Προδιαγραφή εργασίας αντικατάστασης κυρίων αγωγών με την μέθοδο swagelining/close-fit

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PROCEDURE FOR MAINS REPLACEMENT- Swagelining/ Close- Fit (PE.PIPE)

1. SCOPE

This procedure gives guidance for operational personnel engaged on the replacement of existing mains by Swagelining and should be used in conjunction with the corresponding Code of Practice.

2. REFERENCES

Unless otherwise specified this document shall be used with reference to the latest editions of related procedures, standards and specifications dealing with safety, construction planning, traffic management, excavations, reinstatements, materials, plant and equipment, testing and commissioning.

3. DESIGN

3.1 Cold swagelining

Cold swagelining is the process of pulling the pipe using a specially fabricated nose cone pulling head, butt fused to the end of the PE pipe through a die at ambient temperature to reduce its diameter sufficiently to permit its entry into the main to be lined.

3.2 Hot Swagelining

Hot swagelining is a process similar to cold swaging with the addition of pre-heating the PE pipe to a temperature of no greater than 70°C before entry into the die. Hot swagelining reduces towing loads.

3.3 Selection of insertion pipe

The PE liner pipe should have an original diameter slightly larger than the bore of the pipe to be lined in order to obtain a close fit. Both standard and non-standard PE pipe sizes may be used (see Table 1)

3.4 Location of Excavations and selection of pipe storage sites

The swagelining method is closely associated with mains insertion, and consequently the details provided on the selection of launch/reception, intermediate excavations and pipe storage areas in that procedure also apply in this case.

Maximum use should be made of all available records. Details of material types together with the position of existing valves, plugs, bends, tees, condensate receivers, change and double collars, service connections or any other obstructions in the main should be obtained.

Details of other utilities plant must be obtained and both electricity cables and telephone ducts should be physically marked out on site.

Route inspection together with on site marking-out of the main and any recorded features should take place to assist with the validation of recorded information.

3.5 Maintenance of supplies

The guidance given in the procedure for mains insertion also apply in this case.

3.6 Closed circuit television (CCTV) survey and cleaning operations

CCTV survey and inspection details are provided in the Code of Practice corresponding to this procedure.

4. SAFETY ASPECTS

4.1 Close-fit lining involves the use of winching equipment. The following basic essential precautions shall be taken:

a) The Engineer shall ensure that all equipment is of suitable construction for its duty and is in good condition. Those who operate the equipment shall be adequately trained.

b) The rig, winch, lifting and towing equipment (e.g. cable, rope) shall be visually inspected for damage and wear prior to use.

c) Shackles, chains, lifting slings and towing eyes shall be clearly stamped with SWL details, and test certificates shall be available upon request.

d) The close-fit lining rig shall be of adequate design to withstand the forces likely to be imposed during operation. It shall be proof tested and labelled with its SWL.

e) The winching equipment shall be fitted with a calibrated load indicator.

Only purpose built winching equipment shall be used for any winching operation.

f) The winch unit shall be fitted with an automatic safety override to ensure that the maximum pulling force cannot be exceeded.

4.2 Where practicable, the winch load shall be reacted against the outlet end of the existing main, and all cables/ropes under tension shall be below ground or constrained. The length of exposed cable or rope under tension shall be kept to a minimum and contained or constrained against breakage. Care shall be taken when the PE is finally pulled through the die as reversion and sudden release takes place.

Adequate precautions shall be taken to ensure that all personnel are protected from the length of exposed cable or rope under tension.

Anchorage should be provided to prevent unexpected movement whilst a pipe string is set out on rollers.

5. SWAGELINING/ CLOSE-FIT LINING INSTALLATION OPERATION

5.1 Prior to commencement of close-fit lining operations, the interface of the PE pipe to the host metallic main shall be treated by either of the following methods:

a) whilst observing appropriate safety precautions, rounding off all of the cut ends of the host metallic main using a suitable rotary grinding tool, or

b) installing a 2mm thick stainless steel shim at the metallic to PE interface at the point where the PE pipe protrudes from the host metallic main.

5.2 The close-fit lining die shall be checked for damage and kept clean.

5.3 Swivel links are used during winching to ensure that the inserted pipe is not twisted by the swagelining operation.

5.4 Close-fit lining should preferably be a continuous process. In the case of hot swagelining, if for any reason a stoppage is necessary, the burner should be shut down, the burner door opened and the fan left running to reduce the temperature. If these steps are not taken necking of the material may occur when the towing winch load is re-applied.

In the case of both hot and cold swagelining, it is essential to maintain a reduced winch tension during any significant pause in close-fit lining. This reduced winch load should be sufficient to prevent rapid reversion but insufficient to pull more pipe through the die.

5.4 During the close-fit lining operation the towing rates, temperature (in the case of hot swagelining), inserted pipe sizes and towing loads should be monitored. The maximum towing force on any pipe shall not exceed the values given in Table 1.

5.5 The pipe entry roller shall be adjusted once the towing head slowly starts to enter the pipe to ensure the inserted pipe is centralised and is moving steadily without touching the sides of the host carrier main. The winch speed can then be increased smoothly up to its maximum (6 – 10 metres/min is recommended), and maintained, except for circumstances set out in 5.6 below, until the leading end of the pipe string emerges from the other end of the host pipe in the exit excavation. The winch speed should then be smoothly reduced, but whilst still maintaining tension, as the leading end of the pie string reaches its terminal position.

5.6 If there are intermediate excavations to be crossed where a section of the host main has been removed, the winch operator must be made aware of the progress of insertion and slow down the winch as the liner passes through the gap. If the gap is at a change in direction or grade, it may be necessary to guide the liner into the host main again, possibly by using an excavator with a guide roller attached to its dipper arm. This requirement should be determined beforehand, so that the roller can be in place before the pull is started.

5.7 Once the towing head has emerged from the end of the host main, further pipe should be pulled through to allow for reversion of the pipe when the winch load is removed. At least 4% expansion has to be allowed on a length of swaged pipe.

5.8 Each individual close-fit lining operation should be recorded on a data sheet. A typical close-fit lining data sheet is shown in Appendix A.

5.9 Precautions shall be taken to ensure that the pipe end does not damage the cable or rope where it emerges from the host main.

5.10 During close-fit lining, the following precautions shall be taken:

a) Radio, or other approved types of communication shall be maintained at all times between the close-fit lining rig and winch unit operators.

b) Pedestrians shall be excluded from the footpath area when passing the exposed cable/rope under tension between the close-fit lining rig and the pipe entry point.

c) An "unsafe zone" shall be indicated around the close-fit lining rig and winch unit by the use of physical barriers and signs warning of "NO ENTRY".

NOTE – To avoid confusing drivers, the "NO ENTRY" sign should not be the same as that used for road traffic.

d) Adjustment of the pipe entry roller to allow the PE towing head to enter the pipe requires one person to enter the launch pit adjacent to the pipe entry roller. Once this has been done, personnel should not enter the trenches.

e) Only the person measuring the dimensions of the inserted pipe should be allowed to stand at the front of the close-fit lining rig. All other personnel shall stand clear of the close-fit lining rig cable/rope and winch unit whilst close-fit lining is in progress.

f) All personnel should wear safety helmets, gloves and protective footwear.

g) All anchor points shall be monitored whilst close-fit lining is in progress.

h) Care should be taken when removing the "split die" due to circumferential stress loading at this point. The "split die" bolts should be removed first followed by the carrier bolts.

5.11 The use of clean water to lubricate and clean the PE pipe is recommended. Additionally, two small "V"(vee) cuts in the end of the PE pipe to effectively chamfer the pipe pulling end, assist in reducing the towing load in a controlled manner in the final stage of the operation.

6. CONNECTION OF CLOSE-FIT LINED SECTIONS

6.1 Sufficient time should be allowed after removal of the winch load to permit natural recovery of the close-fit lined pipe before any connections are made.
A minimum of 1 hour should be allowed. Dependent upon the ambient temperature conditions, overnight relaxation of the close-fit lined pipe is advantageous to avoid undue stress on the fitting.

The length of free-standing SDR 26 and thinner walled PE pipe should not be greater than 10 metres, and it is essential that a good standard of backfill and compaction of materials surrounding the PE pipe is achieved.

6.2 Where a metal-bodied transition fitting is used to connect close-fit lined pipe together, the fitting should be "self"end loaded and also adequately supported prior to backfilling.

6.3 When connecting metal bodied transition fittings, the distance between flange packing faces should not be greater than 0.1% of the exposed length of pipe.

6.4 Where connections are made to non-anchored mechanical joints, a system of anchoring the pipe against thermal contraction should be used at intervals not greater than 600 metres. The preferred method of achieving this is by the use of an electrofusion coupling as shown in Figure 7. The pipe shall be expanded to the original outside diameter to permit fusion to take place. Alternatively, this may be achieved by using an anti-shear sleeve and split section of the same size PE pipe, as shown in Figure 8.

6.5 Where electrofusion couplings are used to connect lined sections, the PE pipes shall be expanded to enable steel inserts to be fitted prior to the fusion operation.

Steel inserts shall be used when using electrofusion couplings on SDR 26 or thinner walled PE pipe of any diameter, swaged or unswaged.

6.6 If electrofusion service tees are to be installed on "free–standing" sections of SDR 26 PE pipe, the pipe shall be mechanically supported over a length of 300 mm whilst fusion of the electrofusion service tee takes place.

7. PIPE PROTECTION REQUIREMENTS FOR SDR 26 AND THINNER WALLED POLYETHYLENE PIPE

All "free-standing" sections of pipe shall be protected from the risk of interference damage. Suitable methods of protection are:

a) Laying protective tracer/marker tape and heavy duty protective PE tiles, 300mm above the pipe (minimum size – 3.5 mm thick by 600 mm wide)

b) Laying precast concrete slabs, together with protective tracer/marker tape, 300 mm above the pipe.