WATER INDUSTRY
INFORMATION & GUIDANCE NOTE

UK Water Industry

IGN 4-50-03
June 1996: Issue 1
(Page 1 of 13)
ISSN 1353-2529

Reprinted June 2006
for web publication

OPERATING GUIDELINES FOR THE USE OF SITE-APPLIED, FACTORY APPLIED, AND REINFORCED FACTORY APPLIED POLYETHYLENE SLEEVING ON DUCTILE IRON PIPELINE SYSTEMS

1. INTRODUCTION

The corrosion of metals in waters and soils occurs by an aqueous electrochemical mechanism. That is, it involves the presence of water (or moisture) containing dissolved ions (i.e. a solution) at the metal surface, and the transfer of the electrons from the metal surface to the aqueous environment in contact with it. Corrosion protection involves interfering with one or more of these processes.

i) All new ductile iron mains should at least be protected with polyethylene (PE) sleeving prior to burial in order to ensure durable protection is afforded, unless a soil survey or local knowledge of the ground conditions indicates that the soil is non-aggressive. Care is however required in the interpretation of soil resistivity surveys or "local knowledge", which are not in all cases foolproof indicators, particularly in urban situations where the presence of disturbed ground or prior contamination (e.g. on redevelopment sites) may invalidate the assessment. (For further information on the zinc coating system see IGN No. 4-51-01, Pipe Materials Selection Manual 2nd edition or manufacturer's guidance).

ii) The bitumen coating system applied to fittings acts as a protective layer in less aggressive soils.

NOTE: Fittings are not supplied with zinc coating as standard.

Site applied polyethylene sleeving originated in America in 1951. Ductile iron pipes were first manufactured on a commercial scale in the UK in 1961 and during 1966 the first site applied PE sleeving was used. 1984 saw the introduction of zinc coatings for pipes and during 1986 factory-applied PE sleeving was introduced in the UK.

BS 6076 specifies polymeric film for use as protective sleeving for protecting buried ductile iron pipes and fittings. The guidance given in the standard is based on current products, but is not intended to limit future development. The first section of the standard gives general requirements applicable to both site applied and factory applied polymeric sleeving. The second section is exclusively for tubular polymeric sleeving for site application, the third and fourth sections are exclusively for factory application.

The IGN supersedes both IGN 4-50-01 and 4-50-02. Its contents reflects current guidance in BS 6076, BS EN 545 and IGN 4-21-01.

2. PROTECTIVE MECHANISM

The polyethylene sleeving functions by:

i) preventing contact between the pipeline and the surrounding backfill; direct contact between unprotected ductile iron mains and corrosive soils can lead to

Technical enquiries to:
WRc, Frankland Road, Blagrove, Swindon, Wilts, SN5 8YF Tel: (01793) 865151 E-mail: wisign@wrcplc.co.uk

extremely intense and highly localised attack (pitting),

ii) promoting the formation of a relatively uniform aqueous environment between the pipe surface and the sleeving film (note that some water inevitably collects in this space during service); this ensures that any corrosion which might occur tends to be distributed uniformly over the surface concerned, rather than being concentrated in localised areas in the form of pitting, thereby restricting the depth of attack on sleeved ductile iron mains. This effect is maximised if the sleeving is installed so as to fit snugly around the pipe. This is always the case for factory applied sleeving where the application is via purpose built machines on the factory finishing lines,

iii) restricting the access of oxygen (essential for the aqueous corrosion of iron in non-acidic aerobic electrolytes) and of nutrients (necessary to sustain the activity of sulphate-reducing bacteria which can stimulate corrosion of iron in anaerobic environments), which in turn minimises the rate of attack on sleeved ductile iron mains,

iv) the colour of the sleeving gives a clear warning what the pipe is being used for.

3. GOOD PRACTICE PRINCIPLES

General precautions to be observed.

Both Types

- any damage to sleeving must be repaired before backfilling.
- with the implementation of the New Roads and Street Works Act 1991, the emphasis is to reduce the level of failed reinstatements which can be achieved by increasing the level of compaction of the pipe surround and backfill materials. The materials should be compacted with care, particularly where site applied sleevings are being used as these are more susceptible to tearing during installation, than factory applied sleevings.
- sleeving must continue under concrete anchor blocks such that no areas of metal are left exposed to the surrounding backfill.
- at all times follow strictly the manufacturer's instructions covering the application of the PE sleeving.

Site-Applied

- avoid entrapment of soil between the sleeving and pipe surface.
- soil should be removed from the pipe (or fitting) surface prior to sleeving.
- ensure tight fit of sleeving to pipe barrel.

Factory Applied

- care required during transportation, handling, laying and trench backfilling.
- care still required in joint protection.

Further details on the sleeving procedure are given in Appendix A; more detailed information on transportation and handling is given in Appendix B and the procedure to follow when making service connections is given in Appendix C.

4. LIMITATIONS OF USE

PE sleeving is **not** recommended for use in highly aggressive ground conditions. These include:

- Natural soils with resistivity below 750 ohm.cm.
- Natural soils with resistivity below 1500 ohm.cm with seasonal water table, permanent water logging or where the pipe trench acts as a drain exposing the pipe to flowing ground water.
- Made up ground with chemical contamination, e.g. refuse sites, farmyard wastes, heavy industrial sites, mines, chemical plants.
- Soils where stray electrical currents are present, e.g. close proximity to cathodically protected pipelines and DC traction systems. (Refer to BS 7361 for further guidance or consult the manufacturer.)

- Made up ground containing clinker, bricks, flints or other materials likely to cause mechanical damage.
- Highly acidic (pH ≤5) and highly alkaline (pH ≤9) soils.
- Tidal waters, e.g. estuaries, shorelines.

Under these circumstances alternative forms of protection are recommended such as tape wrap. Consult manufacturers for guidance.

In addition PE sleeving is not recommended for use in conjunction with pipeline cathodic protection systems.

5. SELECTION OF SLEEVING MATERIAL

The film types shown below reflect the current developments of sleeving materials.

Unreinforced LDPE (Site application only)

The sheeting was first introduced in the UK during 1966, it is of a tubular form to be applied on site.

Laminated PE (Factory application)

This material consists of a cross laminate of two or more layers extruded in sheet form.

Reinforced Laminated (Factory application)

This sheeting is similar to laminated PE sheeting reinforced with a scrim layer (e.g. polymeric) to give improved strength, rigidity and tear resistance while reducing susceptibility to site damage.

5.1 Materials and Applications

Polyethylene sleeving and plastic adhesive tape are used to provide continuity at pipe joints and fittings. This method may be varied to suit individual conditions providing the end result is a snug fitting and continuous protective enclosure for both pipes and fittings.

Polyethylene sleeving for site application is normally supplied in the form of layflat tubular film. Table 1 gives the recommended layflat widths for the standard ductile iron pipe diameters according to the pipeline jointing system, together with information on the weight and approximate length of sleeving per standard roll. Polyethylene sleeving for underground iron mains must comply with the requirements of BS 6076. Tables 2, 3 and 4 give the approximate quantities of sleeving, plastic adhesive tape or waterproof wrapping tape required according to the type of joint and the method used to complete the protection at joints and fittings.

The quantities shown in the tables are for guidance and it is suggested that allowances be made for wastage, etc.

Polyethylene sleeving in tubular form is not readily available for ductile iron pipes of 1400 mm and 1600 mm nominal diameter. For these sizes wrapping the pipes with polyethylene sheets may be considered, the procedure for which is described in Appendix A.

It is recommended that coloured PE sleeving should be used for buried ductile iron mains, to facilitate subsequent identification. The sleeving colour should be selected on the basis of intended pipeline application as follows:

Potable water	**Blue**
Sewage and drainage	**Black or red**

Table 1 - Size of sleeving

Pipes and fittings with push-fit flexible joints			
Nominal pipe size DN	Layflat width mm	Length of sleeving on roll (approx) m	Weight of roll (approx) kg
80	280	87	14
100	280	87	14
150	400	87	18
200	550	87	22
250	650	87	26
300	700	87	28
350	800	87	33
400	1100	87	45
450	1100	87	45
500	1350	44	28
600	1350	44	28
700	1750	44	36
800	1750	44	36
900	2000	44	41
1000	2000	44	41
1100	2500	44	51
1200	2500	44	51
1400*	3500	44	71
1600*	3500	44	71

* Consult pipe manufacturers

Table 2- Approximate quantities of sleeving for pipes and fittings with push-fit flexible joints

Nominal pipe size DN	Per metre of pipe m	Per fitting m
80-250	1.1	1.5
300-450	1.1	2.0
500-800	1.1	3.0
900-1200	1.1	4.0
1400-1600*		

* Consult pipe manufacturers

Table 3 - Approximate quantities of sleeving for pipes and fittings with bolted gland joints

Nominal pipe size DN	Per metre of pipe m	Per fitting m
80-250	1.30	4.0
300-450	1.35	5.5
500-600	1.35	6.0

Table 4 - Approximate quantities of plastic adhesive tape

Nominal pipe size DN	50 mm wide plastic adhesive tape	
	Per metre of pipe m	Per fitting m
80	0.70	4.6
100	0.80	5.2
150	0.95	6.8
200	1.15	8.5
250	1.30	10.1
300	1.50	11.7
350	1.70	14.0
400	1.85	15.5
450	2.05	17.5
500	2.20	19.0
600	2.55	22.0
700	2.90	25.5
800	3.25	28.5
900	2.50	32.0
1000	2.75	35.0
1100	3.00	38.5
1200	3.25	42.0
1400*		
1600*		

* Consult pipe manufacturers

APPENDIX A - SITE APPLIED SLEEVING PROCEDURE

A.1 PRECAUTIONS

1. Remove all soil and foreign matter from the external surface of the pipe/fitting before sleeving.
2. If necessary, repair damaged areas on the factory-applied coating. Wire brush damaged area and paint over with a material compatible with the original coating. This applies to the external surface of the pipe barrel only.
3. Avoid damaging the polyethylene sleeving.
4. Ensure the sleeving is fitted snugly to the pipe barrel.

5. Repair any damage to the sleeving before backfilling.
6. Ensure that the trench base is free of any material likely to damage the sleeving.
7. Use backfill which is free of any material likely to damage the sleeving.
8. Backfill carefully to avoid damage to the sleeving.

NOTE: Do not electrically overbond pipelines which are going to be polyethylene sleeved. Do not use polyethylene sleeving in conjunction with pipeline cathodic protection systems.

Suitable for pipes with push-fit flexible joints and for pipes with bolted gland joints.

A1.1 Pipes

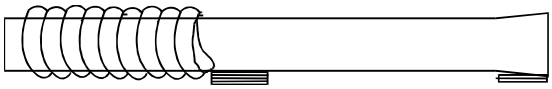

Figure 1

1. Support the pipe on two timbers, one under the socket, the other approximately 2 m from the spigot, use wedge to prevent the pipe rolling.
2. Cut a piece of sleeving approximately 0.5 metre longer than the effective length of the pipe; i.e. 6 m for 5.5 m pipes, 8.5 m for 8 m pipes.
3. Slide the sleeving onto the spigot end and bunch up behind spigot timber (Figure 1) taking care not to damage the sleeving on the end of the pipe.

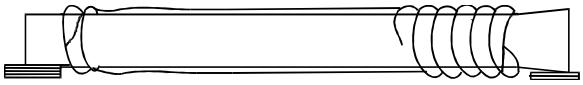

Figure 2

4. Reposition the spigot timber at the extreme spigot end and pull the sleeving sufficiently far back from the spigot end to allow for subsequent jointing (Figure 2).
5. Ensure that the sleeving is correctly positioned relative to the spigot end (Figure 3). Pull the sleeving tightly around the pipe and fold the excess to form a triple thickness pleat of film over the pipe crown.

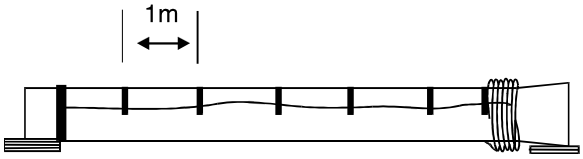

Figure 3

6. At the spigot end of the pipe tape the end of the sleeve to the pipe body around the whole circumference ensuring that the tape overlaps the end of the sleeve and onto the pipe (Figure 3). Secure the fold in position using short strips of plastic adhesive tape at a maximum spacing of 1 metre.
7. The excess sleeve at the socket end may be left pulled back from the socket or alternatively it may be temporarily folded into the mouth of the socket to keep out extraneous material while positioning the pipe in the trench.
8. Lift the sleeved pipe using padded slings or other lifting tackle which will not damage the sleeving film. Lay the pipe in the trench with the triple thickness layer of film on the crown to provide a cushioning effect during backfilling and make the joint in the recommended manner. (Ensure that if the sleeving has been folded into the socket this is removed prior to jointing). If hydraulic jointing tackle is being used an extra piece of sleeving draped loosely over the pipe underneath the tackle will protect the sleeving around the pipe from damage.
9. After completion of the joint, any exposed portion of the spigot end between the sleeving and the face of the adjoining socket should be taped over using plastic adhesive tape. Care should be taken to ensure that sleeving or tape at the spigot end is not trapped under the gasket as this could impair the seal of the joint.

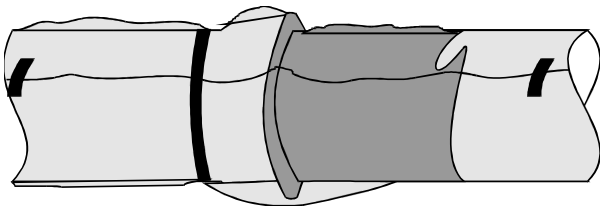

Figure 4

10. Draw the excess sleeve over the joint, fold neatly and tape around the circumference of the pipe at the back of the socket (Figure 4).

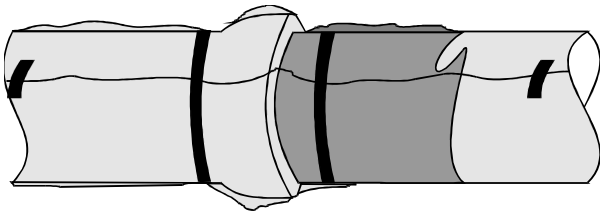

Figure 5

Make a second pass with the tape around the circumference immediately in front of the socket (Figure 5). These two bindings ensure a reasonable snug fit of sleeving in the joint area.

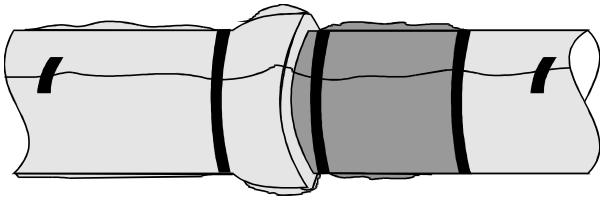

Figure 6

Finally, tape the end of the sleeve around the full circumference making sure that the tape overlaps onto the sleeve of the adjacent pipe to effect a seal (Figure 6).

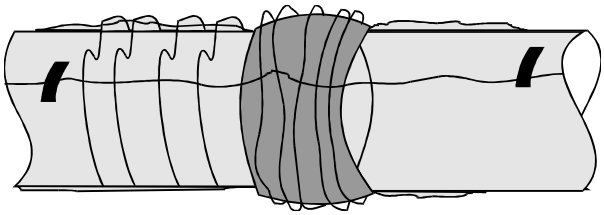

Figure 7

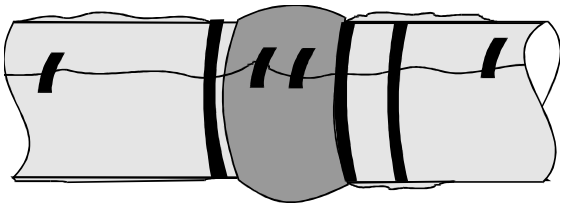

Figure 8

11. In the case of bolted gland or flanged joints, a pad of some four film thicknesses should be placed around the circumference of the joint before the sleeve is secured in position to provide protection over any sharp edges (Figures 7 and 8).

A1.2 BENDS

12. Where the body of a bend is to be sleeved, cut a piece of sleeving to extend along the length of the bend beyond the socket faces to overlap onto the barrels of the pipes on either side. For the larger angled bends it is suggested that the sleeving is cut to suit the angle of the bend.
13. Make the joint at one side of the bend. Slide the short length of sleeving loosely onto the spigot end of the next pipe to be jointed and make the joint. Alternatively dependent upon the size of the bend and laying techniques employed, it may be preferable to position the sleeving loosely on the bend itself prior to jointing.
14. After completion of the joints any exposed portion of the spigot ends between the sleeving and the bend socket faces should be taped over using plastic adhesive tape as in sub-clause 9 (of A1.1).
15. For bolted gland or flanged joints, form and position pads around the sockets as in sub-clause 11.
16. Draw the short length of sleeving over the fitting with an equal amount projecting beyond each socket face. Pull this sleeve tightly around the body of the bend and fold the surplus neatly, taping around the circumference behind each socket (Figure 9). On large diameter fittings a further turn of tape around the centre of the bend may be beneficial in assisting the sleeving to achieve a snug fit.

17. Tape around the circumference of the pipes to complete the protection. See sub-clause 10 (Figures 5 and 6).

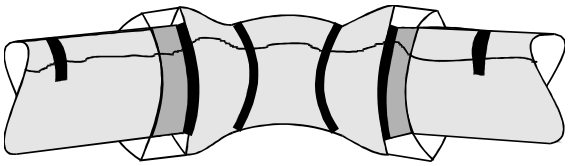

Figure 9

A1.3 TEES

18. Cut two pieces of sleeving approximately 300 mm longer than the overall length of the tee.
19. Slide one length onto the spigot end of each of the adjacent pipes to which the tee is to be connected and make the joints in the normal manner.
20. After completion of the joints any exposed portion of the spigot ends between the sleeving and the tee socket faces should be taped over using plastic adhesive tape as detailed in sub-clause 9.

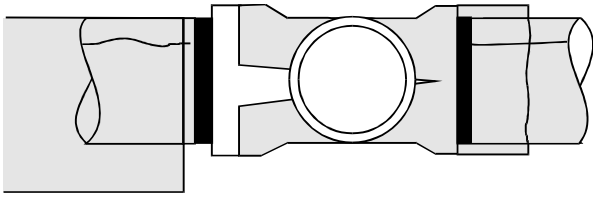

Figure 10

21. Cut one piece of sleeving part way along its length on the branch side, sufficient that the sleeve can be pulled over the tee body (Figure 10).

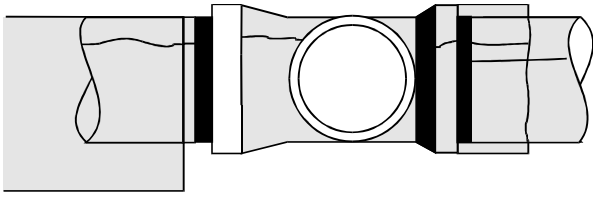

Figure 11

22. Pull the sleeve tightly around the body of the tee and fold the surplus neatly at the crown. Tape around the circumference of the tee immediately behind the socket (Figure 11).

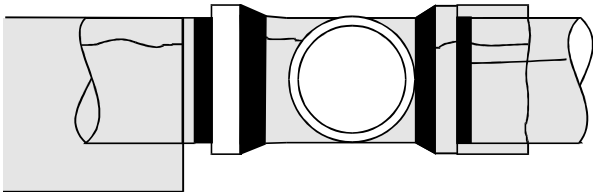

Figure 12

23. Make a second pass with the tape around the circumference of the tee at the end of the sleeve overlapping onto the body (Figure 12).

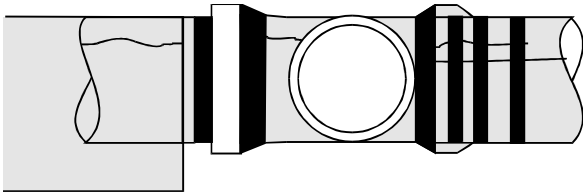

Figure 13

Complete the securing of the sleeve by taping around the circumference of the pipe in front of the socket and finally at the end of the sleeve ensuring that the tape overlaps onto the adjacent sleeving to provide a seal (Figure 13).

24. Repeat the above process with the second sleeve.

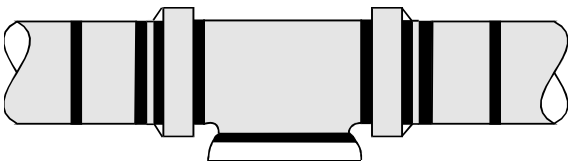

Figure 14

25. Where the sleeving overlaps onto the branch, fold to the contours of the fitting and tape around the circumference of the branch (Figure 14).
26. Cut a length of sleeving sufficient to cover the branch and overlap onto the spigot of the adjacent pipe. Slip this onto the spigot of the pipe to be jointed into the branch socket and make the joint in the normal manner.
27. Tape over any exposed portion of the spigot and between sleeving and socket face using plastic adhesive tape as detailed in sub-clause 9.

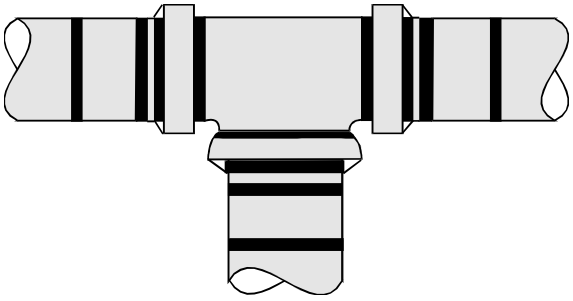

Figure 15

28. Pull the sleeve tight around the branch and fold neatly on the crown. Tape round the circumference at the end of the sleeve, overlapping onto the body of the tee. Make a second pass around the branch in front of the socket and complete the fixing of the sleeve by taping around the circumference of the pipe at the end of the sleeving (Figure 15).

29. Any parts of the tee left exposed - perhaps in the radius area between body and branch - should be covered with plastic adhesive tape.

A.2 INSTALLING POLYETHYLENE SHEET ON 1400 mm and 1600 mm DIAMETER PIPES

As with the application of tubular sleeving, this is done out of the trench with the pipe ends supported on wooden battens to raise the pipe off the ground. The sleeving is applied in such a manner that its length lies circumferentially around the pipe.

1. Cut sheeting into lengths approximately 1 m longer than the circumference of the pipe.
2. Position first length on the pipe and fasten one end to the pipe with adhesive tape.
3. Pull sheet tightly around the pipe and seal the overlapping end with adhesive tape.
4. Apply subsequent pieces in a similar manner, each overlapping its neighbour by approximately 0.5 m, until the pipe is protected from the back of the socket to a point sufficiently far back from the spigot to allow for subsequent jointing.
5. Seal all circumferential joints - including the ones at each end - with adhesive tape.
6. Once the pipe has been laid, protect the exposed joint area either by wrapping with sleeving in a similar manner to that described above, ensuring that all edges are sealed.

APPENDIX B - FACTORY-SLEEVED PIPE - TRANSPORTATION, HANDLING AND LAYING

B.1 TRANSPORTATION AND HANDLING

B1.1 Bundled pipes

Protective packaging is used to protect the sleeved pipes from possible damage through contact with the bundle supports. When loading and unloading the bundles, the following general principles should be adhered to:

B1.1.1 Loading

- When bundles are handled using a fork lift truck, care must be taken to avoid damaging the underside of the bottom layer of pipes. When loading onto lorries which have a chock rail along the side, it is important that the bundles be raised sufficiently to allow the access of the fork lift blades.
- Only webbing straps should be used to secure the load. These must pass over the protective packaging material.

B1.1.2 Unloading

- Complete bundles of pipes may be unloaded using either fork lift truck or crane. Care should be taken to avoid damaging the sleeved pipes as a result of sliding contact with the fork lift. If a crane is used the bundles must be lifted using two broad webbing slings. Never attempt to utilise chains or wire ropes as these might cause the bundle to slip, or damage the protection system.
- Bundles may be stacked, one on top of the other, with the axes of the pipes parallel. The maximum stack height should be carried out to manufacturer recommendations, however this may be reduced depending on the location and should be determined by competent supervising staff.
- Base timbers of stacked bundles should be positioned onto the protective packaging of lower bundles.
- It is recommended that wherever possible bundles are not broken down until just before laying. When bundle breakdown is carried out, the retaining straps should be cut using either a strap cutting tool or tin shears. The straps are usually under tension and care should be taken when cutting, in the event that a cut end may fly, for this reason goggles and protective gloves should be worn. It is essential that when releasing the bundle straps the pipes are not used as a fulcrum to break the straps.
- Separated pipes may be lifted singly using a crane with either two webbing slings around the pipe or crane hooks inside the ends of the pipe, provided they are suitably protected to prevent damage to the internal pipe lining. If any other method is used, it is essential that some form of protection is used on the pipe area that will be in contact with the lifting tackle.
- Pipes should never be rolled or dropped off the transportation, nor rolled along the ground.
- If separated pipes are built into stacks after unloading, the bottom row should be supported on substantial clean timbers with subsequent clean timbers placed between each successive layer. Contact of one pipe socket against another pipe barrel must be avoided. (Guidance is given in BS 8010: Part 2: Section 2.1).
- Where debundled pipes are transported to site from store, these should be treated as in Section B1.2.
- Where pipes are strung out along the intended line of the main, care must be taken during the placement of these pipes that they are not laid on ground having substantial projections of stones, rocks or other such materials. The use of a timber support under the spigot end is recommended.

B1.2 Pipes not bundled

Pipes which are not supplied in bundles shall be transported singly. Pipes in the stockyard should be supported on substantial timbers which permit the access of fork lift blades without damage to the sleeving.

B1.2.1 Loading

- Loading onto lorries may be undertaken using either a fork lift truck or a crane. When lifting pipes with a crane either two webbing slings around the pipe or padded crane hooks inside the ends of the pipe should be used. Timbers should be placed between each row and positioned to coincide with the protective packaging on the pipes. If the lorry has a chock rail along each side, it is important, as with bundled pipes, that the bottom row be raised sufficiently to allow the access of fork lift blades.
- Only webbing straps should be used to secure the load. These must pass over the protective packaging on the pipes.

B.1.2.2 Unloading

- If pipes are unloaded using a fork lift truck, care must be taken not to cause damage to the sleeving with the fork blades.
- Where pipes are unloaded by crane this should be done in the manner described in B1.1.2 for lifting separated pipes of smaller diameters.

- Similarly, where pipes are to be stacked then this should be carried out in the manner prescribed for individual pipes of smaller diameter. See B1.1.2.

B.2 LAYING OF PIPES (ALL SIZES)

B2.1 General precautions

1. If pipes are strung out along a site, it is important that the handling instructions given in Appendix B are carried out.
2. It is essential to avoid contact of the pipe with sharp objects. Rolling the pipe along the ground must be avoided.
3. Prior to placing the pipe in the trench the sleeving must be checked for possible damage and where necessary repaired in the manner described in B2.6.
4. Pipes must only be lifted into the trench using webbing slings. They must not be rolled in from the side of the trench.
5. Ensure adequate clearance is excavated under the joints to allow adhesive tape to be properly applied. (See B2.2 for joint protection options.)
6. When entering the spigot into the socket dragging of the pipe along the trench bottom should be avoided.
7. Do not lever against the side of the pipe to align pipes after jointing unless a suitable protective pad is used between the pipe and the lever.
8. Care must be taken during the backfilling of the trench to ensure that the sleeving remains undamaged. The trench bottom must be free of any object that is likely to cause damage to the sleeving, as must be the backfill material in the immediate proximity of the pipes. Backfill must be carefully placed and care taken when compacting to avoid damage to the sleeving.

B2.2 Joint Protection
Using PVC tubular muffs

These are available for pipelines with both push-fit and mechanical flexible joints. The muffs for mechanical joints are reinforced over their centre section to reduce the risk of damage from the socket flange, nuts and bolts on the joint. There are minor differences in methods of securing joint muffs, reference to manufacturer's literature should be made.

1. Ensure plastic securing straps are positioned on the outside of the muff.
2. Pass the muff over the socket or spigot of the pipes to be jointed.
3. After jointing the pipes, move the muff into position over the joint and pleat as tightly as possible over the joint.
4. Pull the straps tight to secure the muff in position.

The key steps of this method are illustrated in Figures 16 to 19.

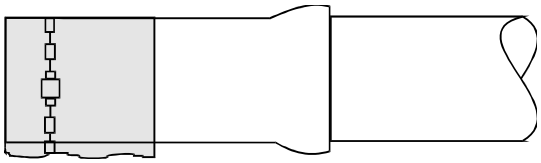

Figure 16 - Muff ready for pulling over the completed joint

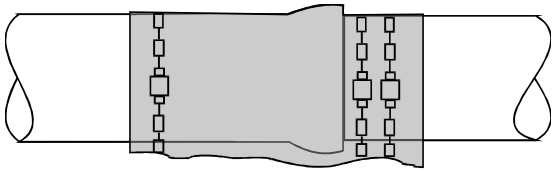

Figure 17 - Muff drawn over joint

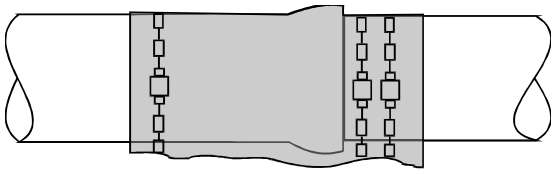

Figure 18 - Securing straps are connected as shown and pulled tight

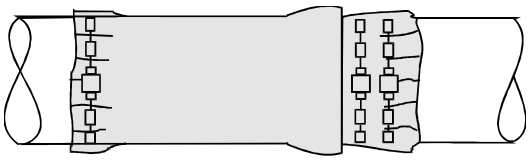

Figure 19 - Completed joint protection

B2.3 Cutting pipes

The cutting of pipes having factory applied sleeving should be carried out in the following manner:

1. For pipes of 350 mm diameter and larger, check whether the pipe is suitable for cutting in the field. If not, check that the diameter of the pipe is within the jointing tolerances given in BS EN 545.
2. Mark the position of the cut on the sleeve.
3. Measure a distance slightly greater than a socket depth each side of this mark and cut the sleeve at these two places.
4. Remove the central section of sleeve and secure the two cut ends with plastic adhesive tape.
5. Cut the pipe at the appropriate point.

B2.4 Fittings

Fittings will normally be protected by factory applied muffs or tape wrap.

Where fittings have their bodies tape wrapped at works care must be taken to avoid damage during transportation and storage. Where the weight of fitting necessitates the use of lifting gear, webbing slings must be used. No more than one item should be lifted at a time.

Joint muffs should be installed in the following manner:

1. During laying pull the extra long muffs onto the spigot ends of the adjacent pipes.
2. Make the necessary joints between pipe and fitting.
3. Pull the muffs over the socket and part of the body of the fitting and secure with the restraining straps as described in B2.2.

NOTE: Upon completion there should be substantial overlap of the two muffs on the body of the fitting.

B2.5 Minor repairs

It is essential for long term protection that damage to the sleeving system is repaired. Consequently pipework should be inspected prior to and during laying for damage.

The method of repair will generally involve patching the damaged area in the following manner:

1. Smooth down or cut off any wrinkled sleeving.
2. Ensure damaged area is wiped clean and dry.
3. The damaged area should be checked for damage to bitumen/bitumen and zinc and repaired if necessary.
4. Select a patch of appropriate size from the repair kit provided by the pipe manufacturer.
5. Peel off the backing paper and apply the patch to the area under repair. Pressure should be applied to ensure an adequate contact and seal between the patch and parent wrapping.

This method of repair is illustrated in Figures 20 to 24.

Should a repair kit not be available then any damage should be repaired in the manner laid down for site applied sleeving described in Appendix A2.2.

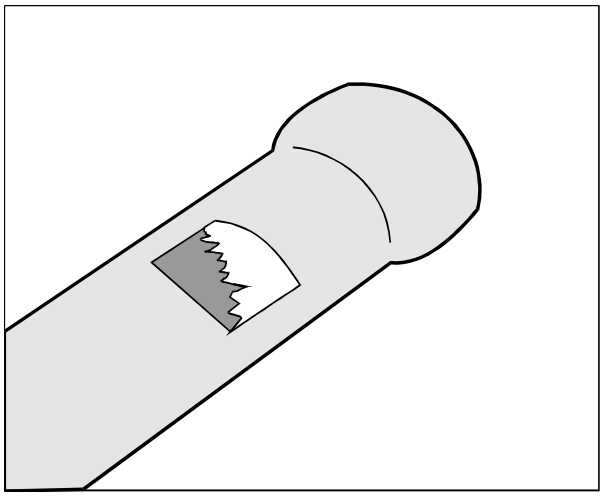

Figure 20 - Sleeving damage to be repaired

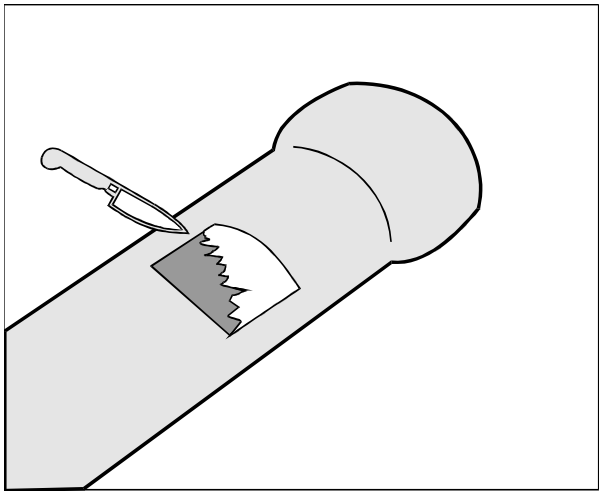

Figure 21 - Cut away flap of material

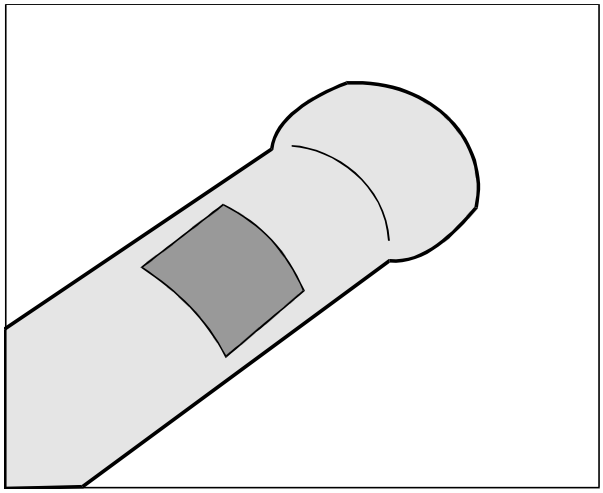

Figure 22 - Clean and dry area to be repaired

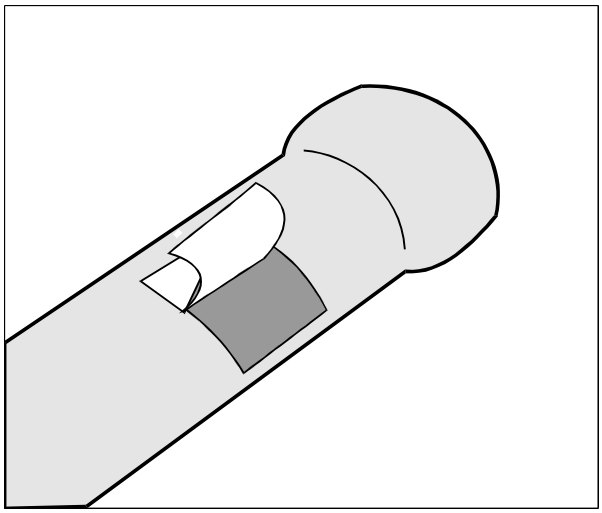

Figure 23 - Apply self adhesive patch

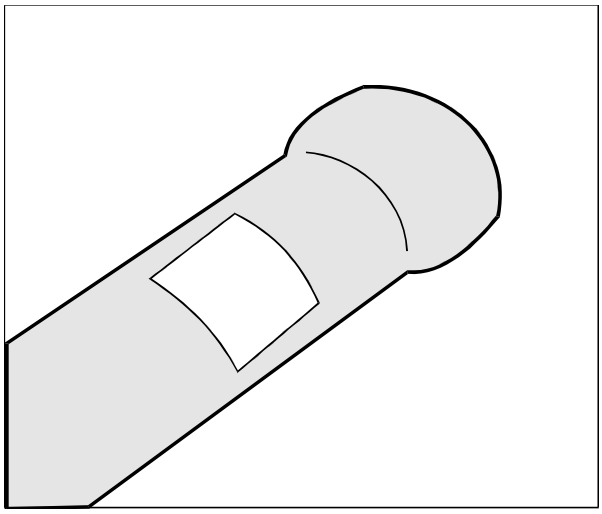

Figure 24 - Completed repair

APPENDIX C - SERVICE CONNECTIONS

1. Prior to making the service connection, place the saddle of the tapping machine on the pipe in the correct position. Mark around the saddle.
2. Remove the saddle and carefully cut away the sleeve in the area marked (Figure 25).
3. Proceed with the tapping in the normal way.
4. Once the connection is made, complete the protection by the application of waterproof tape over all exposed metal surfaces, including the ferrule (Figure 26).

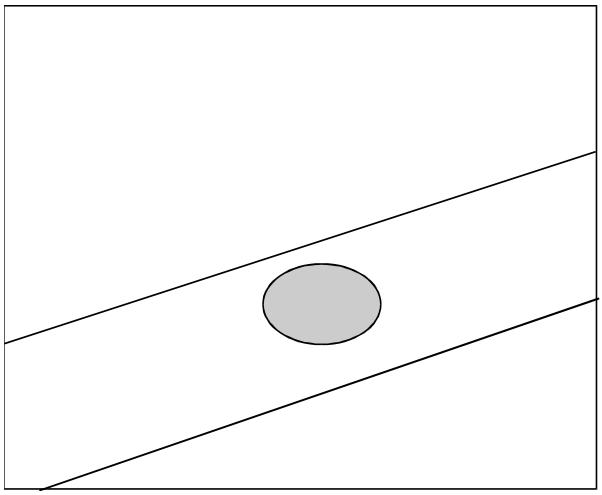

Figure 25 - Sleeving cut away from area of tapping

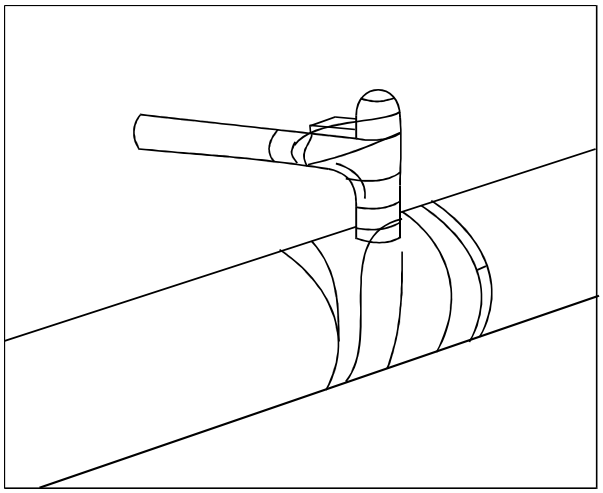

Figure 26 - Completed connection with waterproof tape wrapped over all exposed metal surfaces