VOLUME 5 CONTRACT DOCUMENTS FOR SPECIALIST ACTIVITIES

SECTION 8 TRENCHLESS INSTALLATION OF HIGHWAY DRAINAGE AND SERVICE DUCTS

PART 3

SERIES NG 8000

NOTES FOR GUIDANCE

INTRODUCTION

This Series of the Notes for Guidance applies to the installation by trenchless techniques of highway drainage, service ducts, sleeves and culverts of internal diameters or width 900 mm or less.

INSTRUCTIONS FOR USE

1. Remove Series NG 8000 for Volume 5, Section 8, Part 3 and archive as appropriate.

2. Insert new Series NG 8000 into Volume 5, Section 8, Part 3.

3. Archive this sheet as appropriate.

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Contents

8001. SCOPE

1 These notes for guidance convey as appropriate the reasoning behind the requirements in the Specification where this is considered necessary. The information required from the designer/compiler that will detail the performance required from the trenchless installation is given in Appendix 80/1.

8002. INFORMATION

General

1 Trenchless techniques should be considered for crossing environmentally sensitive areas, roads, railways, airfield runways, taxiways, urban developments and as a means of limiting damage to trees. The techniques have been shown to be a positive means of reducing indirect and social costs, particularly those arising out of traffic delays caused by disruptive installation methods. Trenchless installation also offers the benefits of rapid installation, minimal environmental disturbance and little disruption to an existing pavement and adjacent infrastructure.

2 Trenchless installation of pipes is a continuously evolving technology and developments in industry may overtake this edition of the Specification. The techniques listed in this Specification are not exhaustive and approval of the use of other techniques should not be withheld if they are capable of meeting the performance requirements.

3 In many cases there will be more than one method of installation that could provide an appropriate solution and the designer should allow the Contractor to select from the range of alternative techniques. The performance requirements are specified in Appendix 80/1 and these should influence the Contractor's choice of installation method.

4 (11/06) In addition to the information required in Appendix 80/1, the designer should provide Drawings showing the following information:

- Identification of pipe runs to be constructed using trenchless, minimum dig or rehabilitation techniques;
- Existing pipes to be replaced;
- Existing chambers which may be used as launch/ reception pits and reinstated;
- Existing chambers which may be used as launch/ reception pits and abandoned;
- Launch/reception pits to be converted to permanent chambers;
- Existing pipes to be connected to new pipes;
- Working areas;
- Areas of contaminated land;
- Carriageway levels and sections;
- Information on underground structures and foundations;
- Location of Statutory Utilities and other authorised users plant;
- Motorway communication cables;
- Road lighting and power cables.

5 The Contractor's chosen solution may be a proprietary system. All elements to be designed by the Contractor should be listed in Appendix 1/11.

6. (11/06) Series NG 000 (MCHW 2.000) should be consulted on the preparation of Contract-specific information and requirements.

General

1 Guidance on the various methods and their suitability for different applications is given in Tables NG 80/1 to 80/5. The Tables show typical pipe sizes and lengths of drives. This information should only be considered as a guide.

Table NG 80/1 - Trenchless New Installation Techniques

Technique	Pipe Diameter (mm)	Pipe material	Soil Types	Typical Installation Length	Limitations/comments
Microtunnelling	150 – 900	C, Co, GRP, SRC	Any	up to 150 m	Boulders and obstructions can halt machine. Installations above 900 mm i.d. are outside the scope of this document although the technique may be appropriate for larger diameter pipes
Pipe Jacking	=900	C, Co, GRP, SRC	Any	up to 250 m	Not suitable for working under water at diameters less than 900 mm. Installations above 900 mm i.d. are outside the scope of this document
Directional Drilling	300 – 900	S, PE	Not gravels, rock or soil with a large number of boulders or cobbles	up to 1500 m	Only suitable for gravity sewers if they have a significant fall, as tolerances cannot be guaranteed. Many systems require tracking of the drill head from the surface above it and are, therefore, unlikely to be suitable for motorway crossings unless equipped with the remote tracking system. Installations above 900 mm i.d. are outside the scope of this document although the technique may be appropriate for larger diameter pipes
Thrust Boring	50 – 500	S, PE	Cohesive is most suitable, avoid cobbles, boulders or soft ground	up to 50 m	Only suitable for small diameter, flexible pipe. Recommended minimum cover = 10 x pipe diameter

Key

C	Clay	GRP	Glass Reinforced Plastic
Co	Concrete	UPVC	Unplasticised Polyvinyl Chloride
S	Steel	PE	Polyethylene
RC	Reinforced Concrete		

(11/06) Further details of pipes can be found in Tables 5/1 and 5/2 (MCHW 1.500)

Table NG 80/2 - Non Steerable New Installation Techniques

Technique	Pipe Diameter (mm)	Pipe material	Soil Types	Typical Installation Length	Limitations/comments
Auger Boring	50 – 900	Various inside Steel casing	Cohesive. Avoid cobbles, boulders or soft ground	60 m	Boulders, cobbles and soft ground can halt/deflect the bore. Installations above 900 mm i.d. are outside the scope of this document although the technique may be appropriate for larger diameter pipes
Pipe Ramming	50 – 900	Various inside Steel casing	Not soil containing boulders	Up to 80 m	Boulders and cobbles can halt/deflect the casing off-line. Installations above 900 mm i.d. are outside the scope of this document although the technique may be appropriate for larger diameter pipes
Impact Moling	40 – 250	PE, UPVC	Cohesive is most suitable, avoid cobbles, boulders or soft ground	Up to 30 m	Boulders, cobbles and soft ground can halt/deflect the bore. Granular soils may provide insufficient friction against the mole. Recommended minimum cover = 10 x pipe diameter

Key

C	Clay	GRP	Glass Reinforced Plastic
Co	Concrete	UPVC	Unplasticised Polyvinyl Chloride
S	Steel	PE	Polyethylene
RC	Reinforced Concrete		

(11/06) Further details of pipes can be found in Tables 5/1 and 5/2 (MCHW 1.500)

Table NG 80/3 - On-Line Replacement Techniques

Technique	Pipe Diameter (mm)	Existing Pipe Material	Upsize Possible	New Pipe Material	Soil Types	Typical Installation Length	Limitations/comments
Pipe Bursting	50 – 800	Co, C, AC, UPVC, CI, PF, S, PE	Up to 800 mm diameter	C, PE, GRP, PP Continuous or segmental	Avoid narrow rock trenches, concrete surround or densely packed granular soil	100 m Maximum 400 m	Cannot handle ductile iron collars or valves. Curves can be negotiated using continuous pipe. Burster can deal with localised pipe collapses. Existing flows must be diverted. Lateral connections must be disconnected before replacement starts
Pipe Eating	200 – 600	C, Co, AC, GRP, RC	Up to 600 mm diameter	GRP, Co, C Continuous or segmental	Any	150 m	Some can operate in live drainage conditions but care must be taken to avoid polluting flows during replacement

Key

C	Clay	CI	Cast iron	PE	Polyethylene
Co	Concrete	GRP	Glass Reinforced Plastic	UPVC	Unplasticised Polyvinyl Chloride
S	Steel	S	Steel	PP	Polypropylene
RC	Reinforced Concrete	PF	Pitch Fibre		

(11/06) Further details of pipes can be found in Tables 5/1 and 5/2 (MCHW 1.500)

Table NG 80/4 - Minimum Dig New Installation Techniques

Technique	Pipe Diameter (mm)	Pipe Material	Soil Types	Typical Installation Length	Limitations/comments
Narrow Trenching	90 – 5900	PE, UPVC, C	Cohesive and self-supporting	150 m/day	Maximum depth to invert is 3 m. Can be difficult to achieve compaction in a narrow trench, self-compacting backfill is recommended
Mole Ploughing	45 – 300	Continuous flexible PE	Most. Avoid very hard ground, very soft ground and soft/hard layers	150 - 300 m/day	Maximum depth to invert is 2 m Only suitable for verges, fields, etc

Table NG 80/45 - (11/06) **Rehabilitation**

Technique	Pipe Diameter (mm)	Pipe Material	Soil Types	Typical Installation Length	Limitations/comments
Cured in Place Lining	75 – 900 – 1200	In accordance with WIS 4-34-04	Any	Manhole to manhole	Long-term strength depends on type of resin used and method of curing. Should be designed in accordance with WIS 4-34-04
Sliplining	20 – 900 – 2500	PE, C, Co, RC, GRP	Any	Manhole to manhole	Reduction in cross sectional area of pipeline may significantly reduce flow capacity of pipeline

Key

C	Clay	GRP	Glass Reinforced Plastic
Co	Concrete	UPVC	Unplasticised Polyvinyl Chloride
S	Steel	PE	Polyethylene
RC	Reinforced Concrete	WIS 4-34-04	Renovation of gravity sewers by lining with cured-in-place pipes (11/06)

(11/06) Further details of pipes can be found in Tables 5/1 and 5/2 (MCHW 1.500)

8004. GENERAL REQUIREMENTS

Method Statements

1 Specific requirements for information to be provided in the Contractor's Method Statement should be entered in Appendix 80/1. The following list includes examples of items that may need to be provided:

- Site staff and organisation;
- The experience of the Contractor and his staff, with the installation type and the identified ground conditions;
- The details of the plant should be sufficient to demonstrate its suitability for achieving the requirements and to work within any noise and vibration limits where these are restricted;
- Setting out method and means of achieving specified tolerances;
- Location and construction details of drive and reception pits;
- Method of spoil removal and storage;
- Methods of dealing with ground water and existing pipe flows;
- Design loads for pipes;
- Design information for Cured in Place Liners;
- Maximum permitted draw and angular deflection for the pipes;
- The use of support fluids, lubricants and drilling fluids;
- Risk Assessments;
- Pit access;
- Emergency procedures;
- Geotechnical Certifications;
- Working hours.

Records

2 Records to be kept by the Contractor and supplied to the Overseeing Organisation should be entered in Appendix 80/1. Table NG 80/6 includes examples of items that may need to be provided.

Ground Movement

3 Where trenchless installations are undertaken beneath motorways and trunk roads no heave or settlement should be allowable. If the designer considers this is too onerous, values of acceptable heave or settlement should be entered in Appendix 80/1. For installations in other areas the designer should consider the allowable values for heave and settlement and enter these in Appendix 80/1.

4 In order to monitor any heave or settlement caused by the pipe installation, the Contractor should take measurements of levels at the locations and frequencies specified in Appendix 80/1. The designer should choose the locations with a view to the practicality of taking the readings. Existing levels at the locations should be agreed with the Contractor prior to work commencing.

Monitoring Adjacent Structures and Services

5 The Overseeing Organisation should determine the location and condition of adjacent structures and services that are likely to be affected by the Works. Certain structures may be particularly susceptible to noise, vibration or ground movement and, prior to inviting tenders, the Overseeing Organisation should assess where special measures are likely to be required for protecting these structures. The information on location and condition of these structures together with the restrictions to be imposed and the monitoring requirements should be presented by the Overseeing Organisation on the Drawings and in Appendix 80/1. The Contractor is required to confirm the information on site and provide proposals to meet the requirements of the Overseeing Organisation in respect of these structures and services.

Machinery

6 All machinery should be checked for electromagnetic compatibility to ensure that there are no conflicts of operational frequency between the trenchless installation plant and any motorway communications system. This is particularly important due to the sophistication of the motorway and other control systems now in use.

Contaminated Land

7 All areas of contaminated and potentially contaminated land should be thoroughly investigated prior to the design. The results of the investigation should be included in Appendix 80/1 and the accompanying Drawings and schedules.

Table NG 80/6: Records to be kept (As indicated by an asterisk)

	Micro Tunnelling & Pipe Eating	Pipe Jacking	Directional Drilling	Thrust Boring	Auger Boring	Pipe Ramming	Impact Moling	Pipe Bursting	Narrow Trenching	Mole Ploughing	Cured in Place Lining	Sliplining
Contract	*	*	*	*	*	*	*	*	*	*	*	*
Reference of pipe run	*	*	*	*	*	*	*	*	*	*	*	*
Date of work	*	*	*	*	*	*	*	*	*	*	*	*
Start time	*	*	*	*	*	*	*	*	*	*	*	*
Finish time	*	*	*	*	*	*	*	*	*	*	*	*
Details of any stoppages	*	*	*	*	*	*	*	*	*	*	*	*
Diameter of bore	*	*	*	*	*	*	*	*	*	*	*	*
Pipe material	*	*	*	*	*	*	*	*	*	*	*	*
Pipe diameter	*	*	*	*	*	*	*	*	*	*	*	*
Joint packing	*	*	*		*		*	*				
Length installed	*	*	*	*	*	*	*	*	*	*	*	*
Main survey checks	*	*	*	*	*	*	*	*	*	*		
Soil conditions	*	*			*				*			
Ground water level	*	*			*				*		*	*
Line and level achieved	*	*	*	*	*	*	*	*	*	*		*
Lubrication	*	*	*					*				
Support Fluid			*					*				
Jacking & winch loads w.r.t. progress	*	*	*	*				*	*	*		*
Slurry pressures, viscosity, discharge, flow rate	*	*	*									
Shield role, pitching, steering adjustment	*	*	*									
Thrust rate, cutting torque, soil discharge	*	*	*									
Interval at which measurements should be taken												
Grout materials and volumes												*

8005. PIPES FOR DRAINAGE AND SERVICE DUCTS

Pipes

1 The pipes used will depend on several factors including ground conditions, method of installation and intended use. Many trenchless methods can use standard pipes but microtunnelling and jacked methods require specially constructed pipes. Apart from meeting its in-service performance requirements the pipe has to have a structural wall section adequate to meet the forces imposed when it is jacked.

2 If the Contractor intends to use plastic pipes (even if they have a BBA Certificate) he should demonstrate to the Overseeing Organisation that there will be sufficient side support from the trench to retain the design section of the pipeline.

3 Where a trenchless method has been used to create the bore but the pipe is to be installed by hand then the standard pipes and service ducts given in SHW Tables 5/1 and 5/2 can be used. Where pipe installation is to be by towing or jacking then the pipes should be capable of accommodating the increased forces as a result of the installation technique.

Tolerances

4 (11/06) If the designer/compiler wishes to relax the tolerances given in sub-Clause 8005.10 then the revised acceptable tolerances to true line and level for each bore should be entered in Appendix 80/1. Determination of tolerances should take account of the gradient requirements and the proposed purpose of the bore. This will have a bearing on the number and types of trenchless techniques that can be used to install the bore.

Steering of Rigidly Jointed Pipes

5 (11/06) If rigidly jointed polyethylene and steel pipes are subjected to bends exceeding those in Clause 8005.13 there is a risk of the pipe collapsing or flattening out.

Connecting to Existing Drains, Chambers and Channels

6 (11/06) When pipes have been drawn into the bore it is possible, depending on pipe material, that the service pipe will have stretched. It is important to allow the material to recover from this imposed stretch before cutting to fit between manholes, sealing at manholes or manhole invert shaping. Polyethylene pipes usually take at least 12 hours to recover.

8006. SPECIFIC REQUIREMENTS FOR ON-LINE REPLACEMENT TECHNIQUES

Specific Requirements for Pipe Bursting

1 Where the existing pipe has deviations in line or level over a length in excess of 5 m, that section of pipe should be replaced by non-trenchless techniques.

8008. SPECIFIC REQUIREMENTS FOR REHABILITATION TECHNIQUES

Specific Requirements for Cured in Place Lining

1 The thickness and composition of the liner is designed in accordance with the WIS 4-34-04.

2 Details of the liner design should be given to the Overseeing Organisation along with the results of testing on the samples from the installation. This is the only control on the structural capabilities of the liner.

Specific Requirements for Sliplining

3 Where grouting of the annulus is undertaken extra care should be exercised to ensure flotation does not occur as this could put the finished pipeline out of tolerance.

NG SAMPLE APPENDIX 80/1: TRENCHLESS AND MINIMUM DIG TECHNIQUES

[Note to compiler: This should include:]

1. (11/06) Identification of those drainage or service duct installations from Series 500 Appendix 5/1 and 5/2 that are to be constructed using trenchless or minimum dig techniques and schedule of permitted techniques; Product certificate requirements, for example, Kitemark certificates, BBA certificate etc. *[8004.1]*;

2. Information to be included in Contractor's method statement including directions of bores or sequence of works, if to be specified *[8004.2]*;

3. Records of installation required (refer to Table NG 80/6 plus any additional requirements) *[8004.5]*;

4. (11/06) Allowable ground movements if different from those specified in sub-Clause 8004.7 and the locations and periods when ground levels should be measured *[8004.7, 8004.8]*;

5. Requirements for monitoring adjacent structures, pavements and services including conditions, line and level surveys and restrictions, if to be specified *[8004.9]*;

6. Information on the presence and nature of known areas of contaminated ground including soil profile information *[8004.16]*;

7. Requirements for existing manholes or chambers that are not to be reinstated *[8004.21]*;

8. (11/06) Permitted tolerances on alignment of pipeline if different from sub-Clauses 8005.10 and 8005.11 *[8005.10, 8005.11]*;

9. The locations where existing drains, chambers or channels are to be connected to new drains, chambers or channels *[8005.19]*;

10. Details of reinstatement requirements for Minimum Dig Techniques, if to be specified *[8007.1]*;

11. Details of sampling and testing required for cured in place lining technique *[8008.4]*;

12 (11/06) The content of the survey report, including number of copies and types should be specified *[8006.1, 8008.7 and 8007.9]*.