealing.

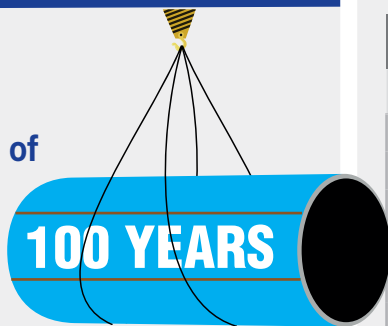
The natural flexibility of a fully welded polyethylene pipeline can accommodate relatively large deflections. However, where a high degree of differential settlement is anticipated, consideration should be given to the use of support pads. The use of ‘hinged’ joints (rocker-pipes) is considered to be inappropriate for polyethylene pipeline installations.

EMBANKMENT INSTALLATION

Where pipes are to be installed above existing ground level and then covered, they should not be laid until the mound of made up ground has been built up and compacted to one metre above where the crown of the pipe is to be. A trench should then be cut into the mound and the pipes laid in the conventional way.

DID YOU KNOW?

PE Pipes provide a minimum life cycle of 100 years as per IGN 4-32-18



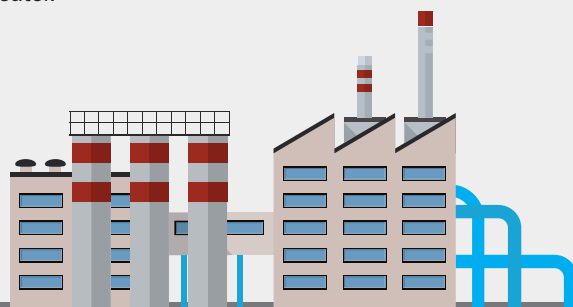
ABOVE-GROUND SUPPORTED INSTALLATION

For exposed supported above ground pipework, proper anchorage is essential. The structure and anchorages must resist or accommodate thermal stresses or movement over the ambient temperature range to which the pipe system will be subjected.

It is preferable that a polyethylene pipe is installed at or near the maximum operating temperature such that pipes are thermally expanded whereby at that point clamps or supports can be bolted into position thus restraining the pipe from further movement. As the pipeline cools, tensile stresses are developed and the pipeline will remain straight between supports. If the pipeline then warms to its original installation temperature, it returns to its installation condition and sag between pipe supports is minimised. Supported polyethylene pipe systems may also be designed using the traditional methods, employing ‘flexible arms’ and ‘expansion loops’. For further information, please refer to BS EN 806 part 4 Annex B.

SUPPORT

Recommendations for maximum support spacing are given in the table below. They are based on a mid-span deflection of 6.5mm when the pipe is full of water and assume a long term flexural modulus of 200MPa at an ambient temperature of 20°C. Pipe clips used for anchorage and support should have flat, non-abrasive contact faces, or be lined with rubber sheeting, and should not be over-tightened. The width of support brackets and hangers should normally be either 100mm or half the nominal pipe bore diameter, whichever is the greater.



Above ground pipework maximum support spacing (metres)

Pipe	SDR 11	SDR 17
25mm	0.7	N/A
32mm	0.9	N/A
63mm	1.1	N/A
90mm	1.3	1.2
110mm	1.5	1.3
125mm	1.6	1.4
160mm	1.8	1.6
180mm	1.9	1.7
200mm	2.0	1.8
225mm	2.1	1.9
250mm	2.2	2.0
280mm	2.3	2.1
315mm	2.5	2.3
355mm	2.6	2.4
400mm	2.8	2.5
450mm	2.9	2.7
500mm	3.1	2.8
560mm	3.3	3.0
630mm	3.5	3.2

Note: Figures given are for horizontal support spacings; and may be doubled for vertical support spacings.

POLYETHYLENE PIPE FOR WATER

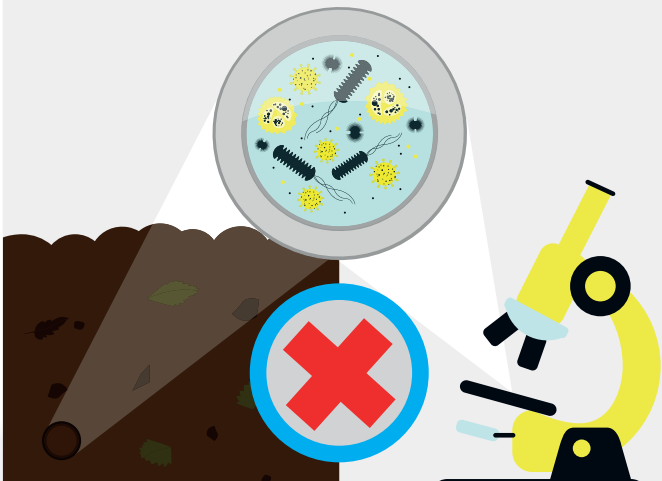
Protecta-Line Pipe is designed to safely transport drinking water in contaminated land. The approved pipe range is from 25mm to 630mm diameter with working pressures up to 16 bar.

FEATURES & BENEFITS

- Kitemarked to WIS 4-32-19
- Kitemarked to EN 12201
- Compliant with BS 8588
- Fully compliant with Reg 31
- Available SDRs 11 / 17
- Available in coils up to 180mm diameter
- Standard stick lengths of 6m & 12m
(Other lengths available on request)
- Lifecycle of 100 years

DID YOU KNOW?

Protecta-Line is impervious to contaminants in the soil which means no Soil Samples or excavation of contaminated soil to landfills are required delivering lower installation costs.



BENEFITS

PROTECTION AGAINST ALL KNOWN CONTAMINANTS

EXCELLENT LIFETIME COST SAVINGS

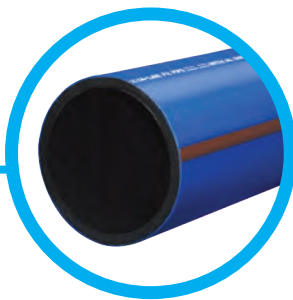
NO EXPENSIVE SOIL SAMPLES

COST SAVINGS DURING INSTALLATION

KITEMARKED SYSTEM

FLEXIBLE MATERIAL PROPERTIES

SAVE ON LANDFILL COSTS



PROTECTA-LINE

- Kitemarked to WIS 4-32-19
- Compliant with EN12201
- Compliant with Reg 31 (England & Wales / Scotland /NI)
- WRAS approved
- Compliant with BS 8588
- Available from 25mm to 630mm
- Available in SDR11 / 17
- Suitable for 16 bar water supply

SDR 11



SDR 17



**upto
16bar**



Compliant with
EN12201

PIPE HANDLING & STORAGE

Although relatively lightweight, polyethylene pipe products should be treated with a similar level of caution as for heavier metallic pipe products.

Whilst polyethylene is a robust and resilient material, care should be taken not to cause excessive scuffing or gouging of the surface. Surface damage may occur during handling, storage and installation, but providing the depth of any score is no greater than 10% of the wall thickness, then the service performance of the pipe or fitting will not be affected.

USEFUL SOURCES OF INFORMATION

The Health & Safety Executive (HSE) provides information and guidance on its website (hse.gov.uk) which is relevant to the handling and storage of pipes and fittings, including but not limited to:

GS6	LOLER	PUWER	HSG150
Avoiding danger from overhead power lines	Lifting Operations and Lifting Equipment Regulations	Provision and Use of Work Equipment Regulations	Health and safety in construction





DELIVERIES

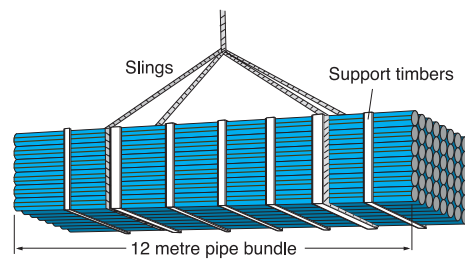
The key stakeholders within the UK plastic pipe industry have created a best practice document entitled "Recommended Guidelines for the Safe Delivery and Unloading of Polyethylene Pipes" which provides a risk-based framework to assist with the safe handling of plastic pipe products.

This document has been commended by the HSE, please click here to download the document.



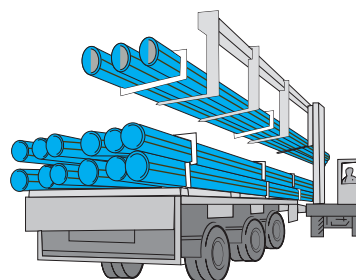
SIX PIPE HANDLING STEPS

- 1 Pipes should be stored on flat, firm ground, able to withstand the weight of the materials and lifting apparatus
- 2 When pipes are loaded and unloaded, allow for some bending deflection – lifting points should be evenly spaced
- 3 Where slings are used, they should be wide, and made of a suitable non-metallic material (e.g. nylon or polypropylene), and not metal slings, hooks or chains



Good lifting practice

- 4 Standard six-metre bundles may be handled by a forklift, but longer lengths should be moved by a side-loader with a minimum of four supporting forks or by a crane with a spreader beam

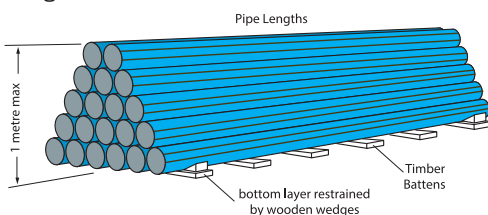
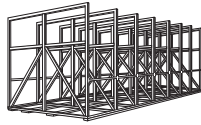


Handling of long lengths

- 5 Exercise special care when handling pipes in wet or frosty conditions in case they have become slippery
- 6 Pipes should never be thrown or dropped from any height, including from delivery vehicles

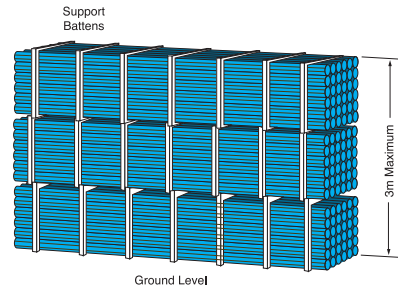
HOW TO STORE YOUR PIPES

- Where larger diameter coils are to be stored vertically, they must be secured in purpose built racking with protective matting positioned underneath
- Never drag or roll individual pipes or bundles
- Keep pipes well away from sharp objects
- Do not allow pipes to be exposed to sunlight or any heat source for prolonged periods
- The packaging (battens, shrink-wrap, pallets, strapping etc.) is designed to provide protection to the pipes and should be kept intact until they are ready for use
- Do not allow pipes to come into contact with lubricating or hydraulic oils, gasoline, solvents or other aggressive materials
- Pipe lengths stored individually should be stacked in a pyramid no more than one metre high, with the bottom layer laid on timber battens and fully restrained by wedges



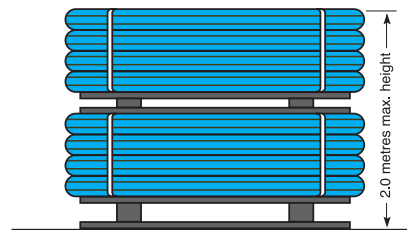
Storage of loose pipes

- Pipe bundles should be stored on level ground with the battens supported by timbers or concrete blocks, and stacked no more than three metres or three bundles high



Storage of bundles

- Coiled pipe should be stored flat, on firm level ground with wooden battens beneath the bottom coil, and should be stacked no more than two metres high



Storage of coils

- Batches of coils delivered on pallets should remain secured to the pallet and only be broken down at time of use.

COIL DISPENSING

SAFETY FIRST: Pipe held in coils is under tension and is strapped accordingly. Coils may be hazardous if released in the incorrect manner.



PLEASE READ THE FOLLOWING GUIDELINES BEFORE ATTEMPTING TO RELEASE COILS

PIPES 63MM AND ABOVE

Pipes 63mm and above – with outer bands and additional strapping of individual layers

- Coils of pipe above 32mm should only be dispensed from the appropriate coil trailer
- Do not remove any bands until the pipe is required for use
- Carefully remove the outermost layer first, only releasing the length of pipe immediately required
- Successive layers can then be released by removing banding one layer at a time as the pipe is drawn from the coil

PIPES 32MM AND BELOW

Pipes 32mm and below – in coils which are shrink-wrapped

- Do not remove the outer wrapping until the coil is almost fully unwound
- Take the free end of the pipe from the inside of the coil
- Take only sufficient pipe for immediate use from the coil

PIPELINE INSTALLATIONS USING NO-DIG TECHNIQUES

AVAILABLE PROCEDURES FOR PIPELINE INSTALLATIONS USING NO-DIG TECHNIQUES

Polyethylene pipe systems from GPS are designed to make the installation quicker, easier and more cost effective. Installation is as much a part of the cost equation as ease of maintenance and the cost of the pipe systems itself.

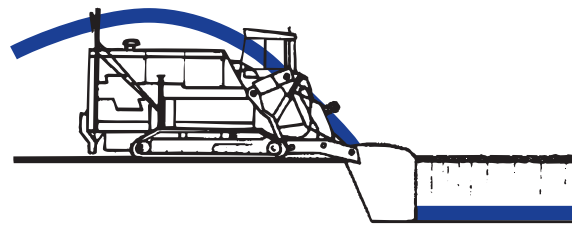
Polyethylene great advantage in installation is not only its lightness and flexibility but also its toughness allowing a number of low impact installation processes to be considered. These processes involve the minimum disruption and impact to the environment and often involve techniques such as “low-dig” and “no-dig”. Since the need for in-trench jointing is eliminated, the width of excavations can be minimised, resulting in reduced labour cost, less imported backfill and lower reinstatement costs.

Some of these techniques are described below.

CHAIN TRENCHING

Modified mechanical diggers with oblique profiled buckets are ideal provided that the spoil produced by the digging action is relatively fine.

Chain excavators in particular will break up the original ground finely and permit trench widths only 50 to 100mm greater than the PE pipe outside diameter.



MOLEPLOUGHING

This technique was originally developed for laying land drainage and adapted for installation of gas and water pipes in rural areas. It enables pipelines to be laid across rural landscapes with minimum disruption to agriculture, while the ground can also be reinstated virtually to prime condition. A new PE pipe string is literally ploughed into the ground to a prescribed depth and ground restore immediately to its original condition.

NO-DIG



Impact Moling illustration (courtesy of TT-UK Ltd)

IMPACT MOLING

Impact moling is highly economic in instances such as road crossing, where considerable savings can be made over traditional open-cut excavation methods. Traffic control systems are often unnecessary, for example, and the cost of excavation, backfill and reinstatement is virtually eliminated. With this installation method, excavation is only necessary at the starting and finishing locations of the pipeline – in order to accommodate the mole and its ancillary equipment. The impact mole drives a borehole between launch and reception pits, leaving the ground surface undisturbed.

PIPE BURSTING

Size-for size replacement or upsizing of existing iron pipelines can be achieved with significant savings by the pipe bursting method. With this technique an existing main is cracked open and the borehole simultaneously expanded by a mole. Modern pipe bursting moles, especially those with hydraulically expanding segments, can crack and open out an unserviceable pipeline, even if it has repair collars or concrete surrounds. Risk of damage to adjacent utility installations is minimised by using hydraulic moles, helping to maximise the cost advantages of using the existing “hole in the ground”.



SLIP-LINING / INSERTION

This is a rehabilitation and renovation technique in which a replacement PE pipe string of smaller size is inserted into an existing decommissioned pipeline.



Although rarely necessary, pressure grouting of the annular gap can enable the existing pipeline to be rehabilitated structurally, whilst also reinforcing the hoop strength of the new PE pipe.

Though some reduction in flow capacity is inevitable, this can be minimised by careful preparation and cleaning of the old pipe so that the largest possible diameter of new PE pipe can be inserted. In many instances an average annular clearance of as little as 5% of the main’s diameter-

less still for sizes above 300mm – has proven adequate where pipelines are reasonably straight and of uniform bore. In pressure pipelines, the reduction in carrying capacity can be compensated for by an increase in internal pressure. In gravity

applications any effect of bore reduction is minimised both by the exclusion of ground water entering the system and by the improved flow characteristics of PE.

TECHNIQUES



DIRECTIONAL DRILLING

This is a pipe installation technique that was originally developed for oil and gas wells, however it is now increasingly used for PE pipe. It allows pipelines to be installed under roads and rivers etc. with minimal excavation work. The technique involves drilling a hole under an obstacle and then pulling the pipeline back through an enlarged hole, from the far side.



CLOSE FIT INSERTION SYSTEMS

Close-fit rehabilitation systems offer two advantages. They never require grouting and, in most cases, even though there is a slight reduction in pipe diameter, the exceptional hydraulic smoothness of PE pipe actually enables flow capacity to be increased.

If the old main is structurally unsound, close-fit PE linings can be SDR17 or SDR11, depending on ground cover and pressure requirements. For pipelines that are strong but leaking, PE lining thickness down to SDR33 or thinner should be considered. With a 100 year minimum life and exceptional gap-bridging performance, thin-walled PE linings provide a cost effective sealing membrane that is totally reliable.

Connecting Protecta-Line

ELECTROFUSION

PRINCIPLES OF ELECTROFUSION

Electrofusion fittings incorporate an electrical heating coil to which an Electrofusion Control Unit (ECU) supplies the electrical energy necessary to heat the coil. When the coil is energised the material adjacent to it melts and forms an expanding pool which comes into contact with the surface of the pipe. The continued introduction of heat energy causes the pipe surface also to melt and a mixing of pipe melt and fitting melt takes place; this is vital to produce a good weld. Following the termination of the heat cycle, the fitting and pipe are left to cool and the melted material solidifies to form a sound joint.

Preparation and assembly procedures are similar for all electrofusion systems. Some fittings require the fusion time to be entered into the ECU manually and are therefore described as manual. Some fittings incorporate auto-recognition aids and the ECUs are therefore described as automatic. Some of our fittings are Barcode read only and can only be read by an ECU that has Barcode read facility. All of our standard fittings require a 39.5V supply. Please be aware that the Barcode read only fittings are variable voltage and are determined by the ECU box via the Barcode read facility.

Hot and cold zones sometimes called melt and freeze zones, are formed after energising the coil. The length of these zones is particularly important. Each zone ensures that fusion is controlled to a precise length of the socket of the fitting and

that the melt pressure is also controlled throughout the entire jointing process. The precisely controlled pitch and positioning of the coil in relation to the inner surface of the socket ensures uniform heat distribution.

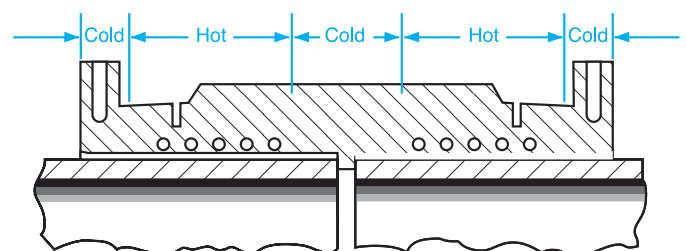
ELECTROFUSION

It is essential that the Protecta-Line pipe is properly prepared prior to electrofusion jointing. It is necessary first to remove the outer PE layer, aluminium layer and any residual adhesive layer material.

It is potentially dangerous to carry out electrofusion jointing where the aluminium layer is still in place.

The Protecta-Line Surprep Scraper must be used for pipe end preparation, as it not only removes the outer layers, but it also prepares the core pipe for electrofusion jointing.

Electrofusion clamps should be checked for suitability before commencing work, particularly in larger sizes. All electrofusion joint assemblies must be held in clamps throughout the fusion and cooling periods.



DID YOU KNOW?

A correctly installed electrofusion coupler will last as long as the pipe – in excess of 100 years



ELECTROFUSION CONTROL UNITS (ECUS)

Electrofusion Control Units are designed to operate from an electrical mains or field generator supply having an output of 110V and a rating of generally 3.5 to 7.5kVA for 39.5V. Frialen XL fittings require a specialist ECU box that is 3 phase (Please contact Technical Support for further information).

All ECUs manufactured after 1st January 1996 for sale into Europe should comply with the Electro-Magnetic Compatibility Directive and be CE marked, also should comply with GIS ECG1.

BARCODES AND ECUS

ECUs can be supplied with the ability to read a bar code when connected to an electrofusion fitting. The machines have a bar code reading device that the operator uses to scan the data contained within the bar code. Once the bar code data has been entered, the ECU will usually display a description of the fitting and its size, which should be checked by the operator before proceeding with the electrofusion process.



The bar code system will automatically adjust the fusion time by small amounts to compensate for variations in ambient temperatures. ECUs should contain data logging facilities to ensure traceability of welding parameters. An output socket allows this information to be downloaded onto a computer database or printer to obtain a complete record of the joints that have been made.

ECUs are now available, that can confirm the presence of clamping during the fusion cycle and provide photographic evidence and joint location data, based on satellite navigation systems technology. Additional control over joint quality can be achieved using ECUs that will lock out the unit in the event of any discrepancy in the jointing procedure. To reinstate the unit to full operation, it will be necessary to seek authorisation before the unit can be unblocked and jointing continued.

TRACEABILITY BARCODES

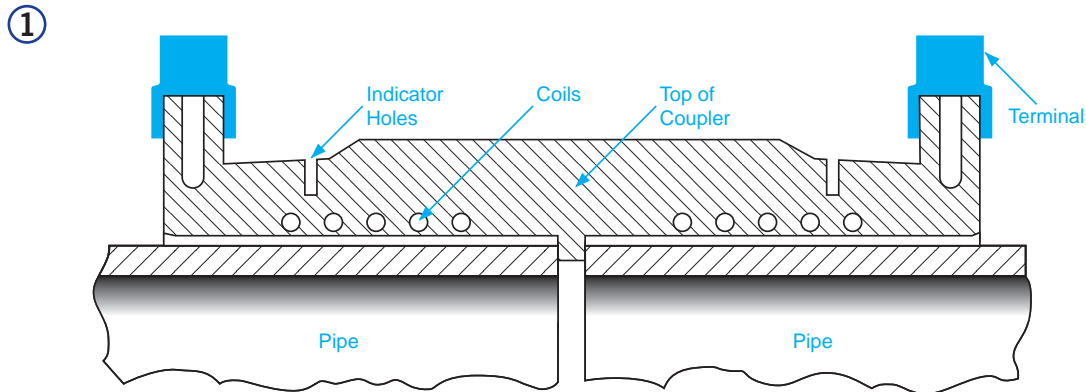
Most electrofusion fittings are fitted with traceability barcodes that can be read by any ECU with a traceability option. This barcode contains specific information regarding the manufacture of the product such as: the name of the fitting manufacturer, the type of fitting, the size of the fitting, the production batch number, the manufacturing location, the product SDR rating, the product raw material, the material status, the material MRS and the material melt flow index.



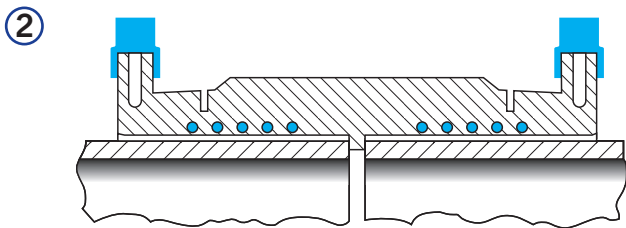
Please note all of our Frialen Electrofusion Fittings have 4.0mm pins. Some ECU's may require adapter pins to operate.

ELECTROFUSION SEQUENCE

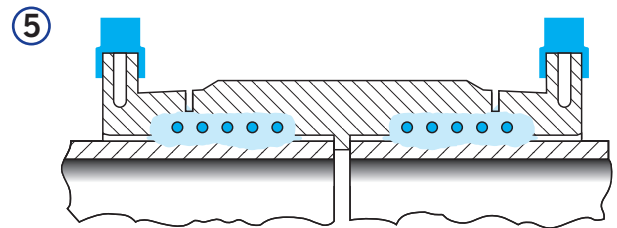
The sectional drawings show the jointing sequence from energising the coil until completion of fusion. The whole cycle is electronically monitored by the electrofusion control unit (ECU).



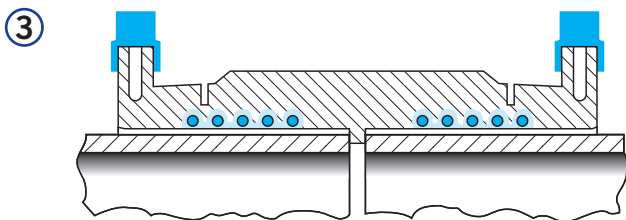
Pipe positioned in coupler prior to energising coil.



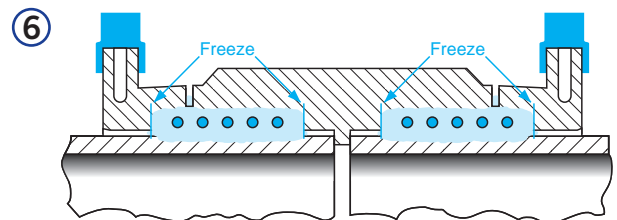
Coil energised.



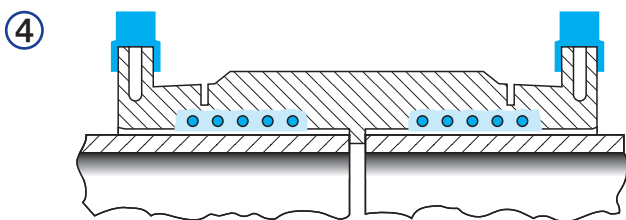
Heat transfers to pipe wall and pipe material starts to melt.



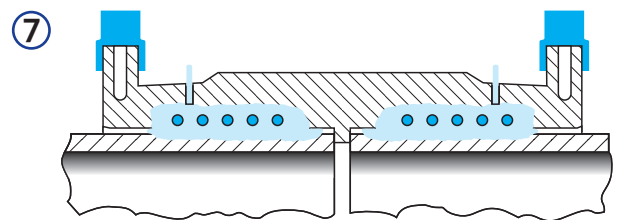
Material surrounding coils starts to melt.



Melt solidifies at the start of the cold zones, thereby sealing the melt zone. Further input of energy causes increase in melt pressure.



Area of melt extends leading to expansion towards pipe surface.



Melt pressure reaches optimum value at end of energising cycle. Emergence of the melt at the indicator holes shows that fusion is complete. *Please note: larger Dia. fittings have visual indicators that change colour to red when fused.*

PRE-JOINTING CHECKS

- 1 Use equipment that is clean, in good condition and regularly maintained.
- 2 Mechanical pipe preparation tooling must be used wherever possible.
- 3 Ensure that the cutters/blades of mechanical scrapers are clean and in good condition.
- 4 Check that you have somewhere clean and dry to place tools and equipment during the electrofusion process, and enough access to the work area.

DO'S

- **DO WORK SAFELY**
- Do understand the principals of electrofusion (refer to pipe manufacturers details if necessary).
- Do use a shelter and ground sheet, (a suitable anti-slip surface) in both dry and wet conditions to minimise contamination. Use end protection to pipes, (plugs or caps) to eliminate draughts.
- Do always use appropriate clamps for the true alignment, restraining and re-rounding of all pipes, both sticks and coils.
- Do ensure control box voltage is compatible with fitting.
- Do ensure pipe and fittings to be jointed are compatible with each other.
- Do cut pipe ends square for all electrofusion socket fittings.
- Do fully prepare pipe and/or spigot surfaces.
- Do keep prepared pipe and/or spigot surfaces and fittings clean.
- Do assemble joint and fuse immediately following preparing the pipe.
- Do check that the fusion time displayed by the ECU (automatic or manual) matches the fusion time on the fitting. In the case of automatic recognition, if the time is different to that shown on the fitting, do not weld.
- Do ensure correct fusion and cooling times are observed and adhered to.

- Do always input the correct operator code and job code to allow for full traceability with Electrofusion Control Units with data retrieval facilities.
- Do mark finished joints with a joint number/data.
- Do ensure that the fusion indicators have risen, if there is no apparent movement of one or both of the indicators, the joint should be cut out and a new joint made (WIS 4-32-08).
- Do ensure that when jointing tapping tees the fitting is correctly positioned on the pipe before fusion. Following the required quality inspections and pressure testing of the welded saddle fitting, the pipe can then be tapped through.
- Do always enter your I.D. details should the ECU request it. Enter your operator and job code to allow full traceability.
- Do always ensure you mark/sign the completed joint with the number issued from the ECU, along with the date if given. This is imperative for full traceability.

DONT'S

- Do not start any electrofusion joint unless it can be completed without interruption.
- Under no circumstances shall an attempt be made to carry out a second fusion cycle on any fitting. This is a WIS 4-32-08 Specification and shall be adhered to.
- Do not use dirty or contaminated fittings.
- Do not use fittings from split or torn bags, all fittings should remain bagged until immediately prior to use.
- Do not ever touch prepared fusion/jointing surfaces.
- Do not allow prepared fusion/jointing surfaces to become wet or damp.
- Do not remove clamps from fitting until cooling time has elapsed.

Procedures for Electrofusion of Protecta-Line Pipes (90mm-630mm)

When made in accordance with GPS PE Pipe Systems' recommended procedures, butt-fusion and electrofusion joints of the Protecta-Line system have been independently shown to meet the requirements of WIS 4-32-19 without any need for subsequent wrapping. This does not exempt installers from local regulations and the local Water Company preferences must be adhered to.

Standard electrofusion procedures must be adhered to, but note the following additional points:

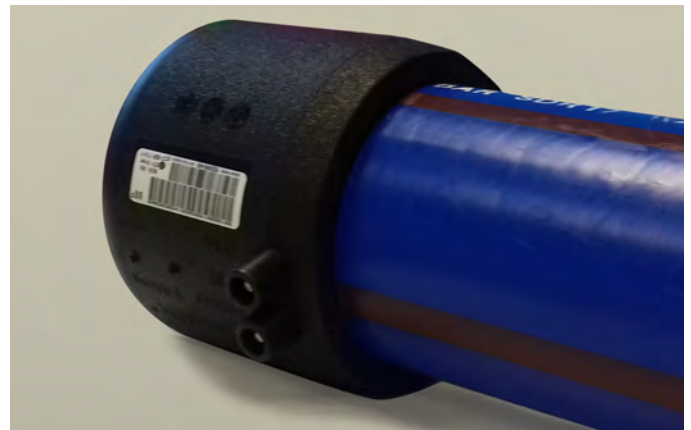
ELECTROFUSION

It is essential that the Protecta-Line pipe is properly prepared prior to electrofusion jointing. It is necessary first to remove the outer PE layer, aluminium layer and any residual adhesive layer material.

It is potentially dangerous to carry out electrofusion jointing where the aluminium layer is still in place.

The Protecta-Line Surprep Scraper must be used for pipe end preparation, as it not only removes the outer layers, but it also prepares the core pipe for electrofusion jointing.

Electrofusion clamps should be checked for suitability before commencing work, particularly in larger sizes. All electrofusion joint assemblies must be held in clamps throughout the fusion and cooling periods.



PROTECTA-LINE JOINTING END PREPARATION FOR ELECTROFUSION PROCEDURES

Pipe Size (mm)	Length (B) (mm)	Register (Z) (mm)	Min preparation / depth Insertion depth (mm)	Max preparation depth (mm)
90	157	3	77	82
110	159	3	78	83
125	172	3	84.5	89.5
160	190	3	93.5	98.5
180	210	3	103.5	108.5
225	236	8	114	119
250	220	8	111	116
280	220	8	109	114
315	300	8	137	142
355	300	8	146	151

For diameters above 355mm, please contact GPS Technical Support on +44 (0)1480 442620 or enquiries@gpsuk.com

Only Protecta-Line fittings shall be used with Protecta-Line pipe. The use of alternative fittings will have the following effects on your Protecta-Line system:

- Invalidation of WRAS approval and manufacturer's system performance warranty.
- Compromised permeation resistance (causing non-compliance with WIS 4-32-19 and possible risks to health).
- Danger of pipe-layer delamination, compromising system performance integrity and risking pipe bursts.
- It is illegal to install fittings non-compliant with the Water Fittings Regulations (or Byelaws in Scotland).

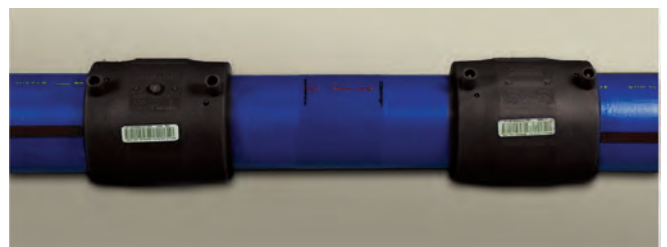


WIS 4-32-19
KM 514626

Repair Using Electrofusion (for Protecta-Line pipe sizes from 225mm to 630mm)

The pipe stops incorporated in the Protecta-Line electrofusion couplers are shearable and have been provided for the specific purpose of using the fittings for making repairs or breaking into existing pipelines.

1. Cut out the damaged section of the Protecta-Line pipe at least four times the length of the electrofusion repair couplers and ensure the pipe ends are cut square.
2. Measure the distance between the exposed pipe ends and cut a length of plain PE100 pipe of the same diameter and wall thickness as the existing Protecta-Line pipe, equal to the measured distance less 10mm ensuring that the pipe ends are cut square
3. Clean the ends of the cut section of plain pipe, for a distance slightly greater than the overall length of the repair couplers.
4. Using the pipe end preparation tool, remove the entire surface of the pipe over the marked area, preferably as a continuous ribbon or strip. Note: The use of mechanical end preparation tools is preferred as hand scraping requires great care and can be time-consuming especially on larger diameter pipes. It is essential that material is removed by scraping or peeling; scratching or abrading is not sufficient.
5. Remove the pipe stops in the coupler. This can be most satisfactorily achieved by placing one end of a thoroughly cleaned short length of pipe into the coupler and striking the other end onto a hard surface. The pipe stops can also be removed using a sharp knife, but care must be taken not to damage the bore of the fitting.
6. Clean the ends of the Protecta-Line pipe for repair and prepare for electrofusion jointing using the Protecta-Line Suprep Scraper as described on pages 38 and 39.
7. Using a suitable marker pen, draw circumferential lines half the length of the repair coupler on the prepared Protecta-line pipe ends which will be used to indicate the location of each repair coupler prior to fusion.
8. Care should be taken to ensure any residual water in the mains is not allowed to come into contact with the electrofusion area.
9. Insert the new plain section of pipe with repair couplers and then slide the repair couplers onto the Protecta-Line pipe ends, ensuring that they are positioned up to the marks on the prepared Protecta-Line pipe ends. Ensure that the surfaces are clean and dry.
10. Carry out the electrofusion jointing procedure as described from page 24.
11. After welding, the plain pipe should be wrapped with Protecta-Line aluminium tape followed by a proprietary waterproof petrolatum tape (equivalent to Denso™). A brief wrapping guideline is on page 42 and a full procedure can be obtained from our Sales Support



Alternative Method

Alternatively, stub flange assemblies may be fitted to the ends of the Protecta-Line pipe (after preparation with the Protecta-Line Surprep Scraper) and then connected with a double flanged ductile iron spacer.

This method may be used where there is a risk of water in the pipe contaminating electrofusion joints during installation.

Foam pigs can be used to temporarily seal the pipe bore. When electrofusion jointing of the stub flange assemblies has been completed, they can be removed before installation of the double flanged ductile iron spacer.



SQUEEZING OFF

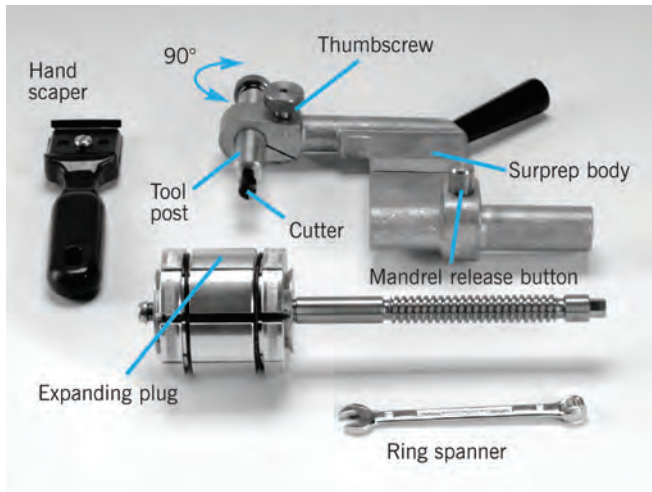
Protecta-Line pipe can be squeezed off in the industry-approved way, as summarised in the GPS Installation and Technical Guide.

However, as a precaution after re-rounding previously squeezed off areas should be wrapped with Protecta-Line aluminium tape followed by a proprietary waterproof petrolatum tape (equivalent to Denso™), in addition to any reinforcement bands that may be required to be fitted.

For information on acceptable usage conditions refer to Table 9.2 in the WRc PE Pipe Systems Manual version 01/02.

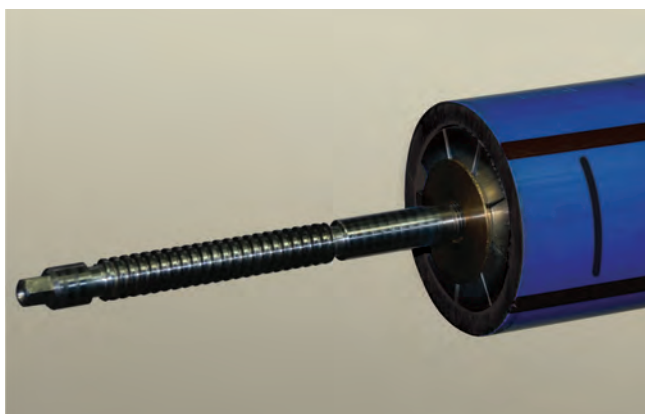


Procedure for Using the Protecta-Line Surprep Scraper (90mm-180mm)



The Protecta-Line Surprep Kit has been designed to allow the correct scraping of Protecta-Line barrier pipe prior to electrofusion jointing.

1. Measure the insertion depth of the electrofusion fitting to be used. Place a mark on both pipes to show the position where the edge of the fitting will be.
2. Clamp the pipe to be prepared taking care to avoid damage to the pipe's outer covering.
3. Separate the mandrel from the body of the Protecta-Line Surprep Scraper.

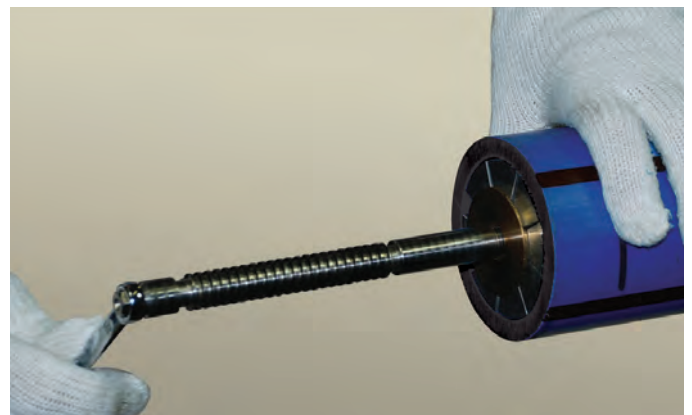


4. Hold the expanding plug and rotate the mandrel anticlockwise until the plug is a light interference fit in the pipe bore.
5. Push into pipe until edge of plug is level with edge of pipe. Expand plug further using the 10mm ring spanner. Do not over-tighten in order to avoid pipe distortion.

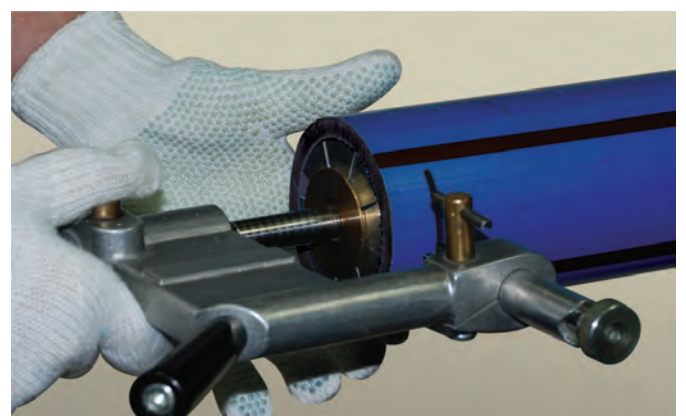
Code	90mm	110mm	125mm SDR11	125mm SDR17	160mm	180mm
01-07-081	●	●	●			
01-07-083				●	●	●

To order, please contact Caldervale directly on 01924 469571 or sales@caldertech.co.uk

The Surprep Kit is available for hire through MCA Hire Services www.mcahire.com and Plant & Site Services Ltd. www.psshire.com



6. Slide the body of the Protecta-Line Surprep Scraper onto the mandrel, depress the release button and position the cutter close to the edge of the pipe.



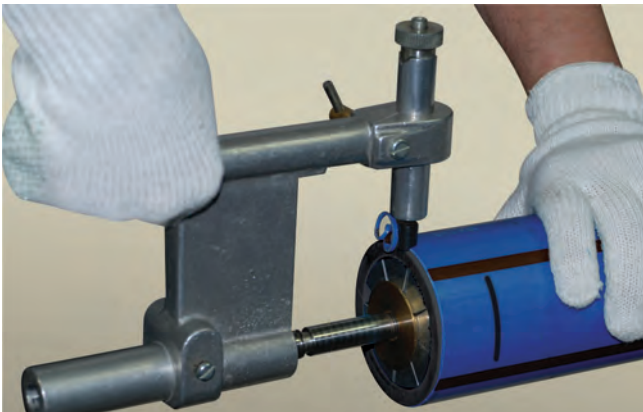
Note: Protecta-Line Surprep Scraper cuts in an anti-clockwise direction, beginning at the end of the pipe.



7. Rotate the knob on the top of the tool post through 90°, against the spring tension, such that the cutter is in its raised position.



8. Loosen the body thumbscrew and position the cutter shoe on the edge of the pipe. Tighten the thumbscrew.



9. Rotate the knob on top of the post through 90° so that spring pressure is applied to the cutter.
10. Rotate the tool anti-clockwise in a smooth continuous motion to remove the outer layers in a continuous strip.
11. Stop cutting when the socket depth mark is reached.



12. Rotate the knob on top of the tool post so that the spring pressure is released.
13. Use the hand scraper to remove the peeled strip from the pipe.

Caution: Do not attempt to break the peeled strip by pulling with bare hands, it has a sharp edge!

Remove the tool in the reverse order of assembly (steps 3-6).

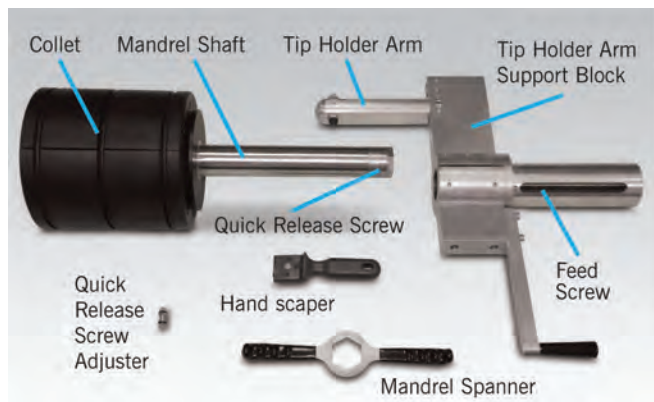


14. Inspect the prepared surface to ensure:
 - i) All of the metallic layer has been removed.
 - ii) All of the adhesive which bonds the metallic layer to the core has been removed.
15. If, for any reason, the prepared surface is not a uniform colour all over, use the hand scraper to complete the preparation process.

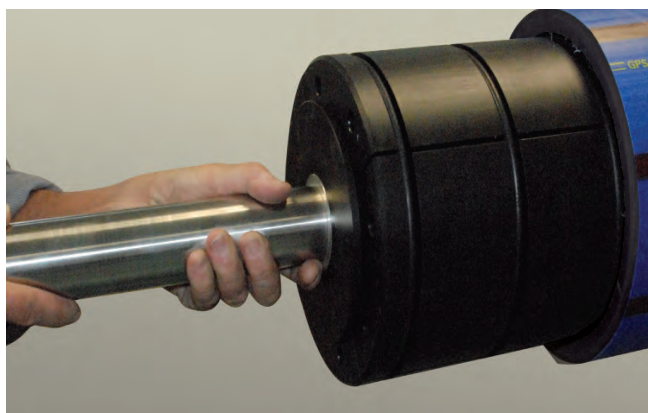
Never attempt a second pass with the Protecta-Line Surprep Scraper.

When made in accordance with GPS PE Pipe Systems' recommended procedures, butt-fusion and electrofusion joints of the Protecta-Line system have been independently shown to meet the requirements of WIS 4-32-19 without any need for subsequent wrapping. This does not exempt installers from local regulations and the local Water Company preferences must be adhered to.

Procedure for Using the Large Diameter Protecta-Line Scraper (above 180mm)



For Protecta-Line sizes above 180mm, the Surprep Scraper is a dedicated tool for each pipe size, with the cutter set to produce the required outside diameter. Adjustments must be done by a competent person and should not be carried out on site.



1. First mark the required length of pipe to be scraped (see table on page 28).

Ensure that the correct size collet for the pipe to be scraped is fitted to the mandrel.

Adjust the collet by twisting the mandrel shaft anti-clockwise until it achieves its smallest outside diameter.

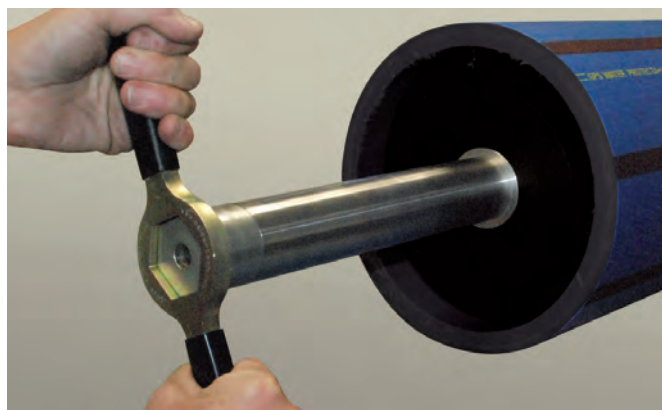
Slide the collet into the bore of the pipe, allowing 20mm of pipe to show after the collet, to allow for the barrelling effect found at the end of the pipe.

	225mm	250mm	280mm	315mm	355mm
Pipe insert collet					
01-07-255	●				
01-07-256		●			
01-07-257			●		
01-07-258				●	
01-07-259					●
Rotary tool c/w mandrill shaft*					
01-07-251	●	●	●	●	●

* Includes 2 collet expanding cones

To order, please contact Caldertech directly on 01924 469571 or sales@caldertech.co.uk. The Large Diameter Scraper is available upto 355mm for hire through MCA Hire Services www.mcahire.com and Plant & Site Services Ltd www.psshire.com.

For information about the Scraper for Protecta-Line sizes above 355mm, please contact GPS Technical Support on + 44 (0)1480 442620 or enquiries@gpsuk.com.

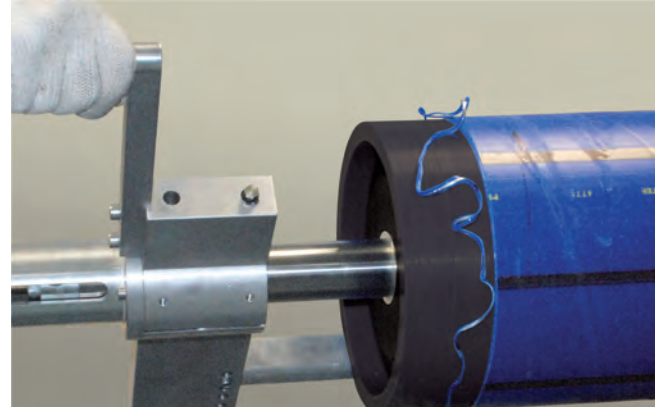
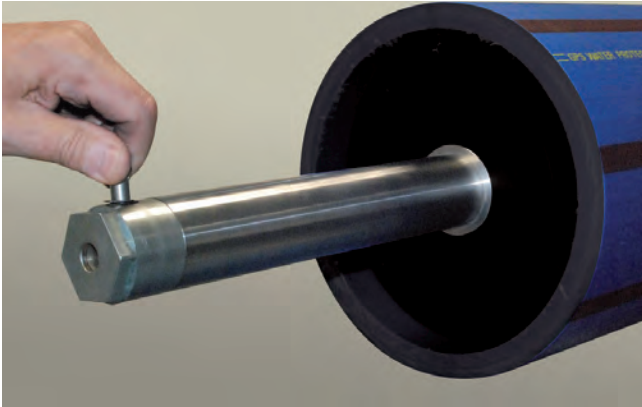


2. Adjust the collet by twisting the mandrel shaft clockwise until the mandrel becomes secure in the bore of the pipe and tighten with the mandrel spanner.

To achieve the correct alignment parallel to the pipe bore, a joggling action in all directions is required.

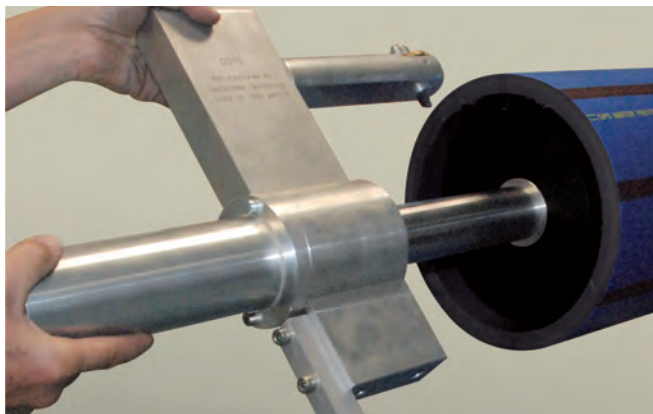
The collet also acts to re-round the pipe so check for gaps between the collet and the bore of the pipe.





3. Once the mandrel is secure and is parallel with the pipe bore, screw down the quick release screw to its full extent (about one and a half turns) using the adjuster, which is stored at the base of the tip arm support block.

Note: Remember the position of the quick release screw.



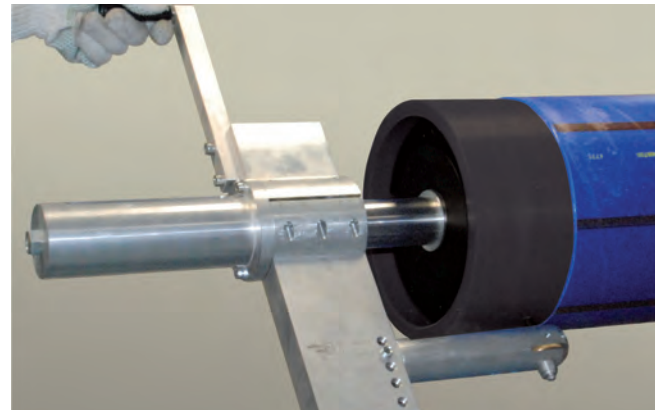
4. Ensure that the tip holder arm has been located in the hole corresponding to the pipe size in the tip holder support block.

Locate the tool onto the mandrel shaft taking care not to damage the bore of the tool.

Slowly slide the tool along the mandrel shaft using a twisting action, until the feed screw touches the quick release feed screw nut.

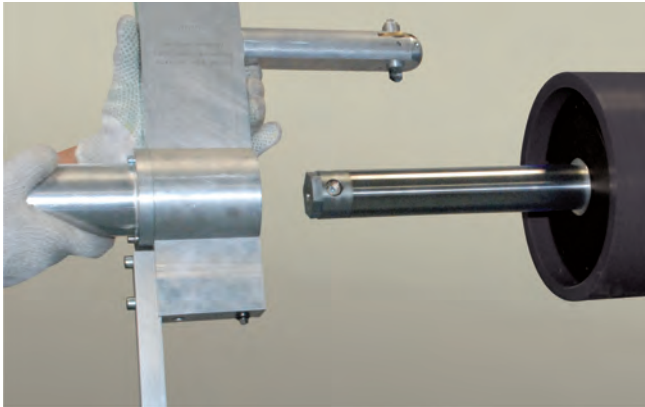
5. Taking care to avoid damaging the quick release nut and feed screw, rotate the tool in a clockwise direction with a slight force pushing forward.

Once the feed screw has engaged with the quick release nut, it will now proceed to travel along the length of the mandrel shaft, removing the outer barrier layers and preparing the pipe for electrofusion jointing.

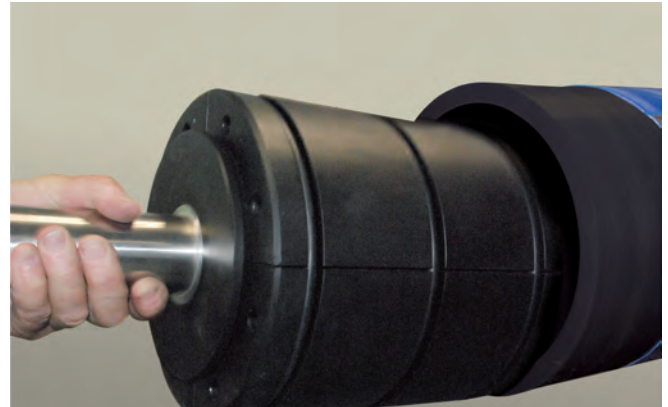


6. When the required length of pipe has been prepared, raise the quick release screw to its top position (about one and a half turns).

The quick release screw can be accessed through the slot in the feed screw housing tube.



7. The tool can now be removed from the mandrel shaft.
Note: The tool should be removed to a clean dry and safe area.



9. Remove the collet and mandrel from the pipe.
The collet should be removed to a clean dry and safe area. If there are any areas of pipe that have not been prepared properly, then the hand scraper should be used to complete the preparation process.

Note: The barrelling effect found at the end of the pipe may result in the barrier layers remaining on the pipe surface for a short distance in from the end of the pipe.



8. Loosen the collet using the mandrel spanner on the mandrel shaft in an anti-clockwise direction until free.

When made in accordance with GPS PE Pipe Systems' recommended procedures, butt-fusion and electrofusion joints of the Protecta-Line system have been independently shown to meet the requirements of WIS 4-32-19 without any need for subsequent wrapping. This does not exempt installers from local regulations and the local Water Company preferences must be adhered to.

Connecting Protecta-Line **BUTT FUSION**

GENERAL

Butt Fusion is a jointing method which allows on-site jointing of pipes 90mm and above. It is a thermofusion process which involves the simultaneous heating of the ends of two components which are to be joined, until a melt state is attained at each contact surface. The two surfaces are then brought together under controlled pressure for a specific fusion/cooling time and homogeneous fusion takes place.

The resultant joint is fully resistant to end thrust and has identical performance under pressure to the pipe.

This method of jointing requires an electrically heated plate to raise the temperature of the pipe ends to the required fusion temperature. It is used for both PE80 and PE100 grades of material for pipes of size 90mm and above of the same Standard Dimension Ratio (SDR).

Automatic Butt Fusion machines are to be preferred, however particularly when jointing the larger pipe sizes, semi-automatic machines with full data retrieval may be considered.

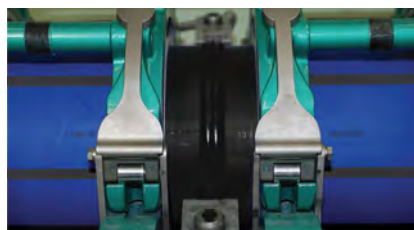
BUTT FUSION

Where this is permitted by the local water company, it is important that the outer PE and aluminium layers are removed far enough back, using the Protecta-Line Surprep tool (see the next pages), to prevent the aluminium from coming into contact with the butt-fusion machine trimmer or heater plates.

In addition, the outer PE and aluminium layers should be removed far enough back to permit normal debanding of the completed joint for normal quality control purposes.

It is recommended that the layers should be removed to a length equal to the width of the debanding tool on the end of each pipe. This should be increased by 50% when carrying out dummy weld procedures prior to final jointing.

Butt-fusion clamps should be checked for suitability before commencing work, particularly in larger sizes. Care should be taken not to damage the outer layers of Protecta-Line pipe when clamping it in the butt-fusion machine. In the case of some machines this may necessitate gently radiusing the edges of the jaw shutlines.



Protecta-Line Blue
in the final stage of
Butt Fusion process

DID YOU KNOW?

**Butt Fusion
provides the
greatest joint
integrity of any
jointing method**



TRAINING COURSES

It is essential that installers of polyethylene pipe systems have received thorough training. Training leading to nationally recognised qualifications can be completed at a number of organisations.

BUTT FUSION JOINTING PRINCIPLES

Butt Fusion machines can be capable of welding moulded fittings directly onto pipe but not in all circumstances as it can depend on the design and make of the equipment. GPS offers two ranges of fittings to provide the greatest flexibility.

Spigot Fittings

These unpupped fittings are long enough to be gripped for Butt Fusion in some types of machines.

Pupped Fittings

Pupped fittings are fabricated in our factory by butt-fusing lengths of pipe (pups) to each leg of a spigot fitting. The pup can be gripped by clamps of site Butt Fusion machines.

GPS standard pupped fittings have a 0.5m length pup for sizes up to 400mm and a 1.0m length pup for sizes of 450mm and above.

Welding in Cold Weather

When Butt Fusion jointing at temperatures below -5°C, a space heater should be provided for the welding shelter to raise the local temperature above 0°C.

EQUIPMENT

- Generator to supply the heater plate, trimmer and hydraulic pump
- Butt Fusion machine fitted with the correct size clamp shells, trimmer, heater plate, hydraulic pump and timer
- Protecta-Line Surprep Tool
- Pipe support rollers
- Welding tent
- External/internal de-beading tool
- Bead gauge
- Cleaning material, lint-free cotton cloth or paper towel
- Digital thermometer with surface probe to check heater plate
- Pipe end caps
- Baseboard
- Pipe cutters
- Air temperature thermometer
- Indelible marker pen
- Timer

JOINTING METHOD PRE-JOINTING CHECKS

Before commencing a welding operation:

- Ensure that equipment used is clean, in good condition and regularly maintained
- Ensure that the correct jointing parameters for the machine type and pipe are known
- Check that the heater plate is clean and dry
- Check that the trimmer is clean and that the blades are not damaged and in the correct position for required pipe size
- Ensure clamp liners and securing screws are of the correct size
- Ensure that the generator is in good condition and has sufficient fuel
- A tent is available to provide shelter during welding and end caps are available.
- The pipes and/or fittings to be jointed are of the same size, SDR and material.
- Required length of pipe has been prepared

DUMMY WELDS

Even though washing of the heater plate may remove large deposits of dirt, very fine particles of dust may still remain on the heater plate. To remove such dust it is necessary to make a dummy joint at the start of each jointing session, whenever the plate has been allowed to cool below 180°C, or at a change of pipe size. Two dummy joints must be made if the pipe size is greater than 180mm.

A dummy joint can be made using pipe off-cuts of the same size, SDR and material as the pipe being installed however, it is not necessary to actually make a joint as the procedure can be discontinued after the full heat cycle has been completed. In the case of Automatic machines the abort button can be used to stop the process after the heat soak period has elapsed.



Butt Fusion machine prior to commencement of fusion process

PRE-JOINTING CHECKS

- Use equipment that is clean, in good condition and regularly maintained.
- Ensure the correct jointing parameters for the machine type and pipe are known.
- Check that the heater plate is clean and dry.
- Check that the trimmer is clean and that the blades are not damaged and in the correct position for the required pipe size.
- Ensure clamp liners and securing screws are of the correct size.
- Ensure the generator is in good condition and has sufficient fuel.

WELDING PROCEDURE

- 1 With the machine in the open position place the pipes in the clamps with the ends adjacent to the trimming tool and with the pipe markings aligned.
- 2 Align and level the components using external support rollers.
- 3 Tighten the pipe clamps to grip and re-round the pipes.
- 4 Cover the free ends of the pipes to prevent cooling of the plate by internal draughts.
- 5 Switch on the trimming tool and bring the clamps slowly together so that the pipe ends are moved against the trimming tool until continuous shavings are cut from each surface.
- 6 Keep the trimming tool turning whilst separating the clamps to avoid steps on the trimmed surfaces.
- 7 Remove the trimming tool taking care not to touch the trimmed pipe ends.
- 8 Remove loose shavings from the machine and pipe ends. Do not touch the prepared surfaces or place hands between the pipe ends.
- 9 Check that both surfaces are completely planed. If they are not then repeat the trimming process.
- 10 Bring the clamps together and check that there is no visible gap between the trimmed faces.
- 11 There should be no discernible mis-match on the outside diameter up to and including 180mm and less than 10% of the wall thickness for pipes greater than 180mm. If the mismatch is greater than these values then the pipe must be realigned and re-trimmed.
- 12 Automatic machines will measure the drag pressure and compensate for this but with the earlier manual machines, there was a need for this to be assessed accurately prior to making each fusion joint and added to the basic ram pressure values shown on the machine.
- 13 With the machine in the open position place the heater plate assembly on the machine, checking that it is up to the correct temperature.
- 14 The automatic Butt Fusion cycle can now be commenced whereupon the required interface pressure will be maintained until a uniform bead of the correct size is formed on each pipe.
- 15 After the initial bead up, the pressure in the hydraulic system will be reduced to between zero and the drag pressure, so as to control the bead growth during the heat soak time.
- 16 When the heat soak time is completed, the machine will automatically open and remove the heater plate before bringing the pipe ends together under the prescribed interface pressure.
- 17 The prescribed pressure must be maintained for the required minimum cooling time.
- 18 After this time the assembly can be removed from the machine but should not be handled excessively for the required period.

POST WELDING CHECKS

- 1 Examine the joint for cleanliness and uniformity and check that the bead width is within the specified limits.
- 2 Remove the external bead and if required the internal bead using suitable debanding tools.
- 3 The beads and joint should be numbered/coded using an indelible marker pen to correspond with the joint details entered into the butt fusion machine data retrieval system.
- 4 The beads should be twisted at several positions and if a bead is seen to split at any point or deformities are present on the underside, then the joint should be cut out from the pipeline and remade. If a similar defect reoccurs, all further jointing should cease until the equipment has been thoroughly cleaned, examined and new trial joints made which are shown to be satisfactory.



DO'S

- **DO WORK SAFELY (If in doubt – always ask)**
- Do understand the principals of butt fusion (refer to pipe manufacturers/machine suppliers guidelines if necessary).
- Do always input correct operator code and job code to allow for full traceability with Automatic Butt Fusion machines.
- Do mark finished joint with joint number.
- Do use a shelter and ground sheet (a suitable anti-slip surface*), both in dry and wet conditions, to minimise contamination, and fit end protection to pipes, (plugs or caps) to eliminate draughts.
- Do ensure pipes are aligned correctly and supported on pipe rollers to minimise drag.

- Do position pipes in clamps with pipe markings aligned and to the top.
- Do perform dummy welds at the start of every welding session, when changing pipe size or if the heater plate has been allowed to cool (one dummy weld on pipe size 180mm and below and two on larger pipe sizes).
- Do ensure that when trimming, a continuous ribbon of material is produced from both pipe ends before commencing feathering operation.
- Do always use trimmer and heater plate stands provided.
- Do always remove swarf from underneath pipe ends and machine chassis following trimming.
- Do visually check that both pipe ends are completely trimmed.
- Do always check pipes for alignment and gaps around the entire circumference of the abutted pipes.
- Do always remove external bead from completed joint, inspect for slit defects/bead uniformity then bag and label with corresponding joint number for full traceability.

DONT'S

- Do not attempt to use equipment unless trained to do so.
- Do not attempt to weld pipes of different wall thickness.
- Do not touch trimmer blades when cleaning and especially when in motion, blades are very sharp and can cause serious injury.
- Do not touch heater plate (unless to clean when cold).
- Do not leave swarf inside pipe or on machine chassis.
- Do not introduce dirt onto trimmed pipe ends at any time, particularly when removing swarf.
- Do not remove pipes from machine until cooling time has elapsed.
- Do not attempt to install pipe until fully cooled.
- Do not attempt to operate the trimmer whilst it is out of the machine or attempt to by-pass the safety switch.
- Do not attempt to cut corners in any part of the welding cycle.

Procedures for Butt Fusion of Protecta-Line Pipes (90mm-630mm)

When made in accordance with GPS PE Pipe Systems' recommended procedures, butt-fusion and electrofusion joints of the Protecta-Line system have been independently shown to meet the requirements of WIS 4-32-19 without any need for subsequent wrapping. This does not exempt installers from local regulations and the local Water Company preferences must be adhered to.

Standard electrofusion procedures must be adhered to, but note the following additional points:

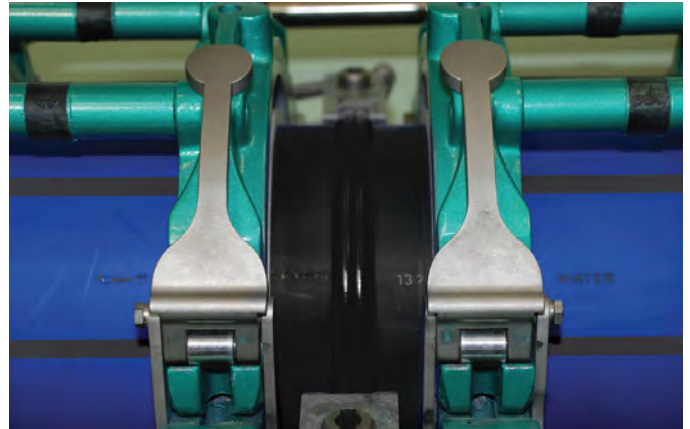
BUTT FUSION

Where this is permitted by the local water company, it is important that the outer PE and aluminium layers are removed far enough back, using the Protecta-Line Surprep tool (see the next pages), to prevent the aluminium from coming into contact with the butt-fusion machine trimmer or heater plates.

In addition, the outer PE and aluminium layers should be removed far enough back to permit normal debanding of the completed joint for normal quality control purposes.

It is recommended that the layers should be removed to a length equal to the width of the debanding tool on the end of each pipe. This should be increased by 50% when carrying out dummy weld procedures prior to final jointing.

Butt fusion clamps should be checked for suitability before commencing work, particularly in larger sizes. Care should be taken not to damage the outer layers of Protecta-Line pipe when clamping it in the butt-fusion machine. In the case of some machines this may necessitate gently radiusing the edges of the jaw shutlines.



Only Protecta-Line fittings shall be used with Protecta-Line pipe. The use of alternative fittings will have the following effects on your Protecta-Line system:

- Invalidation of WRAS approval and manufacturer's system performance warranty.
- Compromised permeation resistance (causing non-compliance with WIS 4-32-19 and possible risks to health).
- Danger of pipe-layer delamination, compromising system performance integrity and risking pipe bursts.
- It is illegal to install fittings non-compliant with the Water Fittings Regulations (or Byelaws in Scotland).



→ Morrisons Bridgewater

Wessex Water responded to both proven and potential contaminants at a development site for a Morrisons distribution centre in Bridgewater by specifying Protecta-Line barrier system.

The 75,000m² distribution centre will serve the supermarket chain's network of stores in the South West and forms part of an £11 million regeneration scheme, including up to 2,000 new homes. The development is located on a mixed brownfield and greenfield site, which combines redundant industrial land with farmland. The mains connection for the scheme is at the front of the site where there is a railway line and a chemical factory, which lead to concerns about contamination.



£11 million regeneration scheme

holes were tested across the site to ascertain the level of contamination and, while the contaminants were not found over a large proportion of the site, the high water table caused by the tidal nature of the River Parret local to the site does present the risk of migration of contaminants across a wider area.”

Explained Bob Wood from Wessex Water: “While stringent controls and operational best practice limit the contaminants from the factory now, historically they have been varied and significant. Trial

It was these concerns over the potential for contaminants to be carried to ‘safe’ soil areas by tidal waters on the flood plain site that prompted Wessex Water to specify 355mm Protecta-Line pipe for a new main running across the distribution centre site, including the footprint of the building and access roads. Around 1,200m of Protecta-Line was used in SDR17, providing up to 10 bar pressure capability which allows for additional capacity to be factored into the installation.

Wessex Water installed the pipe into open trenches, incorporating T-joints to allow take-offs of supply to be added at a future date. All joints were made by butt-fusion and the installation team prepared the pipes using the Protecta-Line Surprep tool to scrape away the outer layers. Wessex Water continued its practice of wrapping the joints using aluminium foil and Denso tape throughout the Protecta-Line installation. Away from the Protecta-Line spine main, the site is not at risk of contamination so ordinary PE pipe was used with steel mechanical fittings to create the joints between the two materials.

Bob adds: “Even a small risk of contaminant migration makes it prudent to specify an effective barrier pipe. Protecta-Line safeguards against ingress of all known contaminants and is our preferred barrier pipe solution so this specification means that we can be confident of a safe water supply, whatever the ground conditions.”

Connecting Protecta-Line MECHANICAL JOINTING

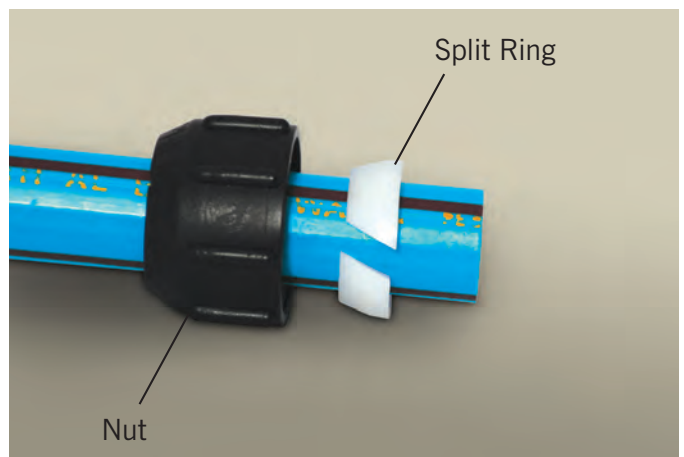
Mechanical jointings allow Protecta-line to be installed and joined in all weather conditions without requirement for specialist equipment. In addition, the mechanical method is suitable for joining polyethylene to many other materials

A comprehensive range of compatible mechanical jointings for Protecta-line are available from GPS including Mechanical compression fittings, Ferrule off-takes, Mechanical fittings and Flanges.

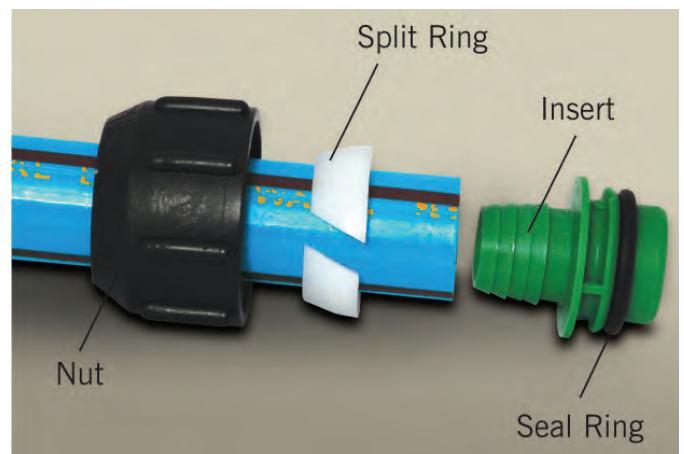
Joining Instructions for 25mm-63mm Protecta-Line Mechanical Compression Fittings (Service Pipes)

For use on GPS Protecta-Line pipe only.

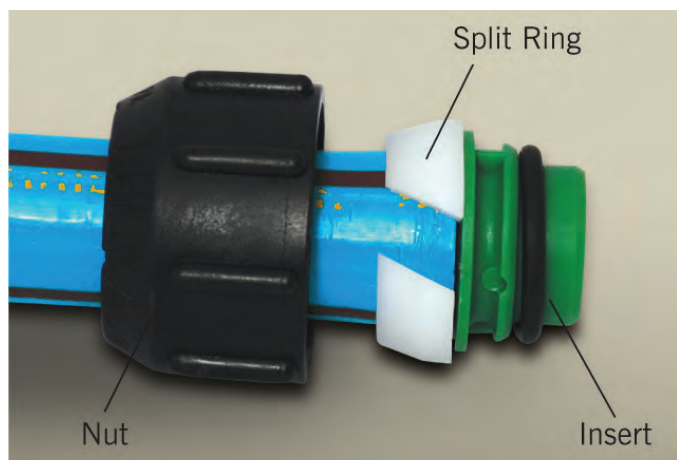
- 1 Cut the pipe square. Unscrew the Protecta-Line fitting and remove the nut and white split ring. Slide these on to the Protecta-Line pipe, first ensuring that the taper of the split ring faces towards the nut.



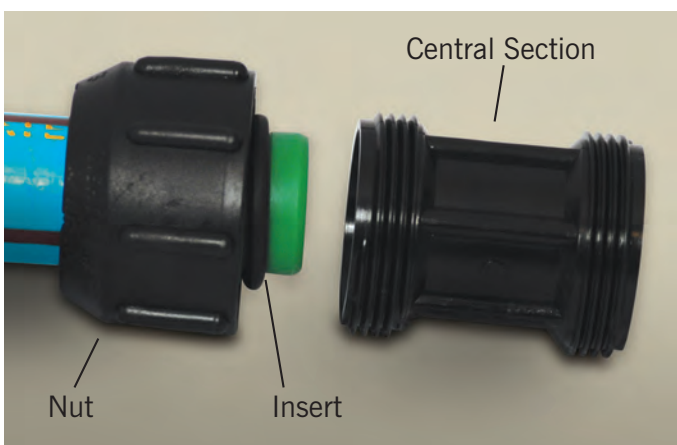
- 2 Tap the insert into the end of the Protecta-Line pipe with a flat wooden object. Ensure that the seal ring is correctly positioned on the pipe insert.



- Slide the split ring along the Protecta-Line pipe until it is up against the insert. Snap the nut over the split ring.



- Offer the body of the fitting to the Protecta-Line pipe end and screw the nut on to the fitting body. Continue to tighten the nut until the thread on the body is no longer visible.

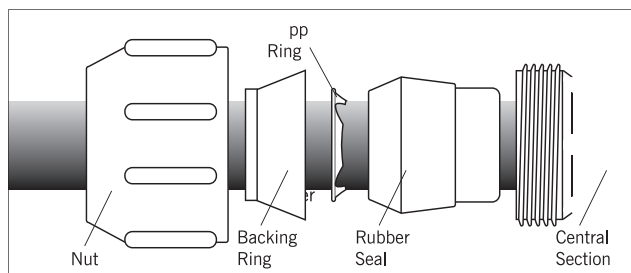


Connecting Protecta-Line mechanical compression fittings to iron fittings

When screwing Protecta-Line Mechanical Compression Fittings onto iron fittings it is important not to use excessive amounts of **thread** sealing tape or other material **because** this can result in unreasonable force needed to complete the joint. Thread sealing tape should be WRc approved.



Protecta-Line to copper joint (incorporates insert set for Copper Type A for above ground use on Table X tube).



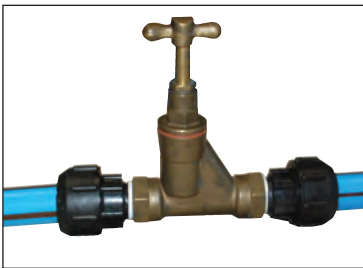
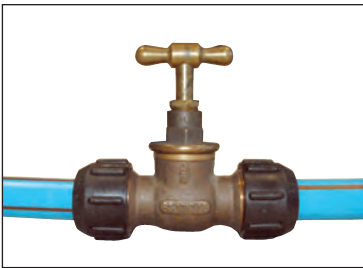
- Cut copper pipe square, preferably with cutters, and deburr.
- Degrease pipe and roughen with wire wool or similar.
- Unscrew nut from copper side of Protecta-Line fitting and slide this nut and plastic backing ring along copper pipe – with taper of backing ring towards nut.
- Then slide metal gripper ring on to pipe and position it 10–15mm from end, ensuring flat face of gripper ring is facing towards backing ring/nut (i.e. slots in the gripper ring must face towards fitting body).
- Next slide rubber seal on to copper pipe all the way up to internal stop – taper facing towards other parts already on pipe.
- This will make certain that the metal gripper ring is pushed to correct location along pipe.
- Slide backing ring forward to meet gripper ring/rubber seal.
- Push assembly into body of Protecta-Line fitting and engage nut.
- Tighten nut firmly with a wrench.
- Ensure all pipework is securely anchored to counteract end loading.

Caution: Do not use heat near plastics and do not re-use gripper ring.

ENABLING PRODUCTS

Stop cocks (BS 5433 type) are available with integral Protecta-Line Mechanical Compression Couplers in sizes 25mm and 32mm.

For larger sizes and as an alternative to the above, stop cocks with threaded connections can be used in conjunction with Protecta-Line Mechanical Compression End Connectors.



Boundary boxes may be used provided they are manufactured in accordance with the required standards, listed in the WRAS Approved Water Fittings directory (section 1520 or 1525) and comply with the requirements of WIS 4-37-01.

Connecting couplers must be approved for use with the Protecta-Line system and pass the requirements of WIS 4-32-19.

The pipe inserts of Protecta-Line Mechanical Compression Fittings seal on the pipe bore and isolate the pipe end from any water pressure. The fittings' threads are BSP taper (male or female) and connections should only be made to the equivalent male or female threaded connections of the boundary box.



Above ground mounted/built-in meter boxes should be considered when the internal components of a boundary box (manifold and/or meter) are of a polymeric material and there is a risk of contaminant ingress where Protecta-Line pipe feeds straight into the box.

Connections to the meter manifold inlet should only be made with fittings approved for use with the Protecta-Line System.

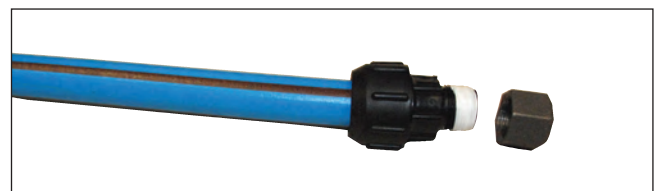


CONNECTING TO ALTERNATIVE BARRIER PIPES SYSTEMS

To connect Protecta-Line to alternative barrier pipe systems, a mechanical connection should be used: either a threaded connection in the case of the service pipe sizes or a flange connection in the case of larger sizes. Contact our Technical Support for further details.

CAPPING OFF

An appropriate Protecta-Line Mechanical Compression Fitting can be used to cap off Protecta-Line pipes as shown below.



TESTING AND COMMISSIONING

The sequence of events for Protecta-Line includes the same basic testing procedures as for conventional PE pipes, but taking extra care appropriate for a contaminated environment as set out by the Local Water Undertaking.

As for standard PE pipes, these procedures will normally require as a minimum the adequate flushing of the services and the testing of all pipes and joints to the maximum head to which the system is to be subjected.

WRAPPING

When made in accordance with GPS PE Pipe Systems' recommended procedures, butt-fusion and electrofusion joints of the Protecta-Line System have been independently shown to meet the requirements of WIS 4-32-19 without any need for subsequent wrapping. This does not exempt installers from local regulations and the local Water Company preferences must be adhered to.

Should wrapping be required, the following table can be used for guidance. The full wrapping procedure can be obtained from our Technical Support.

Aluminium Foil Wrapping Lengths – Foil width 50mm.

Size (mm)	E/F fitting length (mm)	Amount of foil required (metres)	Joints per roll
90	127	3.4	15
110	135	4.5	11
125	147	5.2	10
160	164	7.4	7
180	210	10.2	5
225	236	13.8	4
250	246	15.9	3
280	285	19.3	3
315	300	24.5	2
355	300	27.8	2
400	320	32.5	2
450	340	37.9	1
500	360	44.0	1
560	380	47.1	1
630	420	56.6	1

Size (mm) E/F fitting length (mm)	Amount of foil required (metres)	Code
Aluminium wrapping tape (45m long x 50mm wide)	0.5	44 996 008

Joining Instructions for Protecta-Line Gunmetal Self Tapping Ferrule Straps.

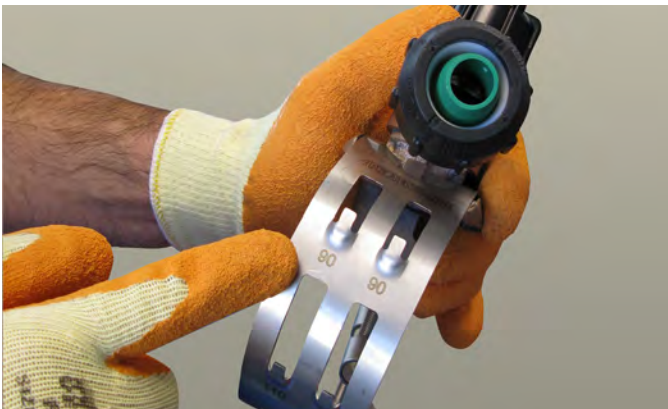
For use on GPS Protecta-Line pipe only.

- Gloves and safety glasses must be worn during the whole assembly process. Do not remove cutter or sleeve from this product before use.
- The ferrule strap cutter includes a sealing sleeve that prevents water contact with the aluminium barrier layer.

Tooling required:

- 13mm socket wrench or spanner
- 8mm square section ferrule key

1. Clean the top of the Protecta-Line main where the ferrule strap is to be fitted, avoiding areas which appear damaged. Ensure that the sealing "O" ring is in place under the upper ferrule strap (take care not to damage this on the protruding sleeve).



2. Unhitch the lower part of the ferrule understrap from the tabs on the upper part of the strap. Leaving the bolt in place, fit the ferrule squarely around the main, re-attach the understrap to the appropriate tabs.



3. Tighten the strap bolt with a 13mm socket wrench or spanner to 12-14Nm of torque.



4. Fit the Protecta-Line service pipe into the compression fitting on the outlet, as described in the instructions overleaf. After aligning the outlet to the desired position, tighten the securing collar and compression fitting.



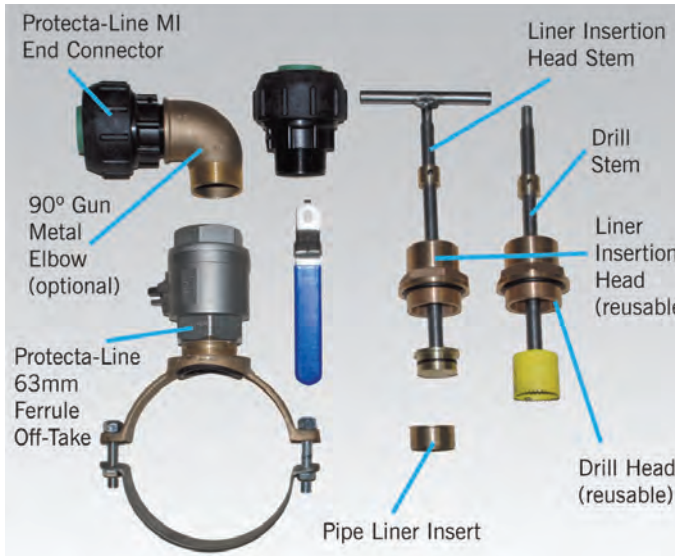
5. Remove the plug from the top of the ferrule cap, and, using an 8mm square section key, wind down the cutter assembly all the way until hard and solid resistance is felt. Note that before the solid resistance is felt there may be a temporary drop in resistance, followed by an increase as the sleeve around the cutter enters the main.



6. Withdraw the cutter all the way up to the top of the stem, employing a final counter-clockwise torque of 12-14Nm to ensure a good seal. Some leakage through the plughole is normal before the cutter has been fully unscrewed. Replace the plug.



Joining Instructions for 63mm Protecta-Line Gunmetal Ferrule Off-Takes

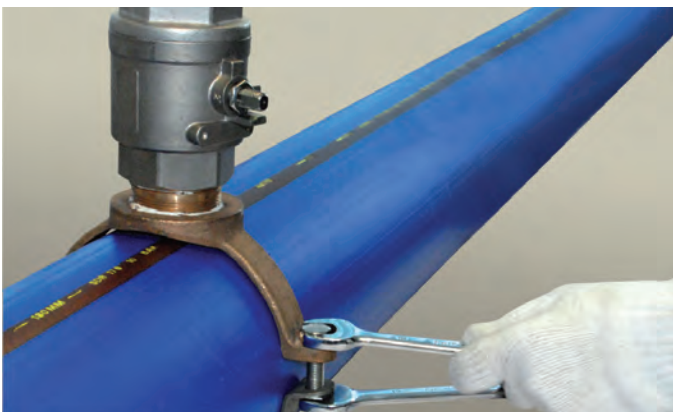


Accessory	Code
* Protecta-Line 2" Drill Head	44 794 003
**Protecta-Line 2" Liner Head	44 794 004
***Protecta-Line Drill/Liner Head O-Ring Kit	44 996 062

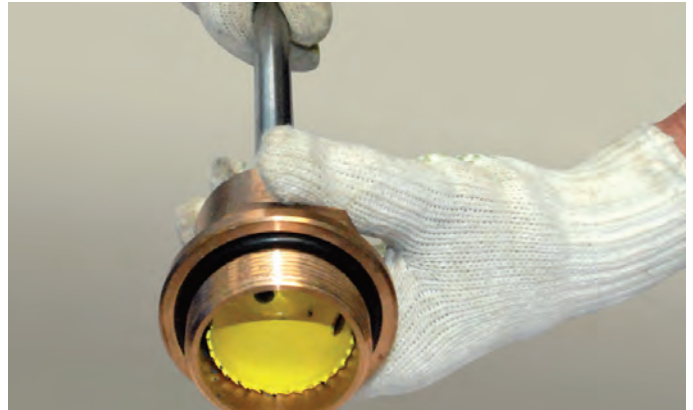
- * Drill Head setting: fix stop at 230mm from base to drill tip
- ** Drill Liner setting: fix stop at 180mm from stop base to bottom of tip on liner head
- *** Includes four O-rings for replacement in either Drill Head or Liner Head

Gloves and safety glasses must be worn during the whole assembly process.

1. Ensuring that the sealing O-ring is in place under the upper ferrule strap, fit the ferrule squarely around the main in the required position and tighten the two strap bolts evenly and symmetrically. Ensure that ball valve operates correctly before fitting.



2. After assembling the drill stem with a 48mm hole cutter, withdraw the drill stem fully into the drill head.



3. Ensure that the ball valve is in the fully open position (anticlockwise rotation). Fit the drill head to the outlet of the ferrule.



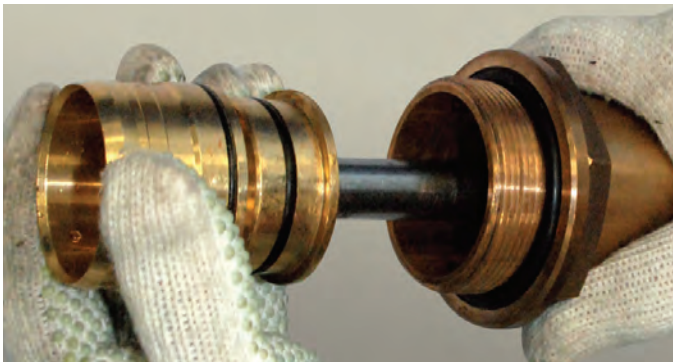
4. Attach the chuck of an electric drill to the top of the drill stem (ensuring that the power supply is disconnected). Re-connect the power supply to the electric drill and operate the drill with downward pressure until the stop on the drill stem contacts the top of the drill head.



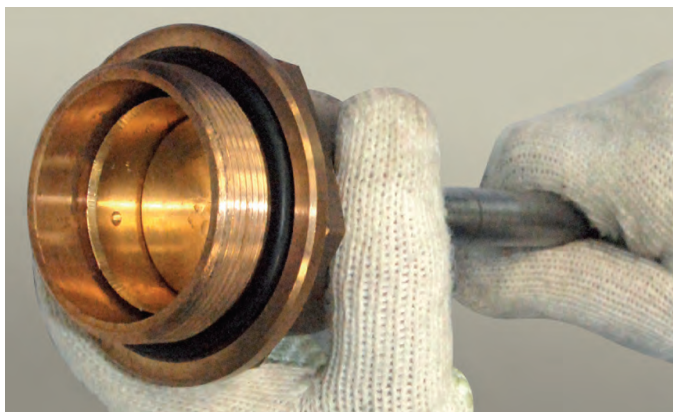
5. Disconnect the power supply to the electric drill and remove the drill from the drill stem. Withdraw the drill stem, until the cutter is fully returned into the drill head and fully close the ball valve (clockwise rotation) before removing the drill head from the outlet of the ferrule.



6. Position the liner insert onto the carrier of the liner insertion head.



7. Fully withdraw the carrier and pipe liner insert into the liner insert head (indicated by the lower depth mark on the stem).



8. Fit the liner insertion head to the outlet of the ferrule. Open the ball valve (anti-clockwise rotation) and fully insert the liner insert, by applying downward pressure on the tee-bar handle on the shaft of the liner insertion head until the stop on the liner insertion head stem contacts the top of the liner insertion head.



9. Withdraw the liner insertion head stem until the carrier is fully withdrawn into the liner insert head (indicated by the lower depth mark on the stem). Close the ball valve (clockwise rotation) and remove the liner insertion head.



10. The communication pipe can now be fitted to the outlet of the ferrule utilising a Protecta-Line 63mm x 2" MI mechanical end connector, either directly to the ferrule outlet (side connection) or in conjunction with 2" MI/FI 90° elbow (top connection).



11. Open the ball valve (anti-clockwise rotation).

Joining Instructions for Protecta-Line Mechanical Fittings

- These fittings are designed for use on GPS Protecta-Line pipes only and their performance on other piping systems is not approved or guaranteed.
- Gloves and safety glasses must be worn during the whole assembly process.
- A torque wrench is required: with a 10mm allen (hex) socket for sizes 63mm – 125mm and a 14mm allen (hex) socket for 160mm – 180mm fittings.

1. **DO** ensure that the pipe ends are cut square.
2. **DO** ensure that the pipe is correctly aligned onto the fitting spigot.
3. **DO** ensure that the pipe is butted up to the insert spigot's pipe stop.
4. **DO** ensure that the shell is flush with the pipe end on the spigot.
5. **DO** remember to re-torque the bolts.
6. **DON'T** remove the fitting and try to reinstall on the same section of pipe, this may create a leak path due to the grooves previously formed on the pipe bore.

1. Ensure the pipe ends are cut square. With the insert in place in the pipes to be joined, or with a 5mm gap between them, centre the shells over the pipe ends and mark the penetration depth.



2. Slide the shell over one of the pipe ends to be joined.



3. Push the insert into the pipe end.



4. Offer up the second pipe end onto the insert and push the pipes together, ensuring both pipes are up against the pipe stops of the insert and correctly aligned on the pipe.



5. Ensure the shells are flush with the pipe ends or for the straight coupler, centre the shell between the depth penetration marks. The fitting is ready to be tightened. Set the torque wrench to the value indicated on the label of the shell.



6. Tighten the hex socket head bolts until the set torque is achieved in each bolt. The pipe will relax after the set torque is achieved, so after a minute or more, retighten the bolts to the set torque. Repeat until less than a quarter turn is needed to reach the set torque*.
7. For the straight couplers, which have two bolts on a double width shell, tighten the bolts alternately and evenly until set torque is achieved in each bolt. The pipe will relax after the set torque is achieved, so after a minute or more, retighten the bolts to the set torque. Repeat until less than a quarter turn is needed to reach the set torque*.

* Repeated tightening of the bolts up to the set torque is necessary and important to compensate for relaxation in the polyethylene. It's normal for the re-torquing process to be conducted three to four times over the course of 5 minutes, but a longer allowance for relaxation between re-torquing may be needed in extremely cold weather where 10 to 15 minutes may be needed for the complete installation process.

Repair Section Using 90mm – 180mm Protecta-Line Mechanical Repair Couplers

- These fittings are designed for use on GPS Protecta-Line pipes only and their performance on other piping systems cannot be guaranteed.
- Gloves and safety glasses must be worn during the whole assembly process.
- A torque wrench is required: with a 10mm allen (hex) socket for sizes 63mm – 125mm and a 14mm allen (hex) socket for 160mm – 180mm fittings.

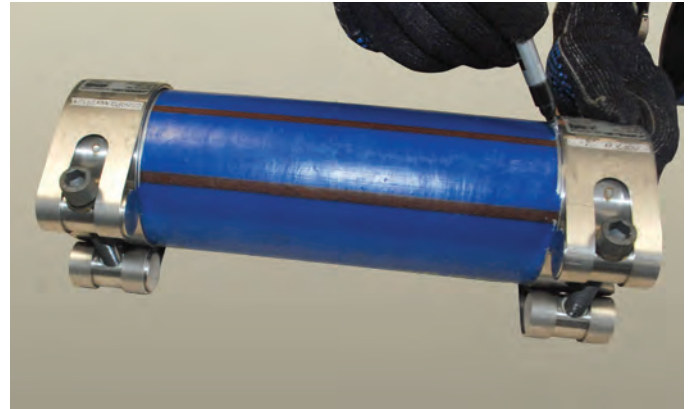
1. Cut out the damaged pipe section. The minimum length of the cut is shown in the table below.

Pipe Size (mm)	Minimum Cut Out Length (mm)	Length of the Repair Piece (mm)
63	440	240
90	440	240
110	470	270
125	470	270
160	470	270
180	470	270

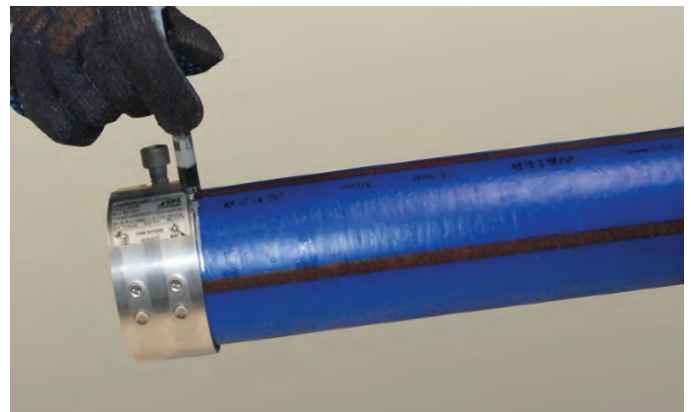
2. From an undamaged pipe length cut out a repair piece. The length of the repair piece should be equal to the length of the cut out less 200mm.



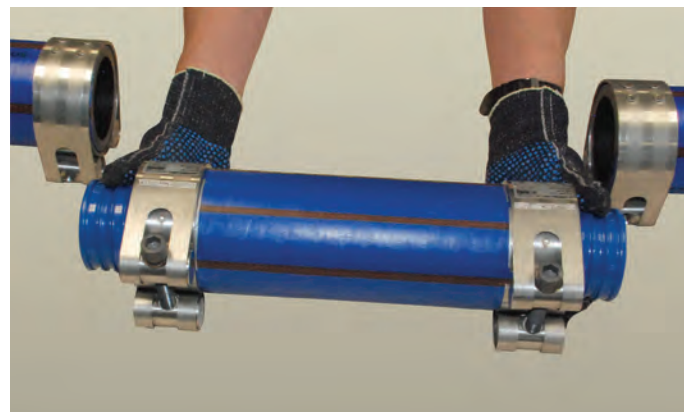
3. Fit the half shells to the ends of the cut out section and mark the penetration depths.



4. The penetration depths is shown in the table on the right. The table is in a separate document and to be added here.



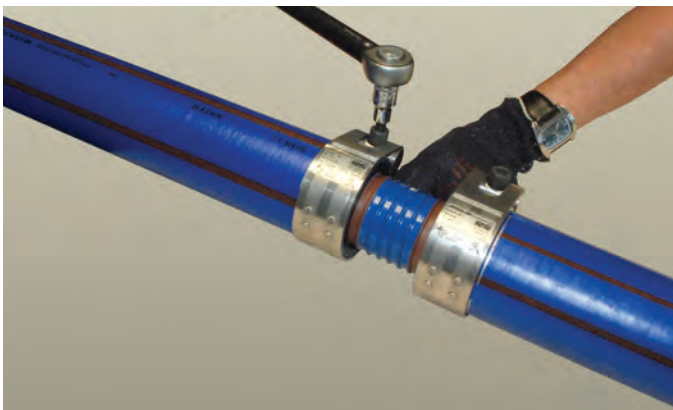
5. Push the repair coupler inserts into the repair piece and position into the cut section.



6. Slide the repair coupler inserts into the cut pipe ends, so all of the depth marks are visible.



7. Tighten the hex socket head bolts until the set torque is achieved in each bolt. The pipe will relax after the set torque is achieved, so after a minute or more, retighten the bolts to the set torque. Repeat until less than a quarter turn is needed to reach the set torque.*



Nominal Pipe Size (mm)	Insertion depth (mm)	Bolt Hexagon (mm)	Torque Nm
63	45	10	50
90	45	10	60
110	52.5	10	60
125	52.5	10	60
160	52.5	14	160
180	52.5	14	160

* Repeated tightening of the bolts up to the set torque is necessary and important to compensate for relaxation in the polyethylene. It's normal for the re-torquing process to be conducted three to four times over the course of 5 minutes, but a longer allowance for relaxation between re-torquing may be needed in extremely cold weather where 10 to 15 minutes may be needed for the complete installation process.

SLIMFLANGE®

SlimFlange is a unique steel reinforced flange adaptor that allows bore-size-for-size jointing of a Protecta-Line pipe to a metal flange.

Compact, lightweight yet strong, it eliminates the usual need to upsize valves or other metal fittings, benefitting installers with the faster more effective installations.

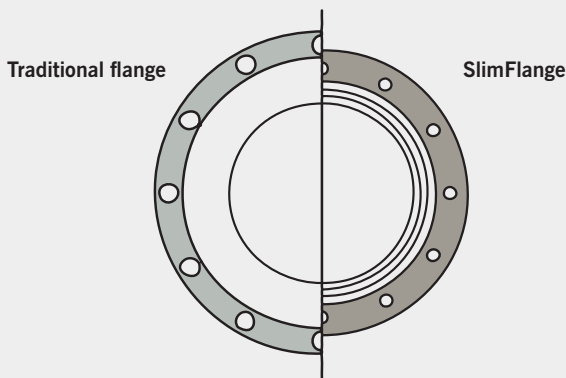
FEATURES

- No need for upsizing metal fittings, or for PE bore reduction
- Fully end load bearing fitting
- Reduced size and weight
- Loose backing ring for flexible installation

BENEFITS

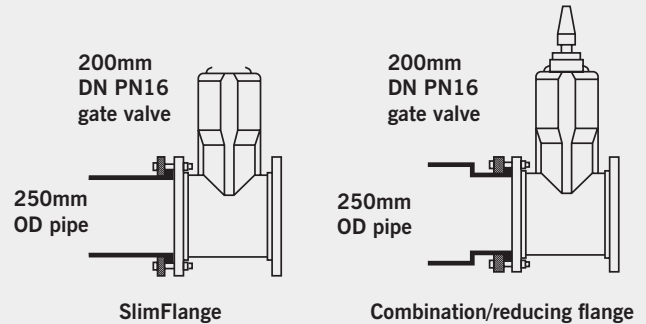
- Cost savings from bore size-for-size connections
- Reduced installation costs
- Smooth bore to maintain full flow capacity
- Improved sealing performance against leaks

UNIQUE SOLUTION



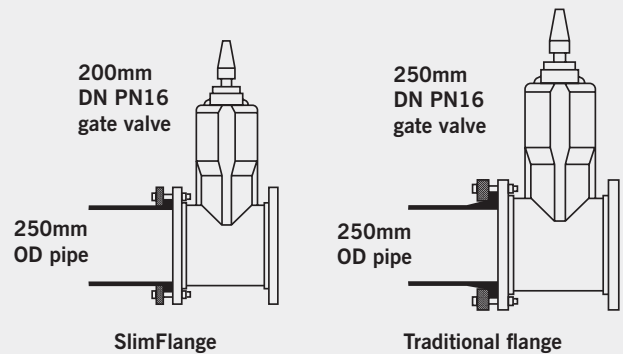
The SlimFlange has the same size bore as a traditional PE Flange, but has a smaller backing ring bolt circle diameter.

NO SAFETY COMPROMISE

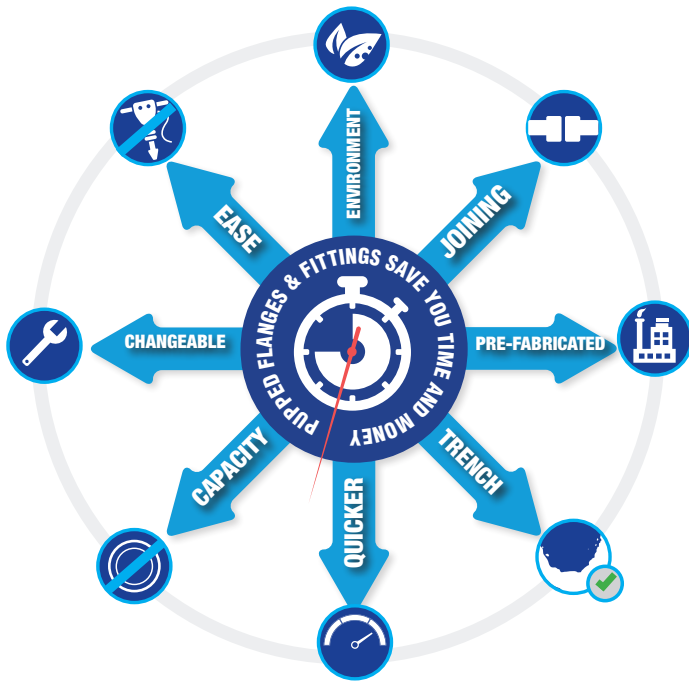


SlimFlange does not lead to loss of strength, unlike PE 'combination' flanges. Size-for-size capability is not achieved by temporary PE bore reduction, which weakens the fitting and increases the potential for blockage.

NO UPSIZING



A 250mm SlimFlange connects 250mm OD (outside diameter) Protecta-Line pipe directly to a 200mm DN PN16 valve. A traditional 250mm Protecta-Line flange requires a 250mm ID (internal diameter) PN16 valve for bolting to match.



CONNECTING PROTECTA-LINE TO OTHER MATERIALS

When joining Protecta-Line to other materials it is important to remember Protecta-Line works on an outside diameter and the wall thickness will vary depending on the SDR.

Ensure the nominal bores are taken into consideration when sizing flange adaptors to make a connection.

Since Protecta-Line are end-load bearing, precautions must be taken when a connection is made to pipe of another material.

To prevent pull-out of any non end-load bearing joints, the transition may need to be externally harnessed or anchored/ thrust blocked.

BOLTING

For Protecta-Line diameters above 180mm, it is recommended that two operators work simultaneously on diametrically opposite bolts where possible.

To guarantee subsequent leak tightness, final torquing should be repeated after the assembly has been allowed to relax for an hour or so.

Evenness of tightening is as important as final torque values – see table to the right.

This table is suitable for SDR 11 & SDR 17 pipe made from PE100 or PE80.

Typical bolting torques for flanges (Protecta-Line to metal flanges)

Standard Flanges				SlimFlanges		
Nominal Protecta-Line size (mm)	Nominal Iron size (mm)	Bolting	Torque (Nm) ±10%	Nominal Iron size (mm)	Bolting	Torque (Nm) ±10%
63	50	M16x4	35	-	-	-
90	80	M16x8	35	-	-	-
125	100	M16x8	35	-	-	-
180	150	M20x8	60	-	-	-
200	200	M20x12	80	-	-	-
225	200	M20x12	80	-	-	-
250	250	M24x12	100	200	M20x12	60
280	250	M24x12	100	-	-	-
315	300	M24x12	120	250	*M20x12	70
355	350	M24x16	150	300	M24x12	120
400	400	M27x16	200	350	M24x16	150
450	450	M27x20	250	400	M27x16	200
500	500	M30x20	300	450	M27x20	250
560	600	M33x20	350	500	M30x20	300
630	600	M33x20	400	500	M30x20	300

*Non standard bolt size

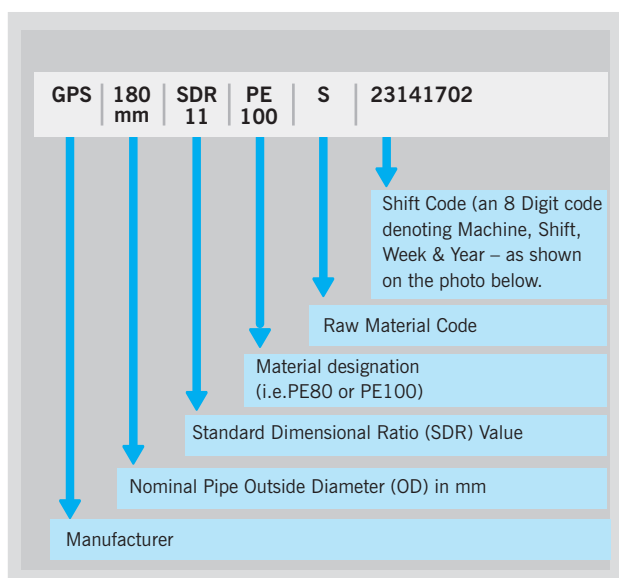
Product range OVERVIEW

PRODUCT MARKING

All Pipes and fittings should be used in order of delivery and to assist stock location.

GPS PIPE MARKING

As a minimum requirement, the following Information is marked indelibly and linearly at intervals along the pipe:



Shift code for a Protecta-Line Pipe

GPS pipe is also marked with the name of any industry standard to which it conforms.

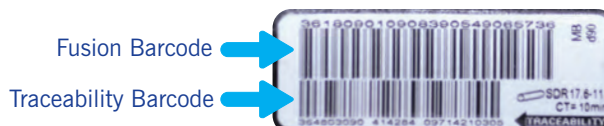
Gas pipe also carries reference to the bar rating of the pipe (usually after the OD) and is marked at three separate intervals within the coding with the word Gas for high visibility and identification purposes.








ELECTROFUSION FITTING MARKINGS

Where applicable, most fittings incorporate the following information on the outer surface, either moulded into the product or on the barcode label:

- **Material Designation – PE100 or PE80**
- **Standard Dimensional Ratio (SDR) of Fitting**
- **SDR Fusion Range (maximum/minimum)**
- **Nominal Size (mm)**
- **Fusion Time (seconds)**
- **Cooling Time (minutes)**
- **Name and Trademark**

Electrofusion fittings product labels also incorporate traceability barcodes to trace the relevant production records. These codes can be read by any ECU with a traceability option.

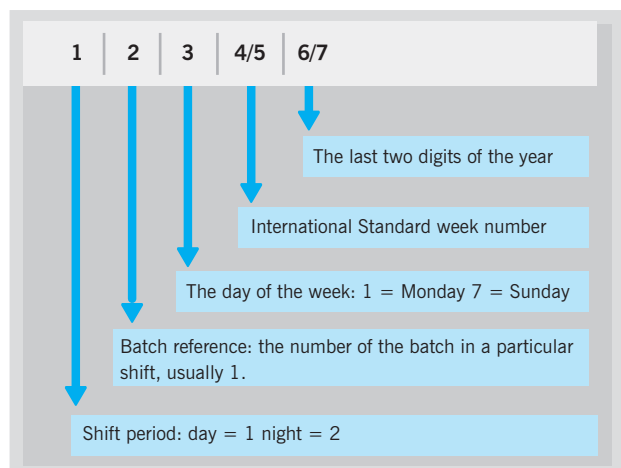


Product Range Overview	Description	Standards/ Approvals	Material	Size Range	Page
PROTECTA-LINE PIPE 	PE barrier pipe for water distribution through contaminated land	Regulation 31/27/30 WRAS WIS 4-32-19 BS EN 12201 (core pipes)	Polyethylene Aluminium	25mm – 630mm (SDR11) 90mm – 630mm (SDR17)	58
PROTECTA-LINE 3^C & 3^{CTH} COILS 	Clean, capped and coiled PE barrier pipe for installation without pre-chlorination	Regulation 31/27/30 WRAS WIS 4-32-19 BS EN 12201 (core pipes)	Polyethylene Aluminium	90mm – 180mm	64
MECHANICAL COMPRESSION FITTINGS 	Mechanical compression fittings for service connections	WRAS WIS 4-32-19	Acetal	25mm – 63mm	68
FERRULE OFF-TAKES 	Saddle ferrules for live off-takes without any flow restrictions	WRAS WIS 4-32-19 WIS 4-22-02	Gunmetal Acetal Stainless steel	25mm & 32mm (for 63mm – 355mm mains) 63mm (for 90mm to 355mm mains)	70
MECHANICAL FITTINGS 	Mechanical compression fittings for mechanical jointing without the need for pipe preparation or welding	WRAS WIS 4-24-01 Type 1 WIS 4-32-19	Stainless steel Rilsan coated steel	63mm – 180mm	74
ELECTROFUSION FITTINGS 	Electrofusion fittings with a bar coding system or rapid and convenient jointing	WRAS WIS 4-32-19	Polyethylene	90mm – 630mm	80
PUPPED FITTINGS 	Extended spigots suitable for electrofusion and butt-fusion jointing	WRAS WIS 4-32-19	Polyethylene	90mm – 630mm	84

OTHER FITTING MARKINGS

All GPS fittings manufactured within a specific batch are marked with an identification number, unique to that batch.

This unique number consists of either 5 or 7 digits, which can be interpreted as follows on the table below:



DID YOU KNOW?



Only by adopting fully Kitemarked products are you able to demonstrate full system integrity.

PROTECTA-LINE PIPE

PIPE FOR CONTAMINATED LAND



BENEFITS

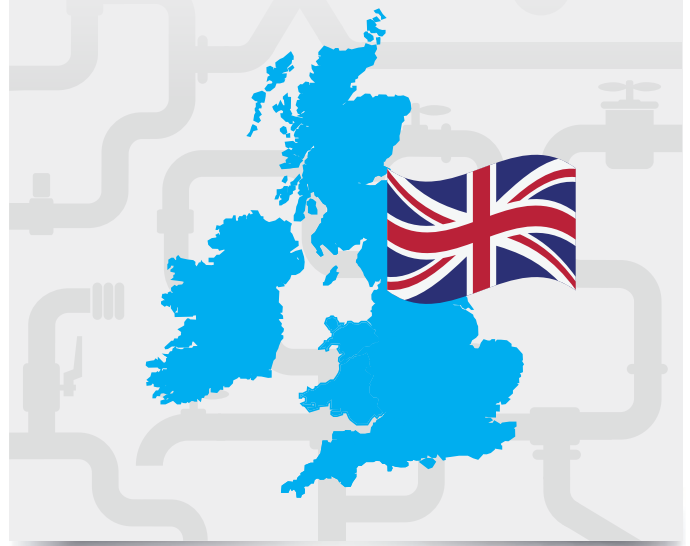
- Proven protection against all recognised brownfield contaminants
- All the installation advantages of polyethylene
- No need for expensive soil sampling
- Lower cost of installation than metallic pipe and is significantly less disruptive
- Excellent lifetime cost savings

FEATURES

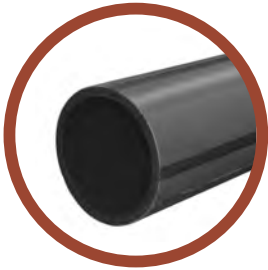
- Black PE100 (Excel) or blue PE80 (MDPE) core pipe with aluminium barrier layer and protective outer PE skin
- Suitable for corrosive conditions
- Can be used for trenchless installations
- Brown stripes provide easy identification and comply with NJUG regulations

DID YOU KNOW?

GPS provides the most comprehensive range of kitemarked barrier pipe systems in the UK to insure full system integrity.

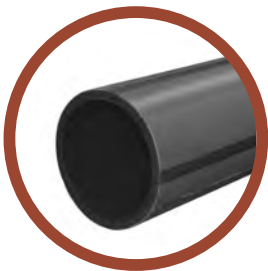


STRAIGHT LENGTHS



SDR 11				
Size /OD (mm)	PE Material	Pressure Rating (bar)	6M product code	12M product code
63	PE100	16	44 512 311	-
90	PE100	16	44 512 313	44 527 313
110	PE100	16	44 512 314	44 527 314
125	PE100	16	44 512 315	44 652 315
160	PE100	16	44 512 317	44 652 317
180	PE100	16	44 512 318	44 652 318
225	PE100	16	44 512 320	44 652 320
250	PE100	16	44 512 321	44 652 321
280	PE100	16	44 512 322	44 652 322
315	PE100	16	44 512 323	44 652 323
355	PE100	16	44 512 324	44 527 324
400	PE100	16	44 512 325	44 527 325
450	PE100	16	44 512 326	44 527 326
500	PE100	16	44 512 327	44 527 327
560	PE100	16	44 512 328	44 527 328
630	PE100	16	44 512 329	44 527 329

STRAIGHT LENGTHS



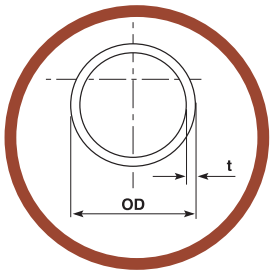
SDR 17				
Size /OD (mm)	PE Material	Pressure Rating (bar)	6M product code	12M product code
90	PE100	10	44 653 313	44 654 313
110	PE100	10	44 653 314	44 654 314
125	PE100	10	44 653 315	44 654 315
160	PE100	10	44 653 317	44 654 317
180	PE100	10	44 653 318	44 654 318
225	PE100	10	44 653 320	44 654 320
250	PE100	10	44 653 321	44 654 321
280	PE100	10	44 653 322	44 654 322
315	PE100	10	44 653 323	44 654 323
355	PE100	10	44 653 324	44 654 324
400	PE100	10	44 506 325	44 507 325
450	PE100	10	44 506 326	44 507 326
500	PE100	10	44 506 327	44 507 327
560	PE100	10	44 506 328	44 507 328
630	PE100	10	44 506 329	44 507 329

COILS



Size /OD (mm)	PE Material	SDR	Pressure Rating (bar)	25M Code	50M Code	100M Code
25	PE80	11	12.5	44 658 307	44 659 307	-
32	PE80	11	12.5	44 658 308	44 659 308	-
63	PE100	11	16	44 658 311	44 659 311	44 660 311
90	PE100	11	16	-	44 659 313	44 660 313
		17	10	-	44 655 313	44 656 313
110	PE100	11	16	-	44 659 314	44 660 314
		17	10	-	44 655 314	44 656 314
125	PE100	11	16	-	44 659 315	44 660 315
		17	10	-	44 655 315	44 656 315
160	PE100	11	16	-	44 659 317	44 660 317
		17	10	-	44 655 317	44 656 317
180	PE100	11	16	-	44 659 318	44 660 318
		17	10	-	44 655 318	44 656 318

PIPE DIMENSIONS

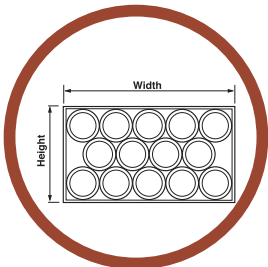


Size* /OD (mm)	SDR	Min OD (mm)	Max OD (mm)	Mean Bore (mm)	Min Wall Thickness (mm)	Min Wall Thickness (mm)	Approx Weight (kg/m)
25	11	26.2	27.4	20.0	3.0	3.7	0.3
32	11	33.3	34.5	26.0	3.7	4.4	0.4
63	11	64.3	65.6	50.9	6.5	7.6	1.3
90	11	92.2	93.5	72.9	9.3	10.7	2.6
	17	92.2	93.5	78.8	6.5	7.5	1.9
110	11	112.2	113.5	89.2	11.1	12.7	3.7
	17	112.2	113.5	96.3	7.7	8.8	2.7
125	11	127.2	128.5	101.2	12.5	14.2	4.7
	17	127.2	128.5	109.6	8.5	9.8	3.4
160	11	163.2	165.1	130.4	15.8	17.9	7.6
	17	163.2	165.1	141.1	10.7	12.4	5.4
180	11	183.3	185.4	146.8	17.6	20.0	9.5
	17	183.3	185.4	158.8	11.9	13.7	6.8
225	11	227.3	229.5	182.5	21.7	24.4	14.5
	17	227.3	229.5	197.4	14.6	16.6	10.3
250	11	252.3	254.9	203.0	23.9	26.8	17.7
	17	252.3	254.9	219.6	16.0	18.3	12.4
280	11	282.3	285.1	227.4	26.6	29.8	22.0
	17	282.3	285.1	245.9	17.8	20.1	15.4
315	11	317.3	320.2	255.7	29.8	33.3	27.6
	17	317.3	320.2	276.6	19.9	22.4	19.3
355	11	357.3	360.6	288.3	33.4	37.3	34.8
	17	357.3	360.6	311.6	22.3	25.1	24.3
400	11	402.3	405.8	324.8	37.5	41.8	43.9
	17	402.3	405.8	351.3	24.9	27.9	30.4
450	11	452.3	456.1	365.4	42.1	46.8	55.3
	17	452.3	456.1	395.2	27.9	31.2	38.2
500	11	502.3	506.4	406.0	46.6	51.8	67.9
	17	502.3	506.4	439.0	30.9	34.5	46.9
560	11	562.3	566.8	454.9	52.0	57.7	84.7
	17	562.3	566.8	491.8	34.4	38.4	58.4
630	11	632.3	637.2	511.6	58.4	64.8	106.9
	17	632.3	637.2	553.2	38.6	43.0	73.6

* The size is the nominal core pipe outside diameter.

Other diameters, SDRs and lengths can be made to order subject to a minimum order value.

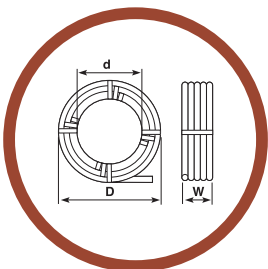
LENGTHS & BUNDLES



Size /OD (mm)	Length (m)	No/Bundle	Width (mm)	Height (mm)	Weight SDR11 (Kg)	Weight SDR17 (Kg)
63	6	210	1238	750	1616	-
90	6/12	100	1188	795	1558/3116	1139/2278
110	6/12	67	1238	795	1488/2979	1088/2179
125	6/12	50	1238	750	1427/2839	1032/2054
160	6/12	33	1238	795	1455/2895	1040/2069
180	6/12	22	1188	730	1226/2553	870/1812
225	6/12	5	1125	335	436/872	310/620
250	6/12	5	1000	360	429/858	301/602
280	6/12	4	1120	390	529/1058	369/738
315	6/12	3	945	425	501/1002	350/700
355	6/12	3	1065	465	631/1261	440/880
400	6/12	3	1200	510	793/1586	550/1103
450	6/12	3	1350	560	998/1996	691/1385
500	6/12	2	1000	610	818/1635	566/1137
560	6/12	2	1120	670	1019/2038	704/1412
630	6/12	2	1260	740	1286/2571	886/1777

Due to continuous development, bundle sizes and weights may vary from that shown.

COIL DIMENSIONS



Size /OD (mm)	Coil Length (m)	d (mm)	D (mm)	W (mm)	Weight SDR11 (Kg)	Weight SDR17 (Kg)
25	25	1000	1200	200	7.5	-
	50				15	-
32	25	1000	1200	200	10	-
	50				20	-
63	25	1800	2200	200	32	-
	50		2300	200	63	-
	100		2400	300	126	-
90	50	2500	3100	300	130	95
	100		3300	400	260	190
110	50	2500	2900	500	185	135
	100		3200	600	370	270
125	50	2500	3000	500	235	170
	100		3200	700	470	340
160	50	3000	3900	500	380	270
	100		3900	700	760	540
180	50	3000	4000	600	475	340
	100		4000	700	950	680

Non standard diameters and lengths are usually available to order subject to a minimum order value.

PROTECTA-LINE 3^C & 3^{CTH} COILS

CLEAN, CAPPED COILS FOR INSTALLATION WITHOUT PRE-CHLORINATION



BENEFITS

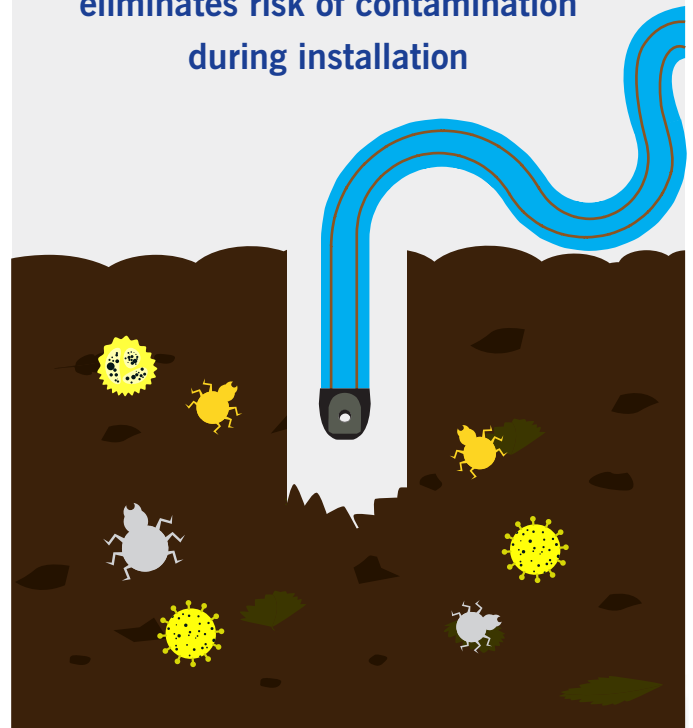
- Immediate installation from stock, without lengthy pre-chlorination
- Less disruption to water supply
- Higher installation productivity compared to unsealed coils
- Post-installation sterilisation for 30 minute contact only – DWI recognised methodology.
- Significant installation cost savings
- Ready to use at the point of delivery
- Fewer visits to site needed – reduced traffic disruption

FEATURES

- Protecta-Line PE100 pipe and PE80 pipe coils with factory-sealed pipe ends
- Factory-clean pipe bore when delivered to site
- Regulation 31 approved for installation without pre-chlorination
- 3^C has factory heat sealed protective caps on both ends. 3^{CTH} has a factory heat sealed protective cap on one end and an integral Towing Head on the other.
- All the advantages of conventional PE and Protecta-Line pipes

DID YOU KNOW?

Protecta-line 3^C with towing head eliminates risk of contamination during installation



3^C (CLEAN, CAPPED, COILED) COILS



SDR 11					
Size /OD (mm)	PE Material	Pressure Rating (bar)	50M Code	75M Code	100M Code
63	PE100	16	44 845 311	-	44 860 311
90	PE100	16	44 845 313	44 862 313	44 860 313
110	PE100	16	44 845 314	44 862 314	44 860 314
125	PE100	16	44 845 315	44 862 315	44 860 315
160	PE100	16	44 845 317	44 862 317	44 860 317
180	PE100	16	44 845 318	44 862 318	44 860 318

Protecta-Line 3^C is a factory clean, capped and coiled pipe solution to negate the need for the lengthy pre-chlorination process prior to installation of potable water pipes. The DWI recognised methodology allows post-installation sterilisation for 30 minutes contact only.

3^{CTH} (CLEAN, CAPPED, COILED WITH TOWING HEAD) COILS



SDR 11					
Size /OD (mm)	PE Material	Pressure Rating (bar)	50M Code	75M Code	100M Code
63	PE100	16	44 850 311	-	44 852 311
90	PE100	16	44 850 313	44 851 313	44 852 313
110	PE100	16	44 850 314	44 851 314	44 852 314
125	PE100	16	44 850 315	44 851 315	44 852 315
160	PE100	16	44 850 317	44 851 317	44 852 317
180	PE100	16	44 850 318	44 851 318	44 852 318

Protecta-Line 3^{CTH} is supplied with a factory fitted towing head, ready to be attached to a towing shackle. It is a factory clean, capped and coiled pipe solution to negate the need for the lengthy pre-chlorination process prior to installation of potable water pipes. The DWI recognised methodology allows post-installation sterilization for 30 minutes contact only.

PROTECTA-LINE 3^C & 3^{CTH} COILS

3^C (CLEAN, CAPPED, COILED) COILS



SDR 17

Size /OD (mm)	PE Material	Pressure Rating (bar)	50M Code	75M Code	100M Code
90	PE100	10	44 846 313	44 847 313	44 849 313
110	PE100	10	44 846 314	44 847 314	44 849 314
125	PE100	10	44 846 315	44 847 315	44 849 315
160	PE100	10	44 846 317	44 847 317	44 849 317
180	PE100	10	44 846 318	44 847 318	44 849 318

Protecta-Line 3^C is a factory clean, capped and coiled pipe solution to negate the need for the lengthy pre-chlorination process prior to installation of potable water pipes. The DWI recognised methodology allows post-installation sterilisation for 30 minutes contact only.

3^{CTH} (CLEAN, CAPPED, COILED WITH TOWING HEAD) COILS

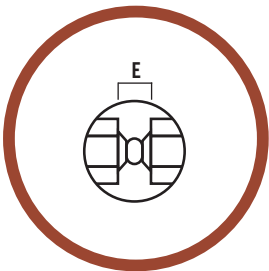
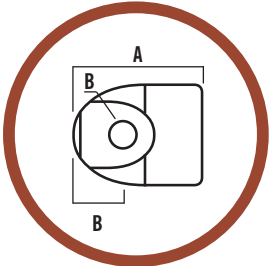


SDR 17

Size /OD (mm)	PE Material	Pressure Rating (bar)	50M Code	75M Code	100M Code
90	PE100	10	44 853 313	44 854 313	44 855 313
110	PE100	10	44 853 314	44 854 314	44 855 314
125	PE100	10	44 853 315	44 854 315	44 855 315
160	PE100	10	44 853 317	44 854 317	44 855 317
180	PE100	10	44 853 318	44 854 318	44 855 318

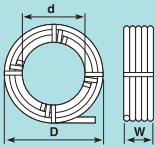
Protecta-Line 3^{CTH} is supplied with a factory fitted towing head, ready to be attached to a towing shackle. It is a factory clean, capped and coiled pipe solution to negate the need for the lengthy pre-chlorination process prior to installation of potable water pipes. The DWI recognised methodology allows post-installation sterilization for 30 minutes contact only.

TOWING HEAD DIMENSIONS



Size * (mm)	A (mm)	B (mm)	C (mm)	E (mm)	Max Towing Load (tonnes) SDR11	Max Towing Load (tonnes) SDR17	Shackle Size (tonnes)
63	123	25	31	20	0.8	-	2.0
90	123	27	44	28	2.1	1.4	4.8
110	131	30	51	32	3.1	1.6	6.5
125	149	33	62	38	4.1	2.7	8.5
160	166.5	40	72.5	46	6.8	4.5	12
180	171.5	40	72.5	46	8.6	5.7	12

* The nominal size is the nominal core pipe outside diameter.



FOR COIL DIMENSIONS
See pages 61

MECHANICAL COMPRESSION FITTINGS

FOR 25MM TO 63MM PROTECTA-LINE



BENEFITS

- Proven barrier protection against contamination
- No contact between the pipe's protective aluminium layer and drinking water
- No risk of joint corrosion
- Easy and rapid all weather installation

FEATURES

- Acetal fittings for jointing Protecta-Line service pipes or connecting to standard PE pipe
- Feature a unique pipe insert that seals securely against the pipe bore
- WRAS approved
- Meet the requirements of WIS-4-32-19
- No pipe preparation, wrapping or specialist equipment required

DID YOU KNOW?

Mechanical Compression Fittings compatible with Protecta-Line have a green insert



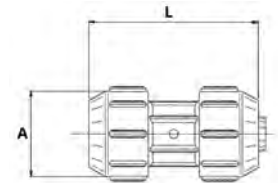
Only Mechanical Compression Fittings with green insert supplied by GPS are compatible with Protecta-Line.

It is illegal to install fittings non-compliant with the Water Fittings Regulations (or Byelaws in Scotland)

**PE TO PE
COUPLERS**



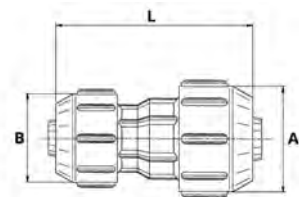
Size (mm)	Product Code	A (mm)	L (mm)	Weight (kg)
25 x 25	44 100 307	51	93	0.1
32 x 32	44 100 308	60	99	0.2
63 x 63	44 100 311	105	155	0.7



**PE TO PE
REDUCING
COUPLERS**



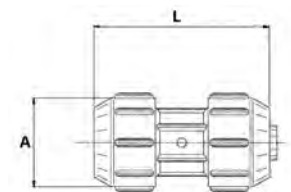
Size (mm)	Product Code	A (mm)	B (mm)	L (mm)	Weight (kg)
32 x 25	44 114 409	60	51	100	0.2
63 x 25	44 114 412	105	81	155	0.6
63 x 32	44 114 415	105	105	155	0.8



**PE TO COPPER
COUPLERS**



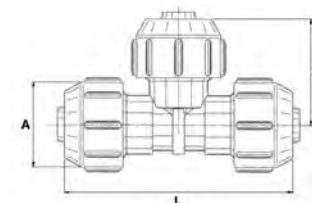
Size (mm)	Product Code	A (mm)	L (mm)	Weight (kg)
25 x 15	44 996 005	51	93	0.1
25 x 22	44 996 006	51	93	0.1
32 x 28	44 996 007	60	93	0.2



EQUAL TEES



Size (mm)	Product Code	A (mm)	C (mm)	L (mm)	Weight (kg)
25 x 25	44 122 307	51	64	134	0.2
32 x 32	44 122 308	60	68	146	0.3
63 x 63	44 122 311	105	100	216	1.3

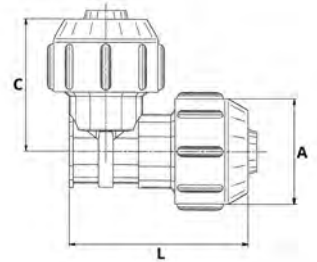


MECHANICAL COMPRESSION FITTINGS

90° ELBOWS



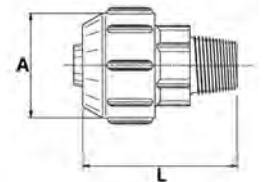
Size (mm)	Product Code	A (mm)	C (mm)	L (mm)	Weight (kg)
25	44 115 307	51	68	93	0.1
32	44 115 308	60	71	97	0.2
63	44 115 311	105	105	158	0.9



END CONNECTORS – PE X MALE IRON BSP TAPERED



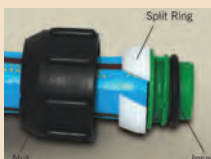
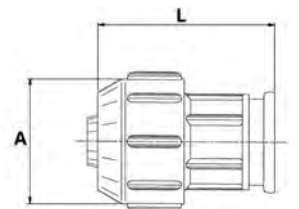
Size (mm x inch)	Product Code	A (mm)	L (mm)	Weight (kg)
25 x 3/4	44 151 608	51	64	0.1
32 x 3/4	44 151 611	60	74	0.1
32 x 1	44 151 612	60	77	0.1
63 x 1 1/2	44 151 628	105	100	0.4
63 x 2	44 151 629	105	105	0.4



END CONNECTORS – PE X FEMALE IRON BSP TAPERED



Size (mm x inch)	Product Code	A (mm)	L (mm)	Weight (kg)
25 x 3/4	44 101 608	51	67	0.1
32 x 1	44 101 612	60	75	0.1
63 x 2	44 101 629	105	100	0.4

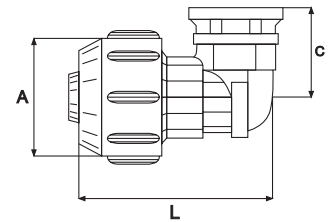


FOR INSTALLATION INSTRUCTIONS
See pages 42

**90° ELBOWS –
PE X FEMALE
IRON BSP TAPERED**



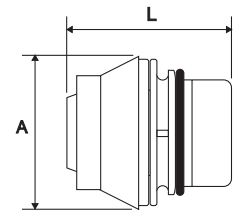
Size (mm x inch)	Product Code	A (mm)	C (mm)	L (mm)	Weight (kg)
25 x 3/4	44 396 608	51	35	73	0.1
32 x 1	44 396 612	60	39	80	0.2
63 x 2	44 396 629	105	62	145	0.6



**REDUCING SETS –
To allow easy
Protecta-Line
diameter changes**



Size (mm x inch)	Product Code	A (mm)	L (mm)	Weight (kg)
32 x 25	44 105 409	44	42	0.1
63 x 32	44 105 415	80	51	0.2

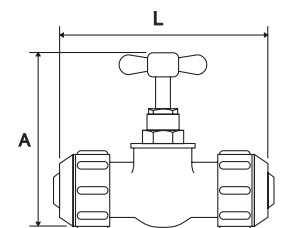


**STOP COCKS –
BS 5433 TYPE**



Size (mm x inch)	Product Code	A (mm)	L (mm)	Weight (kg)
25*	44 142 307	140	135	0.9
32**	44 142 308	165	170	1.7

* Includes 22mm copper Type A insert
** Includes 28mm copper Type A insert



Only Protecta-Line fittings shall be used with Protecta-Line pipe. The use of alternative fittings will have the following effects on your Protecta-Line system:

- Invalidation of WRAS approval and manufacturer's system performance warranty.
- Compromised permeation resistance (causing non-compliance with WIS 4-32-19 and possible risks to health).
- Danger of pipe-layer delamination, compromising system performance integrity and risking pipe bursts.
- It is illegal to install fittings non-compliant with the Water Fittings Regulations (or Byelaws in Scotland).



FERRULE OFF-TAKES

FOR 63MM TO 355MM PROTECTA-LINE



BENEFITS

- No disruption to water supply
- Secure isolation of drinking water from ground contaminants
- Simple, all weather installation with no wrapping or pipe preparation required
- Excellent headloss and flow characteristics
- Proven mechanical compression connections.
- Innovative self-locking thimble design

FEATURES

- Enable live off-takes from Protecta-Line mains without any flow restrictions
- No contact between the pipe's aluminium barrier layer and the drinking water supply
- Self-locking thimble design to prevent delamination
- WRAS approved and Kitemarked to WIS 4-32-19.

DID YOU KNOW?

GPS Ferrule off-takes specifically designed for Protecta-Line eliminate contaminant ingress and delamination

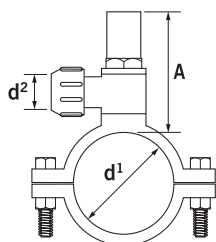


It is illegal to install fittings non-compliant with the Water Fittings Regulations (or Byelaws in Scotland)

**25MM AND 32MM
SELF-TAPPING
FERRULE OFF-TAKES**



(for 63mm to 355m
Protecta-Line mains)



25MM

Size d ¹ x d ² (mm)	Product Code	A (mm)	Weight (kg)	Torque Wrench (mm)	Square Key (mm)
63 x 25	44 763 412	95	0.9	13	8
90-125 x 25	44 763 393	95	1.1	13	8
160-180 x 25	44 763 397	95	1.1	13	8
225 x 25	44 762 400	95	1.9	19	8
250 x 25	44 762 401	95	2.3	19	8
280 x 25	44 762 402	95	2.5	19	8
315 x 25	44 762 403	95	3.2	19	8
355 x 25	44 762 404	95	3.3	19	8

Torque wrench and square key are not supplied with the product

32MM

Size d ¹ x d ² (mm)	Product Code	A (mm)	Weight (kg)	Torque Wrench (mm)	Square Key (mm)
63 x 32	44 763 415	112	1.2	13	8
90-125 x 32	44 763 417	112	1.3	13	8
160-180 x 32	44 763 421	112	1.4	13	8
225 x 32	44 762 424	100	2.1	19	11
250 x 32	44 762 425	100	2.5	19	11
280 x 32	44 762 426	100	2.7	19	11
315 x 32	44 762 427	100	3.4	19	11
355 x 32	44 762 428	100	3.5	19	11

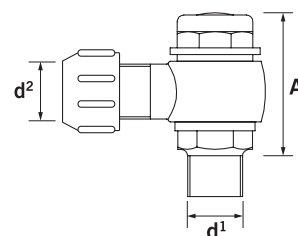
Torque wrench and square key are not supplied with the product

**DUCTILE IRON
FERRULE**



Size d ¹ x d ² (mm x inches)	Product Code	A (mm)	Weight (kg)
25 x 3/4 MI	44 762 407	60	0.5

For installation of Protecta-Line Service Off-Take onto existing ductile iron main



FOR INSTALLATION INSTRUCTIONS
See page 46

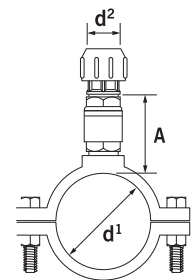
63MM OFF-TAKES



(for 90mm to 355mm Protecta-Line mains)

Size d ¹ x d ² (mm)	Product Code	A (mm)	Weight (kg)
90 x 63	44 762 459	155	3.4
110 x 63	44 762 460	155	3.8
125 x 63	44 762 461	155	3.8
160 x 63	44 762 463	155	3.9
180 x 63	44 762 464	155	3.9
225 x 63	44 762 466	155	5.0
250 x 63	44 762 467	155	5.1
280 x 63	44 762 468	155	5.3
315 x 63	44 762 469	155	5.5
355 x 63	44 762 470	155	6.1

Assembly includes 1 x 63mm PE x Male Iron BSP Tapered End Connector.
Drill and liner tool heads are required to install this range.



DRILL AND LINER TOOL HEADS



(for use with 63mm Off-Takes)

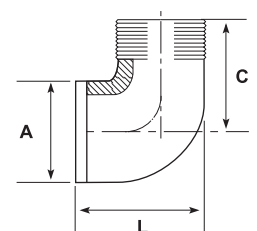
Size (mm) d ¹ x d ²	Product Code
Protecta-Line 2" Drill Head	44 794 003
Protecta-Line 2" Liner Head	44 794 004
Protecta-Line Drill/Liner Head O-Ring Kit	44 996 062

90° GUNMETAL ELBOWS



(optional for use with 63mm Off-Takes)

Size d ¹ x d ² (mm)	Product Code	A (mm)	C (mm)	L (mm)	Weight (kg)
2" MI x 2" FI	44 996 050	72	70	90	0.9



→ Pembroke Refinery

GPS PE Pipes' Protecta-Line barrier pipe system replaced existing metallic pipes, as part of a potable water network renewal programme at the Pembroke Refinery.

As with all industrial sites, where chemicals are stored or processed, Valero's Pembroke Refinery faced the risk of soil contamination, which could potentially lead to health and safety implications for the supply of safe drinking water to the facility.

To ensure it continued to provide a safe and reliable water distribution system, the refinery implemented a water network renewal programme and selected Protecta-Line barrier pipe to replace existing metallic pipes throughout the facility.

The site was commissioned in the 1960s and many of the original metallic pipes had deteriorated and become prone to leaks and bursts. The project team carried out a survey of each pipeline section separately to identify where upgrading was required. Bypasses and temporary connections were put in place for most sections of pipe identified for replacement, enabling the new Protecta-Line pipe infrastructure to replace the old sections of pipe in the same configuration.

In some areas of the site, putting a bypass in place was simply not viable, therefore, the project team opted to slipline some of the existing metallic pipes with Protecta-Line pipe to provide an efficient and cost-effective solution that minimised operational disruption. On these sections of the pipe network, 110mm Protecta-Line pipe was inserted into the existing, corroded six inch carbon steel pipe using a cable to pull the new pipe into the old pipe and manoeuvre it into position.

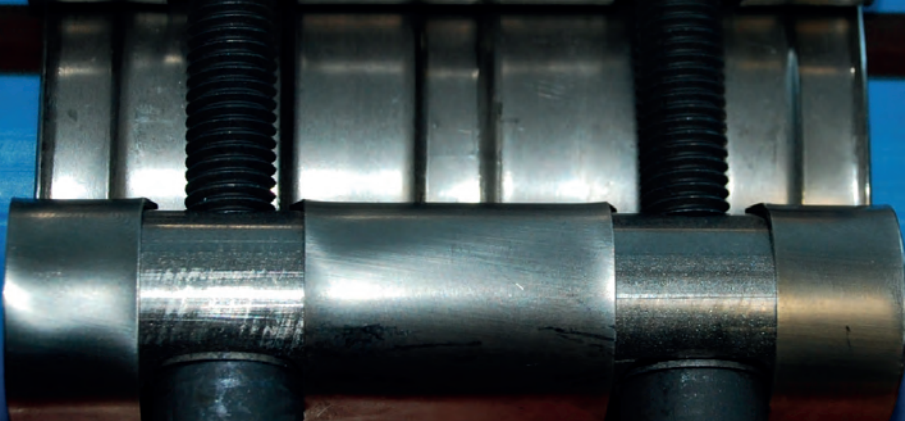
A range of Protecta-Line fluid compression fittings were also installed to ensure the integrity of the contamination barrier, without the need for any special procedures, including couplers, elbows, tees and stub flanges. Protecta-Line stop cocks and self-tapping ferrule off-takes were also used, which enabled live off takes of Protecta-Line service connections without any flow restrictions.

Alongside the need to renew the infrastructure, there was a clear focus on upgrading the pipeline to ensure it met the current regulatory requirements; fully WRAS and Regulation 31 approved for supply of drinking water, Protecta-Line was the ideal solution.

To ensure it continued to provide a safe and reliable water distribution system, the refinery implemented a water network renewal programme and selected Protecta-Line barrier pipe to replace existing metallic pipes throughout the facility.

MECHANICAL FITTINGS

FOR 63MM TO 180MM PROTECTA-LINE



BENEFITS

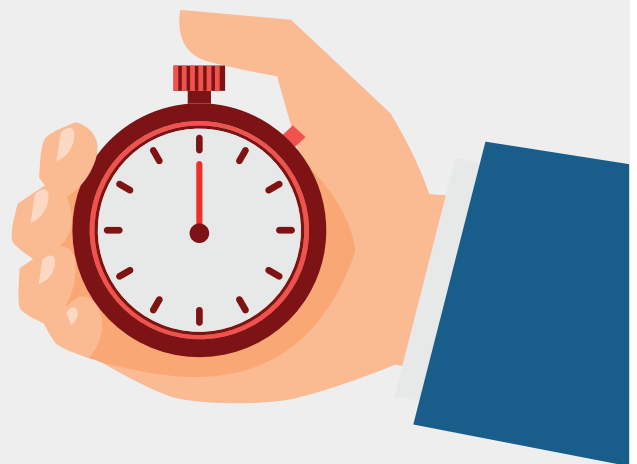
- Fast and easy all weather jointing by a single installer: no need for elastomeric seals, pipe end preparation or welding.
- Only a torque wrench with an Allen (hex) bit socket is required
- No need for specialist tooling (eg. hydraulic pump) or external power supply – reduced health & safety risk
- Can be installed in the tightest of spaces.

FEATURES

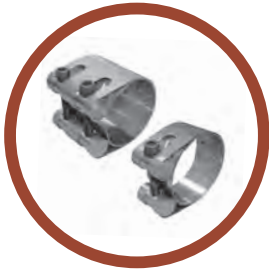
- Supplied ready to install, as a full set of Rilsan coated steel liner insert and corrosion resistant stainless steel outer shells
- The shell mechanically swages Protecta-Line pipe onto the insert liner grooves to give a fully end load bearing joint (WIS 4-24-01 Type 1)
- Lightweight and with a low profile
- Full barrier performance (WIS 4-32-19)

DID YOU KNOW?

**By using mechanical fittings,
upto 70% installation time
can be saved compared to
traditional methods**



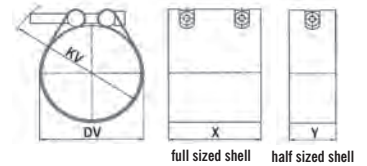
OUTER SHELLS



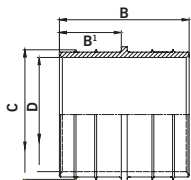
Size (mm)	DV (mm)	KV (mm)	X (mm)	Y (mm)	Hex Size (mm)	Bolts	Torque (NM)
63	67	95	95	48	10	M12	50
90	97	121	95	48	10	M12	60
110	117	140	110	55	10	M12	60
125	132	156	110	55	10 / 14*	M12 / M16*	60 / 120*
160	168	189	110	55	14	M16	150
180	188	217	110	55	14	M16	160

* Bolt M16 FOR SDR11

Protecta-Line Mechanical Fittings are supplied as a full set of liner insert and outer shell(s). Weights shown are for the complete product.



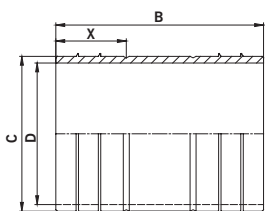
COUPLERS



Size (mm)	SDR	Product Code	B (mm)	B' (mm)	C (mm)	D (mm)	Weight (kg)
63	11	PM 110 311	95	45	50	41	1.6
	17	PM 100 313	95	45	71	62	2
90	11	PM 109 313	95	45	77	67	2.1
	17	PM 109 314	110	53	88	76	2.6
110	11	PM 100 314	110	53	95	82	2.7
	17	PM 109 315	110	53	100	87	3.1
125	11	PM 109 315	110	53	108	95	3.0
	17	PM 100 317	110	53	128	114	4.4
160	11	PM 109 317	110	53	139	125	4.3
	17	PM 100 318	110	53	144	127	4.8
180	11	PM 109 318	110	53	156	139	5.1

Supplied as a set with 1 x liner and 1 x full shell.

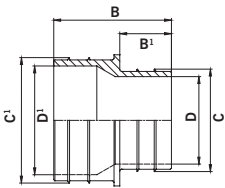
REPAIR COUPLERS



Size (mm)	SDR	Product Code	B (mm)	X (mm)	C (mm)	D (mm)	Weight (kg)
63	11	PM 246 311	195	48	50	40	1.9
90	11	PM 246 313	195	48	71	61	2.6
	17	PM 245 313	195	48	77	67	2.7
110	11	PM 246 314	210	55	88	75	3.0
	17	PM 245 314	210	55	95	82	3.1
125	11	PM 246 315	210	55	100	86	4.0
	17	PM 245 315	210	55	108	94	4.4
160	11	PM 246 317	210	55	128	114	5.8
	17	PM 245 317	210	55	139	125	6.1
180	11	PM 246 318	210	55	144	127	6.7
	17	PM 245 318	210	55	156	139	7.1

Supplied as a set with 1 x liner and 2 x half shells. Other repair liner lengths may be available on request.

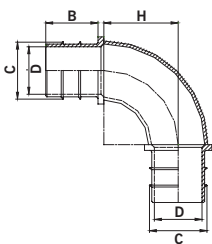
REDUCERS



Size (mm)	SDR	Product Code	B (mm)	B ¹ (mm)	C (mm)	C ¹ (mm)	D (mm)	D ¹ (mm)	Weight (kg)
90 x 63	11	PM 441 459	95	45	50	71	41	62	2.0
110 x 90	11	PM 441 483	103	53 / 46	71	88	62	76	2.5
	17	PM 440 483	103	45	77	95	67	82	2.6
125 x 110	11	PM 441 493	110	53	88	100	76	87	3.3
	17	PM 440 493	110	53	88	108	76	95	3.2
160 x 125	11	PM 441 504	110	53	100	128	87	114	4.8
	17	PM 440 504	110	53	108	139	95	125	5.8
180 x 125	17	PM 440 505	110	53	108	156	95	139	6.2

Consists of 1 x reducing liner and 2 x half sized shells.

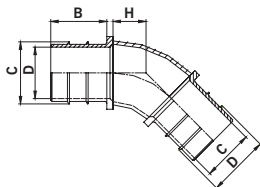
90° ELBOWS



Size (mm)	SDR	Product Code	B (mm)	C (mm)	D (mm)	H (mm)	Weight (kg)
63	11	PM 209 311	45	50	41	69	2.0
90	11	PM 210 313	45	71	62	97	3.2
	17	PM 208 313	45	77	67	100	3.3
110	11	PM 210 314	53	88	76	122	3.7
	17	PM 208 314	53	95	82	122	3.8
125	11	PM 210 315	53	100	87	138	6.1
	17	PM 208 315	53	108	95	147	6.0
160	11	PM 210 317	53	128	114	180	9.3
	17	PM 208 317	53	139	125	195	8.3
180	11	PM 210 318	53	144	127	200	10.6
	17	PM 208 318	53	156	139	226	10.8

Consists of 1 x elbow liner and 2 x half sized shells.

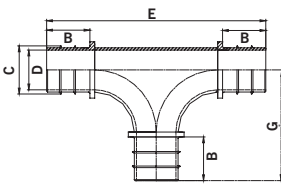
45° ELBOWS



Size (mm)	SDR	Product Code	B (mm)	C (mm)	D (mm)	H (mm)	Weight (kg)
63	11	PM 215 311	45	50	41	32	1.8
90	11	PM 216 313	45	71	62	43	2.3
	17	PM 214 313	45	77	67	44	2.4
110	11	PM 216 314	53	88	76	53	3.1
	17	PM 214 314	53	95	82	54	3.2
125	11	PM 216 315	53	100	87	60	4.9
	17	PM 214 315	53	108	95	64	4.9
160	11	PM 216 317	53	128	114	78	7.4
	17	PM 214 317	53	139	125	84	7.7
180	11	PM 216 318	53	144	127	89	8.1
	17	PM 214 318	53	156	139	94	8.2

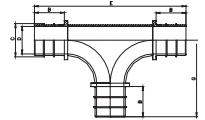
Consists of 1 x elbow liner and 2 x half sized shells.

EQUAL TEES

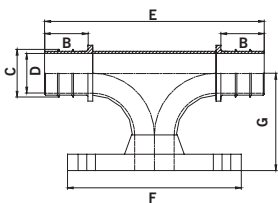


Size (mm)	SDR	Product Code	B (mm)	C (mm)	D (mm)	E (mm)	G (mm)	Weight (kg)
63	11	PM 221 311	45	50	41	214	62	3.0
90	11	PM 222 313	45	71	62	252	81	5.3
	17	PM 220 313	45	77	67	252	81	5.4
110	11	PM 222 314	53	88	76	287	91	7.4
	17	PM 220 314	53	95	82	287	91	7.5
125	11	PM 222 315	53	100	87	315	105	7.5
	17	PM 220 315	53	108	95	325	110	8.9
160	11	PM 222 317	53	128	114	355	125	11.6
	17	PM 220 317	53	139	125	363	129	16.1
180	11	PM 222 318	53	144	127	363	129	12.2
	17	PM 220 318	53	156	139	401	148	19

Consists of 1 x equal tee liner and 3 x half sized shells.



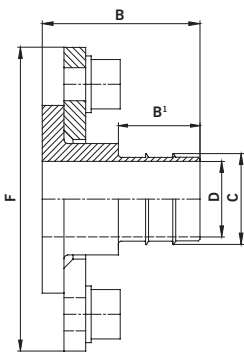
FLANGED BRANCH TEES



Size (mm)	SDR	Product Code	Bolts, Qty	Flange Torque (NM ± 10%)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)	Weight (kg)
90 x DN80 PN16	11	PM 351 313	8 x M16	70	45	71	62	252	200	176	8.9
	17	PM 363 313	8 x M16	70	45	77	67	252	200	176	9.0
110 x DN80 PN16	11	PM 351 314	8 x M16	70	53	88	76	287	200	136	9.5
	17	PM 363 314	8 x M16	70	53	95	82	287	200	136	9.6
125 x DN80 PN16	17	PM 363 315	8 x M16	70	53	108	95	287	200	136	12.0
160 x DN80 PN16	17	PM 363 317	8 x M16	70	53	139	125	287	200	161	16.2
180 x DN80 PN16	17	PM 363 318	8 x M16	70	53	156	139	325	200	174	19.6
90 x DN100 PN16	11	PM 352 313	8 x M16	80	45	71	62	252	220	178	9.1
	17	PM 364 313	8 x M16	80	45	77	67	252	220	178	9.2
110 x DN100 PN16	11	PM 352 314	8 x M16	80	53	88	76	287	220	188	9.7
	17	PM 364 314	8 x M16	80	53	95	82	287	220	188	9.8
125 x DN100 PN16	17	PM 364 315	8 x M16	80	53	108	95	325	220	157	12.2
160 x DN100 PN16	17	PM 364 317	8 x M16	80	53	139	125	325	220	168	16.9
180 x DN100 PN16	17	PM 364 318	8 x M16	80	53	156	139	325	220	182	20.0
160 x DN150 PN16	17	PM 365 317	8 x M20	120	53	139	125	363	285	229	20.4
180 x DN150 PN16	17	PM 365 318	8 x M20	120	53	156	139	401	285	198	23.4

Consists of 1 x flanged branch tee liner and 2 x half sized shells.
 The information given for bolting torque values are for metal to metal connections.
 Flange bolts and gaskets are not included.
 Drilled to BS EN 1092-1:2007 Table 13.

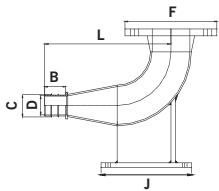
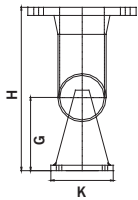
STUB FLANGE ADAPTORS



Size (mm)	SDR	Product Code	Bolts, Qty	Flange Torque (NM ± 10%)	B (mm)	C (mm)	D (mm)	B ¹ (mm)	F (mm)	Weight (kg)
63 x DN50 PN16	11	PM 227 311	M16 x 4	60	83	50	41	45	165	2.4
63 x DN80 PN16	11	PM 228 311	M16 x 8	60	85	50	41	45	202	4.1
90 x DN80 PN16	11	PM 228 313	M16 x 8	70	85	71	62	45	202	3.8
	17	PM 226 313	M16 x 8	70	85	77	67	45	200	3.9
110 x DN100 PN16	11	PM 228 314	M16 x 8	80	93	88	76	53	220	4.0
	17	PM 226 314	M16 x 8	80	93	95	82	53	218	5.0
125 x DN100 PN16	11	PM 228 315	M16 x 8	80	93	100	87	53	220	4.6
	17	PM 226 315	M16 x 8	80	93	108	95	53	220	4.2
160 x DN150 PN16	11	PM 228 317	M20 x 8	120	105	128	114	53	286	11.1
	17	PM 226 317	M20 x 8	120	105	139	125	53	286	10.2
180 x DN150 PN16	11	PM 228 318	M20 x 8	120	105	144	127	53	286	10.2
	17	PM 226 318	M20 x 8	120	105	156	139	53	286	9.0

Consists of 1 x stub flange liner, 1 x half sized shell and backing ring.
 The information given for bolting torque values are for metal to metal connections.
 Flange bolts and gaskets are not included.
 Drilled to BS EN 1092-1:2007 Table 13.

DUCK FOOT BENDS



Size (mm)	SDR	Product Code	Bolts, Qty	Flange Torque (NM± 10%)	B (mm)	C (mm)	D (mm)	F (mm)	G (mm)	H (mm)	J (mm)	K (mm)	L (mm)	Weight (kg)
63 x DN80 PN16	11	PM 384 459	M16 x 8	70	45	50	41	200	135	167	152	90	275	9.4
90 x DN80 PN16	11	PM 384 313	M16 x 8	70	45	71	62	200	135	167	152	115	235	10.0
	17	PM 385 313	M16 x 8	70	45	77	67	200	135	167	152	115	190	10.1
110 x DN80 PN16	11	PM 384 314	M16 x 8	70	53	88	76	200	135	167	152	130	231	10.7
	17	PM 385 314	M16 x 8	70	53	95	82	200	135	167	152	130	178	10.8
125 x DN80 PN16	17	PM 385 484	M16 x 8	70	53	108	95	200	135	167	152	150	243	11.1
160 x DN80 PN16	17	PM 385 486	M16 x 8	70	53	139	125	200	135	167	152	180	310	16.2
180 x DN80 PN16	17	PM 385 487	M16 x 8	70	53	156	139	200	135	167	152	200	347	19.2

Consists of 1 x flanged bend, 1 x half sized shell and gasket.
 The information given for bolting torque values are for metal to metal connections.
 Flange bolts and gaskets are not included.
 Drilled to BS EN 1092-1:2007 Table 13.



FOR INSTALLATION INSTRUCTIONS
 See pages 50

ELECTROFUSION FITTINGS

ELECTROFUSION FITTINGS FOR PROTECTA-LINE



BENEFITS

- Easy and rapid installation.
- Can be carried out in a trench, especially useful for repairs or tie-ins.
- Proven barrier protection against contamination.
- No risk of joint corrosion.
- No contact between the pipe's protective aluminium layer and drinking water.

FEATURES

- For use with pipe sizes in sizes 90mm to 630m.
- Each fitting has a barcode to allow Electrofusion Control Units (ECU's) to read information such as Product Type and Size, Fusion Time and Cooling Time to ensure quick and easy installation.
- Fittings can be jointed either in manual mode (where available) or by scanning their integral barcode label.
- Kitemarked to WIS 4-32-19

DID YOU KNOW?

100
YEARS

When electrofusion fittings are installed correctly, it creates a homogeneous Protecta-Line system which benefits from a life expectancy of 100 years.



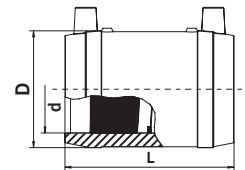
FOR INSTALLATION INSTRUCTIONS
See page 28

COUPLERS – Removable Centre Stop



Size (mm)	SDR	Black Code	D (mm)	L (mm)	Weight (kg)	Fusion Time* (Sec)	Cooling Time (mins)
90	11	PF 612 687	114	138	0.4	85	10
110	11	PF 612 688	137	159	0.7	120	10
125	11	PF 612 689	156	172	1.0	225	15
160	11	PF 612 691	199	190	1.8	360	20

* Manual fusion times are based on 39.5 volt fusion boxes. 4.0mm Terminal Pins.

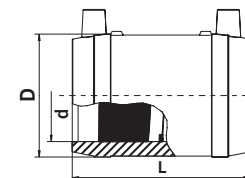


COUPLERS – Slideover



Size (mm)	SDR	Black Code	D (mm)	L (mm)	Weight (kg)	Fusion Time* (Sec)	Cooling Time (mins)
180	11	PF 612 672	220	210	2.1	480	20
225	11	PF 612 674	277	236	4.0	550	20
250	11	PF 612 675	315	246	5.8	620	30
280	11	PF 615 073	347	285	7.7	897	30
315	11	PF 612 670	390	300	10.0	1250	30
355	11	PF 615 074	445	300	16.7	1130	30

* Manual fusion times are based on 39.5 volt fusion boxes. 4.0mm Terminal Pins.

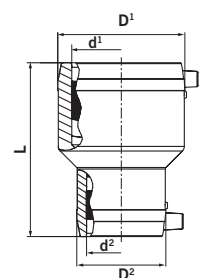


REDUCERS



Size (mm) d x d ¹	Black Code	D ¹ (mm)	D ² (mm)	L (mm)	Weight (kg)	Fusion Time* (Sec)	Cooling Time (mins)
110 x 90	PF 615 693	140	115	180	0.9	180	10
125 x 90	PF 615 694	155	115	200	1.0	240	15
125 x 110	PF 616 510	157	138	204	1.3	barcode read only	
160 x 110	PF 615 695	201	140	230	2.0	300	20
180 x 125	PF 616 511	216	155	274	2.6	300	16

* Manual fusion times are based on 39.5 volt fusion boxes. 4.0mm Terminal Pins.



When made in accordance with GPS PE Pipe Systems' recommended procedures, butt-fusion and electrofusion joints of the Protecta-Line System have been independently shown to meet the requirements of WIS 4-32-19 without any need for subsequent wrapping. This does not exempt installers from local regulations and the local Water Company preferences must be adhered to. See page 57 for details on wrapping tape.

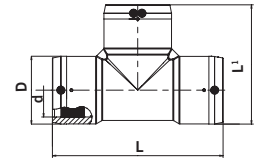
ELECTROFUSION FITTINGS

EQUAL TEES



Size (mm)	Black Code	D ¹ (mm)	L (mm)	L ¹ (mm)	Weight (kg)	Fusion Time*(Sec)	Fusion Time (branch)* (Sec)	Cooling Time (mins)
90	PF 612 166	117	305	211	1.1	90	90	10
110	PF 612 167	142	355	248	2.2	140	160	10
125	PF 612 168	160	384	272	3.5	180	200	15
160	PF 615 277	200	430	315	5.8	400	400	20
180	PF 615 691	228	480	354	7.9	440	440	20

Supplied factory-wrapped to ensure complete barrier performance.
* Manual fusion times are based on 39.5 volt fusion boxes. 4.0mm Terminal Pins.

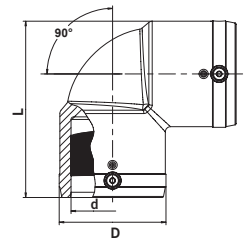


90° ELBOWS



Size (mm)	Black Code	D (mm)	L (mm)	Weight (kg)	Fusion Time*(Sec)	Cooling Time (mins)
90	PF 612 103	115	202	1.0	90	10
110	PF 612 105	138	234	1.6	140	10
125	PF 612 107	157	254	2.0	180	15
160	PF 615 276	207	329	4.9	360	20
180	PF 615 689	228	354	5.8	440	20

* Manual fusion times are based on 39.5 volt fusion boxes. 4.0mm Terminal Pins.

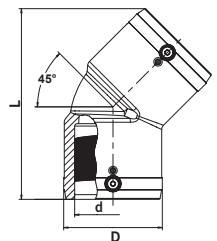


45° ELBOWS



Size (mm)	Black Code	D (mm)	L (mm)	Weight (kg)	Fusion Time*(Sec)	Cooling Time (mins)
90	PF 612 102	115	232	0.8	90	10
110	PF 612 104	138	265	1.3	140	10
125	PF 612 106	157	279	1.8	180	15
160	PF 615 275	207	377	4.4	360	20
180	PF 615 687	228	382	4.6	440	20

* Manual fusion times are based on 39.5 volt fusion boxes. 4.0mm Terminal Pins.



When made in accordance with GPS PE Pipe Systems' recommended procedures, butt-fusion and electrofusion joints of the Protecta-Line System have been independently shown to meet the requirements of WIS 4-32-19 without any need for subsequent wrapping. This does not exempt installers from local regulations and the local Water Company preferences must be adhered to. See page 57 for details on wrapping tape.

FLANGED TEES

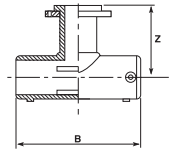


Size (mm)	SDR	Black Code	B (mm)	Z (mm)	Weight (kg)	Fusion Time (Sec)	Cooling Time (mins)
90 x 80 PN16	11	PF 301 313	305	236	3.5	90	10
110 x 80 PN16	11	PF 301 314	355	459	4.9	160	10
125 x 80 PN16	11	PF 301 315	384	503	6.0	200	15
160 x 80 PN16	11	PF 301 317	430	560	8.7	400	20
180 x 80 PN16	11	PF 301 318	480	812	12.2	440	20
90 x 100 PN16	11	PF 302 313	305	438	4.3	90	10
110 x 100 PN16	11	PF 302 314	355	353	4.7	160	10
125 x 100 PN16	11	PF 302 315	384	301	6.0	200	15
160 x 100 PN16	11	PF 302 317	430	528	9.0	400	20
180 x 100 PN16	11	PF 302 318	480	600	12.2	440	20
160 x 150 PN16	11	PF 303 317	430	365	9.7	400	20
180 x 150 PN16	11	PF 303 318	480	365	12.7	440	20

Manual fusion times are based on 39.5 volt fusion boxes
4.0mm terminal pins

Dimension Z is an approximate value, based on the dimensions of the component parts. The nature of the fabrication process is such that the final dimension may be slightly less than the Z value quoted.

Drilled to BS EN 1092-1:2007 Table 13.



FLANGE ADAPTOR KIT



Size (mm)	SDR	Black Code
90 x 80	11	PF 251 313
110 x 100	11	PF 251 314
125 x 100	17	PF 250 315
160 x 150	17	PF 250 317
180 x 150	17	PF 250 318
225 x 200	17	PF 250 320
250 x 200	17	PF 250 534
250 x 250	17	PF 250 321
280 x 250	17	PF 250 322
315 x 250	17	PF 250 543
315 x 300	17	PF 250 323
355 x 300	17	PF 250 547
355 x 350	17	PF 250 324

Drilled to BS EN 1092-1:2007 Table 13.

Note: Sizes 250 and 315mm have sections of pipe butt-fused to the moulding.

ADAPTOR KIT COMPRISES

- 1 x Stub Flange
- 1 X Coupler
- 1 x Gasket
- 1 x Backing Ring

Only Protecta-Line fittings shall be used with Protecta-Line pipe. The use of alternative fittings will have the following effects on your Protecta-Line system:

- Invalidation of WRAS approval and manufacturer's system performance warranty.
- Compromised permeation resistance (causing non-compliance with WIS 4-32-19 and possible risks to health).
- Danger of pipe-layer delamination, compromising system performance integrity and risking pipe bursts.
- It is illegal to install fittings non-compliant with the Water Fittings Regulations (or Byelaws in Scotland).



WIS 4-32-19
KM 514626

PUPPED FITTINGS

PREFABRICATED FITTINGS FOR PROTECTA-LINE



BENEFITS

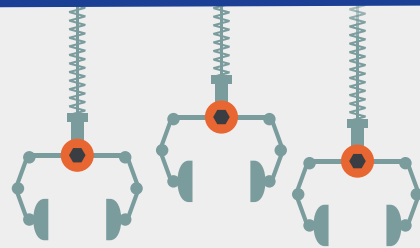
- Bespoke fabrications can be made
- Full barrier performance
- Flexibility to construct a pipeline to individual project needs
- Fully homogeneous pipeline

FEATURES

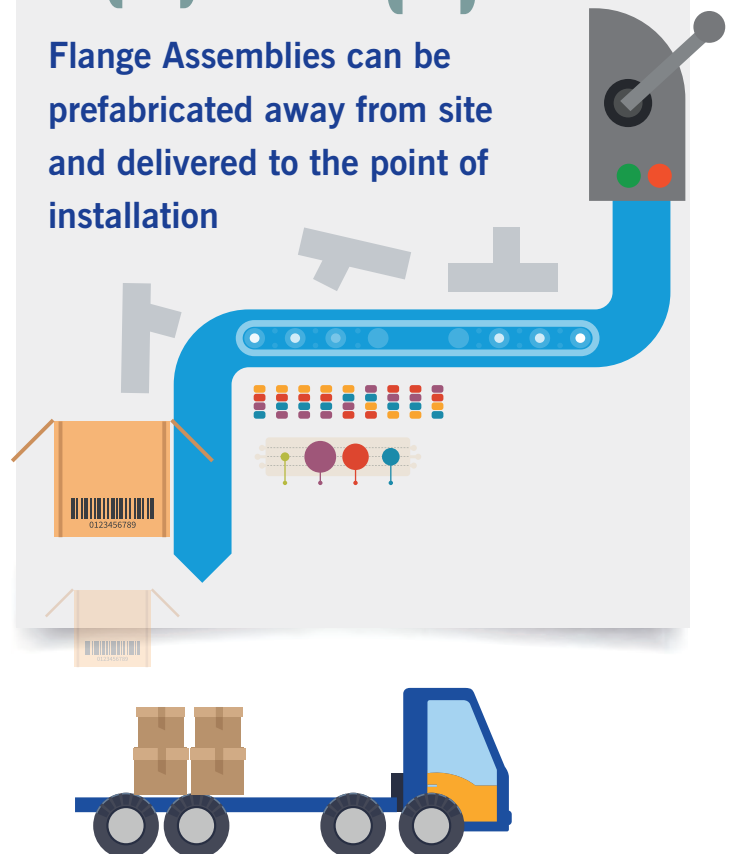
- Puppated fittings featuring extended spigots in various sizes made from Protecta-Line (PE100) pipe
- Suitable for electrofusion and butt-fusion
- 0.5m length pups as standard

Puppated fittings up to 630mm are also available. Please contact the Sales office for details.

DID YOU KNOW?

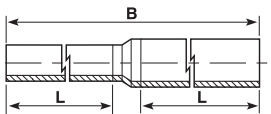


Flange Assemblies can be prefabricated away from site and delivered to the point of installation



PREFABRICATED FITTINGS FOR PROTECTA-LINE

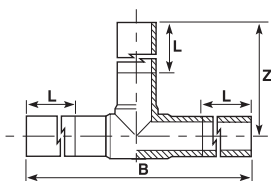
REDUCERS



Size (mm)	SDR 11 Code	SDR 17 Code	B (mm)	L (mm)	SDR 11 Weight (kg)	SDR 17 Weight (kg)
110 x 90	44 323 483	44 322 483	1186	500	3.2	2.2
125 x 90	44 323 484	44 322 484	1202	500	3.6	2.6
160 x 90	44 323 486	44 322 486	1254	500	5.7	3.8
160 x 110	44 323 495	44 322 495	1254	500	6.3	4.3
160 x 125	44 323 504	44 322 504	1254	500	6.9	4.6
180 x 90	44 323 487	44 322 487	1245	500	6.8	4.7
180 x 125	44 323 505	44 322 505	1245	500	8.0	5.4
225 x 160	44 323 507	44 322 507	1295	500	13.1	9.0
250 x 125	44 323 508	44 322 508	1316	500	10.2	6.9
250 x 180	44 323 529	44 322 529	1316	500	16.7	11.3
315 x 180	44 323 531	44 322 531	1555	500	25.9	18.1
315 x 250	44 323 543	44 322 543	1365	500	29.3	20.0
355 x 180	44 323 532	44 322 532	1570	500	20.7	14.1
355 x 250	44 323 544	44 322 544	1390	500	38.2	23.9
355 x 315	44 323 547	44 322 547	1390	500	42.4	30.0

Features a reducer pupped with Protecta-Line pipe. The reducer is factory wrapped to ensure complete barrier performance.

EQUAL TEES



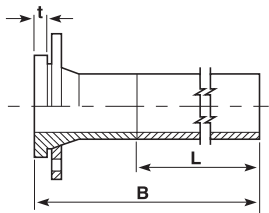
Size (mm)	SDR 11 Code	SDR 17 Code	L (mm)	B (mm)	Z (mm)	SDR 11 Weight (kg)	SDR 17 Weight (kg)
90	44 321 313	44 320 313	500	1277	637	4.2	2.9
110	44 321 314	44 320 314	500	1321	662	6.4	4.4
125	44 321 315	44 320 315	500	1350	676	8.4	5.8
160	44 321 317	44 320 317	500	1413	706	14.4	9.9
180	44 321 318	44 320 318	500	1528	760	19.6	13.5
225	44 321 320	44 320 320	500	1559	778	31.7	21.8
250	44 321 321	44 320 321	500	1582	791	38.5	26.0
280	44 321 322	44 320 322	500	1622	812	49.6	33.9
315	44 321 323	44 320 323	500	1690	851	65.3	44.1
355	44 321 324	44 320 324	500	1829	914	87.5	59.6

Features a black tee pupped with Protecta-Line pipe. The tee is factory wrapped to ensure complete barrier performance.

Bespoke fabricated fittings up to 630mm are now available to order. Please contact our Sales Office for information.

PUPPED FITTINGS

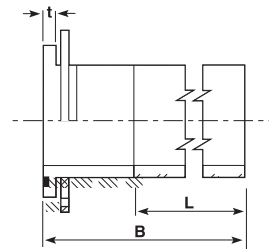
STUB FLANGE ASSEMBLIES PN16



Size (mm)	SDR 11 Code	SDR 17 Code	B (mm)	t (mm) SDR11	t (mm) SDR17	SDR 11 Weight (kg)	SDR 17 Weight (kg)
90 x DN80	44 327 313	44 326 313	640	17	17	3.9	2.4
110 x DN100	44 327 314	44 326 314	660	18	18	5	3.2
125 x DN100	44 327 315	44 326 315	683	25	25	5.7	3.7
160 x DN150	44 327 317	44 326 317	708	25	25	10.3	6.4
180 x DN150	44 327 318	44 326 318	702	30	30	11.5	7.5
225 x DN200	44 327 320	44 326 320	621	32	32	16.5	10.9
250 x DN250	44 327 321	44 326 321	620	35	35	22.6	15.1
280 x DN250	44 327 322	44 326 322	619	35	25	24.1	16
315 x DN300	44 327 323	44 326 323	668	35	25	32.4	23.7
355 x DN350	44 327 324	44 326 324	687	40	30	42.9	31.7

Features a black stub pupped with Protecta-Line pipe.

SLIMFLANGE ASSEMBLIES



Size (mm)	SDR 11 Code	SDR 17 Code	L (mm)	B (mm)	t (mm) SDR11	t (mm) SDR17	SDR 11 Weight (kg)	SDR 17 Weight (kg)
250 x DN200	44 453 321	44 452 321	500	620	31	27	9.0	8.0
315 x DN250	44 453 323	44 452 323	500	620	35	30	14.0	12.0
355 x DN300	44 453 324	44 452 324	500	620	40	35	21.0	19.0

Features a black SlimFlange pupped with Protecta-Line pipe.

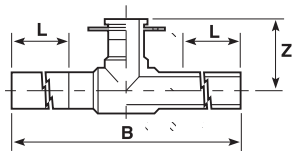
Bespoke fabricated fittings up to 630mm are now available to order. Please contact our Sales Office for information.

Dimensions of pupped fittings should be used subject to a +/- 5mm tolerance due to the nature of the fabrication process.

Standard pup leg lengths: 0.5m in sizes up to 400mm; 1.0m in sizes 450mm and above.

Additional bespoke large diameter fabricated fittings are available to order – please contact our Sales Office for further information.

**FLANGED SHORT
BRANCH TEES**



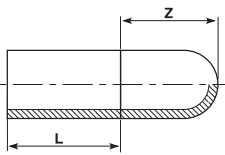
Size (mm)	SDR 11 Code	SDR 17 Code	L (mm)	B (mm)	Z (mm)	SDR 11 Weight (kg)	SDR 17 Weight (kg)
90 x DN80	44 341 313	44 310 313	500	1277	277	3.0	2.2
110 x DN80	44 341 314	44 310 314	500	1320	298	4.5	3.1
125 x DN80	44 341 315	44 310 315	500	1340	310	5.8	4.2
160 x DN80	44 341 317	44 310 317	500	1412	328	9.5	6.6
180 x DN80	44 341 318	44 310 318	500	1420	340	12.9	9.1
225 x DN80	44 341 320	44 310 320	500	1558	366	19.9	13.7
250 x DN80	44 341 321	44 310 321	500	1706	493	29.0	19.9
280 x DN80	44 341 322	44 310 322	500	1706	493	36.1	25.0
315 x DN80	44 341 323	44 310 323	500	1806	543	47.9	33.1
355 x DN80	44 341 324	44 310 324	500	1955	770	59.0	38.7
90 x DN100	44 342 313	44 311 313	500	1277	445	3.5	2.4
110 x DN100	44 342 314	44 311 314	500	1321	345	4.8	3.3
125 x DN100	44 342 315	44 311 315	500	1350	359	6.3	4.4
160 x DN100	44 342 317	44 311 317	500	1412	378	10.0	7.3
180 x DN100	44 342 318	44 311 318	500	1430	406	13.6	9.9
225 x DN100	44 342 320	44 311 320	500	1522	450	22.0	16.0
250 x DN100	44 342 321	44 311 321	500	1741	554	30.1	20.8
280 x DN100	44 342 322	44 311 322	500	1741	554	37.4	26.0
315 x DN100	44 342 323	44 311 323	500	1841	604	49.4	39.3
355 x DN100	44 342 324	44 311 324	500	1841	604	62.5	43.4
160 x DN150	44 343 317	44 312 317	500	1413	408	11.0	7.6
180 x DN150	44 343 318	44 312 318	500	1528	462	15.4	10.7
225 x DN150	44 343 320	44 312 320	500	1560	482	21.4	16.2
250 x DN150	44 343 321	44 312 321	500	1797	601	32.2	22.4
280 x DN150	44 343 322	44 312 322	500	1509	601	50.2	34.0
315 x DN150	44 343 323	44 312 323	500	1897	651	52.1	36.3
355 x DN150	44 343 324	44 312 324	500	1897	651	64.5	45.8

Features a black flanged branch tee pupped with Protecta-Line pipe. The tee is factory wrapped to ensure complete barrier performance.

Bespoke fabricated fittings up to 630mm are now available to order. Please contact our Sales Office for information.

Dimensions of pupped fittings should be used subject to a +/- 5mm tolerance due to the nature of the fabrication process.
 Standard pup leg lengths: 0.5m in sizes up to 400mm; 1.0m in sizes 450mm and above.
 Additional bespoke large diameter fabricated fittings are available to order – please contact our Sales Office for further information.

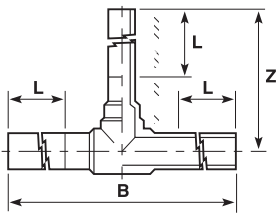
END CAPS



Size (mm)	SDR 11 Code	SDR 17 Code	L (mm)	Z (mm)	SDR 11 Weight (kg)	SDR 17 Weight (kg)
90	44 332 313	44 331 313	500	109	1.3	0.9
110	44 332 314	44 331 314	500	122	2.1	1.4
125	44 332 315	44 331 315	500	128	2.6	1.8
160	44 332 317	44 331 317	500	156	4.5	5.0
180	44 332 318	44 331 318	500	167	5.7	3.9
225	44 332 320	44 331 320	500	203	9.4	6.3
250	44 332 321	44 331 321	500	217	11.8	8.0
280	44 332 322	44 331 322	500	239	15.2	10.2
315	44 332 323	44 331 323	500	256	19.8	13.4
355	44 332 324	44 331 324	500	291	26.2	17.8

Features a black end cap pupped with Protecta-Line pipe.
The cap is factory wrapped to ensure complete barrier performance.

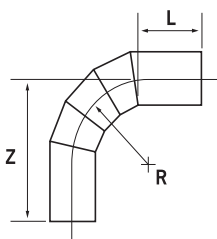
REDUCED BRANCH TEES



Size (mm)	SDR 11 Code	SDR 17 Code	L (mm)	B (mm)	Z (mm)	SDR 11 Weight (kg)	SDR 17 Weight (kg)	
90mm branch	110	44 347 314	44 356 314	500	1321	848	4.8	3.2
	125	44 347 315	44 356 315	500	1350	878	6.0	4.2
	160	44 347 317	44 356 317	500	1413	927	9.8	6.7
	180	44 347 318	44 356 318	500	1528	1207	14.6	10.1
	225	44 347 320	44 356 320	500	1559	1294	23.6	16.4
	250	44 347 321	44 356 321	500	1582	1554	29.9	20.2
	280	44 347 322	44 356 322	500	1622	1673	40.6	27.7
	315	44 347 323	44 356 323	500	1690	1732	52.6	35.4
	355	44 347 324	44 356 324	500	1698	1942	64.4	53.8
125mm branch	180	44 348 318	44 357 318	500	1528	1005	14.9	10.3
	225	44 348 320	44 357 320	500	1559	1308	24.9	17.1
	250	44 348 321	44 357 321	500	1582	1352	30.2	20.3
	280	44 348 322	44 357 322	500	1622	1687	41.9	28.6
	315	44 348 323	44 357 323	500	1690	1746	55.5	37.5
	355	44 348 324	44 357 324	500	1698	1740	64.7	54.0
180mm branch	225	44 349 320	44 358 320	500	1559	1063	25.8	17.8
	250	44 349 321	44 358 321	500	1582	1107	30.7	20.7
	280	44 349 322	44 358 322	500	1622	1442	42.8	29.0
	315	44 349 323	44 358 323	500	1690	1501	56.0	37.9
	355	44 349 324	44 358 324	500	1698	1495	65.2	54.4
250mm branch	315	44 335 323	44 336 323	500	1690	1216	55.6	37.6
	355	44 335 324	44 336 324	500	1698	1179	64.8	54.1

"Features a black tee pupped with Protecta-Line pipe.
The tee is factory wrapped to ensure complete barrier performance."

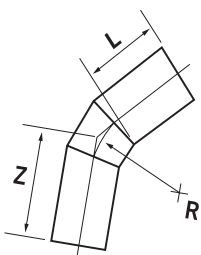
90° MITRED ELBOWS



Size (mm)	SDR 11 Code	SDR 17 Code	L (mm)	Z (mm)	SDR 11 Weight (kg)	SDR 17 Weight (kg)
90	44 244 313	44 243 313	500	617	2.4	1.6
110	44 244 314	44 243 314	500	643	3.9	2.7
125	44 244 315	44 243 315	500	663	5.0	4.0
160	44 244 317	44 243 317	500	708	9.0	6.0
180	44 244 318	44 243 318	500	734	12.0	8.0
225	44 244 320	44 243 320	500	793	20.0	14.0
250	44 244 321	44 243 321	500	825	26.0	17.0
280	44 244 322	44 243 322	500	864	32.0	22.0
315	44 244 323	44 243 323	500	907	42.0	29.0
355	44 244 324	44 243 324	500	962	56.0	38.0

The joints are factory wrapped to ensure complete barrier performance.

45° MITRED ELBOWS



Size (mm)	SDR 11 Code	SDR 17 Code	L (mm)	Z (mm)	SDR 11 Weight (kg)	SDR 17 Weight (kg)
90	44 242 313	44 241 313	500	538	2.3	1.6
110	44 242 314	44 241 314	500	546	3.5	2.4
125	44 242 315	44 241 315	500	553	5.0	3.0
160	44 242 317	44 241 317	500	568	8.0	6.0
180	44 242 318	44 241 318	500	576	10.0	7.0
225	44 242 320	44 241 320	500	595	17.0	12.0
250	44 242 321	44 241 321	500	606	20.0	14.0
280	44 242 322	44 241 322	500	618	25.0	17.0
315	44 242 323	44 241 323	500	632	33.0	22.0
355	44 242 324	44 241 324	500	650	42.0	29.0

The joints are factory wrapped to ensure complete barrier performance.

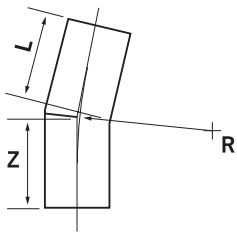
Bespoke fabricated fittings up to 630mm are now available to order. Please contact our Sales Office for information.

Dimensions of pupped fittings should be used subject to a +/- 5mm tolerance due to the nature of the fabrication process.

Standard pup leg lengths: 0.5m in sizes up to 400mm; 1.0m in sizes 450mm and above.

Additional bespoke large diameter fabricated fittings are available to order – please contact our Sales Office for further information.

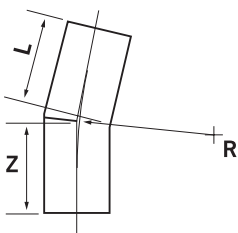
22.5° MITRED ELBOWS



Size (mm)	SDR 11 Code	SDR 17 Code	L (mm)	Z (mm)	SDR 11 Weight (kg)	SDR 17 Weight (kg)
90	44 317 313	44 316 313	500	509	2.2	1.5
110	44 317 314	44 316 314	500	511	3.2	2.2
125	44 317 315	44 316 315	500	514	4.2	2.8
160	44 317 317	44 316 317	500	516	7.0	5.0
180	44 317 318	44 316 318	500	518	9.0	6.0
225	44 317 320	44 316 320	500	522	15.0	10.0
250	44 317 321	44 316 321	500	525	18.0	12.0
280	44 317 322	44 316 322	500	528	28.0	19.0
315	44 317 323	44 316 323	500	531	29.0	20.0
355	44 317 324	44 316 324	500	535	35.0	30.0

The joints are factory wrapped to ensure complete barrier performance.

11.25° MITRED ELBOWS



Size (mm)	SDR 11 Code	SDR 17 Code	L (mm)	Z (mm)	SDR 11 Weight (kg)	SDR 17 Weight (kg)
90	44 298 313	44 297 313	500	504	2.1	1.5
110	44 298 314	44 297 314	500	505	3.2	2.2
125	44 298 315	44 297 315	500	506	4.1	2.8
160	44 298 317	44 297 317	500	508	7.0	5.0
180	44 298 318	44 297 318	500	509	9.0	6.0
225	44 298 320	44 297 320	500	511	14.0	10.0
250	44 298 321	44 297 321	500	512	17.0	12.0
280	44 298 322	44 297 322	500	514	21.0	15.0
315	44 298 323	44 297 323	500	516	21.0	15.0
355	44 298 324	44 297 324	500	518	34.0	29.0

The joints are factory wrapped to ensure complete barrier performance.

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- Invalidation of WRAS approval and manufacturer's system performance warranty.
- Compromised permeation resistance (causing non-compliance with WIS 4-32-19 and possible risks to health).
- Danger of pipe-layer delamination, compromising system performance integrity and risking pipe bursts.
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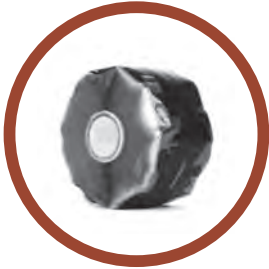
ACCESSORIES

ALUMINIUM WRAPPING TAPE



Description	Product Code
Aluminium wrapping tape (45m long x 50mm wide)	44 996 008

SILICONE TAPE



Description	Product Code
Silicone tape 10.9m long x 48mm wide	53 996 001



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