

COUPLING FOR LINED PIPE

This invention relates to methods for joining lengths of plastic lined metal or other pipe where a welded or threaded joint is not possible or not suitable.

5. In general, methods are described for joining the ends of two plastic lined pipe lengths; the end face of at least one pipe is protected by a plastic collar which is inserted in the open end of the lined pipe and has a flange extending radially to cover the end of the pipe. The flanged collars in two pipe lengths can be forced together inside a coupling sleeve which joins the two pipe lengths together by an interference fit coupling. A band of plastic liner can be carried in an annular recess in the coupling sleeve to mate with the radial edges of the flanged plastic collars so that the conduit is fully lined. The ends of the sleeve can be depressed into the pipe to form a mechanical interlock. That is the subject of this specification.
10. 15. 20. 25. In another form, the lined pipe end can be fitted into a bell formed on the other pipe length; with the plastic collar flange mating with the lining in the bell. That is the subject of Patent Specification No. 8304765 which has been divided from the present specification.

30. According to one aspect of the invention, there is provided a coupling between two lengths of pipe, each of which has a plastic liner including for each length a plastic collar having a tubular portion fitting in the plastic liner of its pipe length and an external flange covering the end of its pipe length, the two lengths being fitted into opposite ends of a coupling sleeve with the two external flanges in contact.

- According to another aspect of the invention, there is provided a method of joining the open ends of two lengths of metal pipe, each having a plastic liner, to form a continuously lined conduit, comprising inserting a plastic collar in the open end of each
5. of the pipe lengths, said plastic collar comprising a tubular portion fitting in the liner in the pipe length and an external flange covering the end of the pipe length, and inserting the ends of the pipe lengths into opposite ends of a coupling sleeve
 10. having an internal diameter slightly less than the external diameter of said pipe length prior to insertion until said flanges meet in abutting relationship

- The joint can be formed conveniently and rapidly without application of sufficient heat to damage
15. the lined pipe, and the interconnection can be sufficiently mechanically interlocked to withstand any internal pressure which

the remainder of the conduit will withstand.

The interconnection method of the invention may be conveniently used in the field to make repairs or alterations in existing lined conduits since

5. rotation of the pipe is not required to form the joint.

The inventions of the parent and divisional specifications may be carried into practice in various ways, and certain embodiments will be described by way of example with reference to the accompanying

10. drawings in which:-

FIGURE 1 is a sectional view of the end portions of two lined pipe sections and the coupling sleeve prior to assembly for a coupling according to the parent specification;

15. FIGURE 2 is a sectional view of a coupling joint in accordance with the parent specification;

FIGURE 3 is a perspective view of an end face collar;

20. FIGURE 4A is a sectional view of one form of the coupling sleeve before reduction to include the sealing band;

FIGURE 4B is a sectional view of the coupling sleeve of FIGURE 4A after the sleeve has been reduced in diameter to contain the sealing band;

25. FIGURE 5 is a sectional view of a coupling joint formed in accordance with the divisional specification from spray coated lined pipe joined by an interference fit;

30. FIGURE 6 is a perspective view of an end face collar for use in joining bell and pin ends of lined pipe to the divisional specification; and

FIGURE 7 is a sectional view of a coupling joint formed using the end face collar of FIGURE 6.

Conventionally, metal pipe sections having a continuous tubular plastic liner such as polyvinyl chloride or other plastic are formed so that the plastic liners extend from the end of the section and overlap at a joint or are formed in some other manner so that the ends of the plastic liners are joined to form a continuously lined conduit.

When a section of such lined conduit is removed, the removal is usually accomplished by merely cutting through the pipe. The pipe may be cut for several reasons, such as to remove a faulty, damaged or leaky section or to install a T or other apparatus. However, when a portion of the conduit is removed, such as by sawing, the pipe and liner are both severed in the same plane leaving an open end. The end face of the pipe is thus exposed and not coated with the liner. In order to rejoin the pipe sections or to join the pipe sections with other conduit, means must be provided to protect the exposed end face of the pipe.

FIGURE 1 illustrates the opposed ends of two pipe sections wherein the pipe liner and metal pipe are coterminous and which are to be joined to form a continuously lined conduit. As illustrated in the drawings, a first pipe section 10 having a plastic liner 11 is to be joined with a second section pipe section 12 having a plastic liner 13. The metal pipes 10 and 12 both have exposed end faces 14 and 15 lying in the planes of the end faces of liners 11 and 13, respectively. In order to protect the end faces 14 and 15 and join

- the ends of the pipe sections 10 and 12 to form a continuously lined conduit, an end face collar 30 is positioned within the open end of pipe 10. As illustrated in FIGURE 3, the end face collar 30 comprises an open-ended cylindrical body 31, the outer dimensions of which substantially conform to the internal dimensions of liner 11 in the pipe. The end face collar 30 includes a radially extending flange 32 which radiates outwardly from the end of the body 31 to mate with the exposed end face 14 of the pipe 10 as illustrated in FIGURE 1. Preferably the end face collar 30 is of the same material as liner 11. Therefore, end face collar 30 may be bonded to the liner 11 with a solvent such as methyl ethyl ketone or any suitable conventional epoxy cement or the like compatible with the materials used. Flange 32 radiates outwardly at least as far as required to completely cover the exposed end face of the pipe and may have an external diameter as much as 0.015 inch greater than the external diameter of the pipe.

An identical collar 30 is similarly positioned within the open end of the second pipe section 12.

25. The ends of the pipe sections 10 and 12 are arranged coaxial with a coupling sleeve 20. Coupling sleeve 20 may be a relatively short section of metal pipe having an internal diameter slightly less than the external diameter of the ends of pipe sections 10 and 12. In the preferred embodiment, the internal diameter of coupling sleeve 20 is

approximately 0.060 inch less than the external diameter of the ends of the pipe sections 10 and 12. The difference in internal and external diameters is known as the interference and, as is known in the art, may vary depending on the size and wall thickness of the pipe, the material of the pipe, the axial length of the interference and other factors.

The open ends 23 and 24 of the coupling sleeve are preferably flared outwardly as indicated in FIGURE 1 to aid in the insertion of the open ends of the pipe therein.

In the preferred embodiment, coupling sleeve 20 is provided with an approximately centrally located annular recess or groove 21 which carries a sealing band 22. Sealing band 22 is preferably of the same material as liner 11 and end face collar 30. The sealing band 22 is preferably bonded or otherwise secured within the recess 21 with a suitable epoxy bonder or the like. The internal diameter of sealing band 22 is at least as small as the internal diameter of the remainder of coupling sleeve 20 and may have an internal diameter as much as about 0.005 to about 0.015 inch less than the internal diameter of the coupling sleeve 20.

The coupling joint is formed by either simultaneous or individually forcing the open ends of pipes 10 and 12 fitted with end face collars 30 as described hereinabove into the opposite open ends of the coupling sleeve 20.

In order to assure a uniform and stable joint, it is preferred that the ends of pipe sections 10 and 12 be cleaned and sized prior to assembly.

- It is well known that outer diameters of pipe may vary slightly from manufacturer to manufacturer and frequently pipe is not completely circular in cross-section. This may be particularly true where the conduit has been previously used. Furthermore, buried or exposed conduit may have corrosion on the exterior surface. Therefore, in order to prepare the ends for interference fit joining, the ends may be cleaned to remove scale and corrosion by conventional means and sized by passing a circular sizing collar thereover. Sizing the ends to the desired external diameter prior to assembly assures that the desired interference is achieved and avoids galling, etc., which would be detrimental to forming a satisfactory interference fit joint.

- If desired, a suitable solvent or bonding agent may be applied to the flanges 32 immediately prior to assembly of the coupling to provide a sealing bond between the opposed faces of the flanges 32 and between the edges of the flanges and the sealing band 22.

- In forming interference fit joints a lubricating agent is sometimes applied to the end of the pipe to aid in inserting it in the bell. When a conventional lubricating agent is used, care must be taken to avoid mixing the lubricating agent with conventional plastic bonding agents such as PVC cement since the lubricating agent will interfere with a formation of a bond between the plastics parts

- In the preferred embodiment an epoxy resin is used as both a lubricating agent and to aid in forming metal-to-metal bond between the ends of the pipe and the coupling sleeve 20. Any suitable conventional bonding agent may be used. A two-part epoxy agent for forming metal-to-metal seals has been found particularly suitable. The preferred epoxy resin is a metal bonding agent sold under the name Steel Seam by Cooks Paint and Varnish Company of Kansas City, Missouri. This bonding agent is a two-part epoxy comprising a curing agent (sold under the trade designation 920L927) which is mixed with a base (sold under the trade designation 920W979). The curing agent and base are mixed immediately prior to use and applied to the external surface of the pipe ends immediately prior to insertion of the pipe ends in the coupling sleeve 20. Care should be taken to avoid mixing the metal-to-metal bonding agent with any PVC cement or solvent used to join the plastic parts. The particular two-part epoxy described hereinabove, however, may be used for both bonding PVC parts as well as the metal joint. In this case no PVC cement used. Instead the two-part epoxy is applied to both the plastic parts and ends of the pipe before insertion of the pipe ends into the coupling sleeve. While the plastic-to-plastic seal achieved is not of the quality achieved with PVC cement, it has been found suitable in most applications. Therefore, a single application of this epoxy may serve as lubricating agent, the metal-to-metal bonding agent and the plastic-to-plastic bonding agent to eliminate problems of contamination.
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Various commercially available apparatus may be used for forcing the pipe ends into the coupling sleeve. For example, a conventional pipe press may be used. In the preferred embodiment, the coupling sleeve is held stationary and the end of one pipe telescopically forced there into until the leading edge of the flange 32 is approximately centrally located within the sealing band 22. The other pipe end is then forced into the opposite end of the coupling sleeve 20 until the opposing flanges 32 meet in an abutting relationship within the sealing band 22.

The completed joint is illustrated in FIGURE 2. It will be observed that the opposed faces of the flanges 32 are mated in a sealing relationship and their outer edges mate with the sealing band 22 to form a sealed connection. The flanges 32 are held together by the end faces 14 and 15 of the pipe ends which are fully encased within the plastic material. Thus, a fully plastics lined conduit is formed. However, structural rigidity is maintained by the interference fit between the pipe ends and coupling sleeve 20. In order to lock the ends of the pipe in a fixed relationship, the flared ends 23 and 24 of coupling sleeve 20 are then radially compressed into the pipe sections 10 and 11 respectively.

Radial compression of the ends of the sleeve 20 to form a crimped interlock may be performed by various methods. Any apparatus which deforms a portion of the sleeve into a corresponding groove

- in the pipe formed by compressing the end of the sleeve may be used. In the preferred embodiment, uniform radial compression is accomplished by partially forcing a crimping collar axially over the end of the sleeve 20 after the interference fit joint has been formed. The crimping collar has an internal diameter which is divergent from a diameter of a slightly more than the external diameter of the pipe to an internal diameter greater than the external diameter of the flared portion of the sleeve. The flared crimping collar is placed over the pipe with its internal diameter expanding in the direction of the sleeve. After the interference fit joint has been formed, the crimping collar is moved axially over the pipe to engage the flared end of the sleeve. Since the crimping collar is internally flared and completely surrounds the pipe, the end of the sleeve is uniformly radially compressed and forced into the pipe to form a groove 25. The end of the sleeve 20 is thus permanently deformed and fitted into the groove 25 to form a interlocking joint as shown in FIGURE 2.

- While it is preferred that the crimped interlock be formed by uniform radial compression for a full 360° around the end of the sleeve, it will be recognised that a full 360° crimp is not necessarily required. Any portion of the sleeve may be crimped to interlock the pipe sections without departing from the principles of the invention. When less than a full 360° crimp is used, however, the degree of mechanical interlock will be proportionately reduced.

While crimping the mouth end of the sleeve by forcing a crimping ring thereover has been described it will be readily appreciated that other means may be used for applying radial compression to

- 5. the mouth or other portion of the sleeve. For example, a circumferentially rotating inwardly compressing roller may be used to roll the mouth of the sleeve into the pipe to accomplish similar results. Rolling the mouth of the sleeve to form the crimp does
- 10. not apply uniform radial compression to the mouth and thus may not form a uniformly crimped joint. However, use of a circumferential radially compressing roller permits deformation of the sleeve 20 at locations other than the end thereof. For example, a circumferential
- 15. radial roller may be used to form one or more grooves or sections of grooves at various locations along the length of the sleeve to form similar mechanical interlocks.

- The interconnection method and apparatus
- 20. described hereinabove may be used equally well with conduit in which the liner is a tubular liner bonded to the internal surface of the pipe and with spray-coated liners formed in place by spraying or otherwise applying a fluid liner to the interior
 - 25. of the pipe to form a liner in place. However, the formed in place liners are usually thinner than bonded tubular liners and sometimes rupture when the groove 25 is formed by compression of the open end of the sleeve. Obviously, if the
 - 30. liner is ruptured, cracked or dislocated by the crimping operation, a fully lined conduit will not be formed. In accordance with the preferred

- practice of the invention, the tubular body 31 of the end face collar 30 must be of sufficient axial length to extend past the groove 25 formed in the crimping operation. If the tubular body is bonded to the liner 11 and extends past the groove 25, the body 31 will merely be slightly deformed at the groove but will not separate from the liner 11, thus a fully lined conduit will be maintained.
10. Since the end faces 14 and 15 of the pipe sections 10 and 12 may not lie exactly 90° from the longitudinal axis of the pipe sections, the opposed flanges 32 may not be fully engaged when the joint is assembled. Accordingly, the sleeve
15. 20 is provided with a sealing band 22 as described hereinabove. Therefore, even though there may be a partial gap between the flanges 32 in the completed joint, any fluid entering the gap can only contact the sealing band 22 so long as the ends of the
20. pipe sections are within the sealing band 22 in the completed joint.

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Where relatively thick-walled material is used for the coupling sleeve 20, recess 21 may be formed by cutting a centrally located annular recess in the internal surface of the sleeve. A sealing

5. band 22 of appropriate dimensions and of the desired material may then be affixed within the recess. The sealing band may, of course, be a pre-cut section of material or may be formed in place in the recess 21. Alternatively, where reduction of the wall
10. thickness of the sleeve by grooving is undesirable a pre-cut sealing band of the required dimensions may be positioned and preferably bonded within a sleeve 20 as shown in FIGURE 4A. Thereafter, the sleeve 20 is reduced in external and internal diameter on both
15. sides of the sealing band 22, thereby containing the sealing band 22 within a groove 21 of the original diameter of the sleeve, as shown in FIGURE 2B. Shrinking of the sleeve 20 to the desired dimensions may be accomplished by forcing a sizing ring thereover
20. as described hereinabove with respect to the pipe ends. In any case, the coupling sleeve is formed to contain a sealing band of appropriate size and material approximately centrally located therein having an internal diameter which is less than the external
25. diameter of the pipe to be joined thereby.

The coupling joint described is particularly suitable as a repair joint for coupling the open ends of an installed conduit in the field. While the joint has been described with particular reference to

5. joining two identical open pipe ends to form a continuous conduit, it will be appreciated that the principles thereof are equally applicable to joining one open pipe end with other conduit means where the coupling sleeve is appropriately designed. For example
10. the coupling sleeve may have different internal diameters on opposite sides of the sealing band if the sealing band is appropriately designed to mate with collars of different external diameters to join pipe sections having different external diameters.
15. Likewise the coupling sleeve 20 may be an integral part of another conduit section, valve or T-piece wherein the sealing band forms part of or is previously bonded to an internal liner. Likewise, although the invention has been described in connection with use
20. of a PVC liner, it will be readily recognised that the method is equally applicable to other types of liners, including lining materials which are formed in place in the conduit by spraying.

- Furthermore, although the method as described
25. above is particularly useful in making repair joints in an installed lined conduit, the principles thereof are equally applicable to joining lengths of lined pipe sections to form a lined conduit.

Another method of forming a fully lined junction

30. between two pipe sections with an interference fit, is illustrated in FIGURE 5 wherein the end face collar 30

- is used to coat the end face of one pipe section 50. As indicated above, conventional interference fit couplings cannot be formed to join two lengths of spray coated lined pipe and form a fully lined conduit since the pin end of the pipe is either not coated or the coating thereon is so thin or weak that it is damaged by insertion of the bell. In accordance with the alternative method, one end of the pipe section 52 is enlarged to form a bell 54 having an internal diameter slightly less than the pin end of pipe section 50. The bell 54 is thus connected to the pipe 52 by a tapered throat 55. A formed-in-place coating 51 is formed on the internal surface of the pipe sections 50 and 52 by conventional means such as spraying.

- The coating on the pin end 50 therefore extends only to the end face of the pipe or may actually cover all or part of the end face. Any such formed in place coating, however, would be too fragile to withstand an interference fit coupling. The coating in the bell end extends at least through the throat 55 but does not extend substantially into the bell 54. Obviously, any coating 51 extending into the bell 54 would be scraped from the method pipe surface by the pin end when the interference fit joint is formed and may interfere with the formation of an interference fit joint.

- To form a fully lined coupling, an end face collar 30 as described herein above is positioned within the pin end of pipe section 50 with the radially extending flange 32 covering the end face of the pin

- end 50. The tubular body 31 of the end face collar extends into the pipe 50 well past the point where the groove will be formed when the mouth of the bell is deformed and is bonded to liner 11, all as described hereinabove. The pin end 50 is then telescopically forced into the bell 54 until the flange 32 on the end face of the pin mates with and overlaps the leading edge of the coating 51 in the throat 55. As described hereinabove, the pin end of the pipe 50 and the flange 32 are coated with a bonding agent prior to insertion into the bell so that the flange 32 may be bonded directly to the liner 51 in the throat 55. Thus, a metal-to-metal interference-----
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- fit coupling is formed between the pin end 50 and the bell 54 while a bonded plastic-to-plastic seal is formed between the liner 51 in pipe section 52 and the end face collar 30 forming a continuously lined conduit. The mouth 56 of the bell 54 may then be deformed radially inwardly to form and interlock with a groove 57 as described hereinabove to form an interlocked interference fit coupling.
5. Since the tubular body 31 of the end face collar 30 extends past the mouth of the bell 54 and is bonded to the liner 51 in pipe section 50, any rupture or displacement of the liner 51 by formation of the groove is covered by the body 31, thus insuring a fully lined coupling.
10. In order to form an extended overlap of the plastic liner in the joint, the end face collar 30 may be modified as shown in FIGURES 6 and 7. In the modified end face collar of FIGURES 6 and 7 the radially extending flange 32 is extended axially and reverse curled to taper inwardly as shown at 32A. The inwardly tapered extension 32A thus overlaps and mates with the liner 51 in the throat 55 of the bell. The overlapped extension 32A may therefore be bonded directly to the liner 51 in an extended overlap region to form a more effective plastic-to-plastic bond in the joint and form a more effective lined joint. In all other respects, the joint formed as shown in FIGURE 7 is the same as the joint formed as shown in FIGURE 5.
15. From the foregoing it will be appreciated that the couplings described hereinabove may be formed using various types of liners for either repair couplings modifications or for original installation coupling of pipe lined with formed in place liners.
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1. A coupling between two lengths of pipe each of which has a plastic liner, including for each length a plastic collar having a tubular portion fitting in the plastic liner of its pipe length and an external flange covering the end of its pipe length, the two lengths being fitted into opposite ends of a coupling sleeve with the two external flanges in contact.
5. 2. A coupling as claimed in Claim 1 in which the coupling sleeve has a plastic liner in contact around both external flanges
10. 3. A coupling as claimed in Claim 1 or Claim 2 in which the two external flanges are bonded together.
15. 4. A coupling as claimed in any of Claims 1-3 in which the tubular portion of each plastic collar is bonded in its plastic liner.
20. 5. A coupling as claimed in any of Claims 2-4 in which the external flanges are bonded to the liner in the coupling sleeve.
25. 6. A coupling as claimed in any of claims 1-5 in which the two pipe lengths are interference fits in the coupling sleeve.
30. 7. A coupling as claimed in any of Claims 1-6 in which the liners extend to the end of the pipe lengths.



8. A coupling as claimed in any of Claims 2-7 in which the liner in the coupling sleeve is at a mid position in the coupling sleeve, not extending to the ends of the coupling sleeve.
5. 9. A coupling as claimed in any of Claims 1-8 in which the ends of the coupling sleeve are radially inwardly deformed to form grooves in, and to interlock with, the respective pipe lengths.
10. 10. A coupling as claimed in Claim 9 in which the tubular portion of each plastic collar extends beyond the groove in the pipe length.
15. 11. A coupling as claimed in any of Claims 1-10 in which the coupling sleeve comprises a cylindrical body having an internal diameter less than the external diameter of said pipe lengths, an approximately centrally located annular recess in the internal surface thereof, and a cylindrical plastic band having an internal diameter at least as small as the internal diameter of said coupling sleeve positioned within said annular recess.
20. 12. A sleeve as claimed in Claim 11 in which the ends of the sleeve are flared radially outwardly.
25. 13. A coupling between two lengths of pipe constructed and arranged substantially as herein specifically described with reference to FIGURE 2 of the accompanying drawings.
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14. A method of joining the open ends of two lengths of metal pipe each having a plastic liner to form a continuously lined conduit comprising; inserting a plastic collar in the open end of each of the pipe lengths, said plastic collar comprising a tubular portion fitting in the liner in the pipe length and an external flange covering the end of the pipe length; and inserting the ends of said pipe lengths into opposite ends of a coupling sleeve having an internal diameter slightly less than the external diameter of said pipe length prior to insertion until said flanges meet in abutting relationship.
15. A method as claimed in Claim 14 in which the end of the coupling sleeve are deformed inwardly to form grooves in the pipe lengths, thereby mechanically interlocking the pipe lengths and said coupling sleeve.
16. A method as claimed in Claim 14 or Claim 15 in which a bonding agent is applied to the end of at least one pipe length and to the/or each flange prior to insertion.
17. A method of joining the open ends of two lengths of metal pipe each having a plastic liner to form a continuously lined conduit performed substantially as herein specifically described with reference to FIGURES 1-4 of the accompanying drawings.

The text of the specification has been reproduced by photocopying the applicants original typescript. It may contain a few amendments which are difficult to read. The original typescript containing these amendments may be inspected on the premises of the Patent Office



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