

MCMC MTSFB TC G025-4:2020

TECHNICAL CODE

BASIC CIVIL WORKS - PART 4: HORIZONTAL DIRECTIONAL DRILLING

Developed by



Registered by



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MCMC MTSFB TC G025-4:2020

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Committee representation

This technical code was developed by the Fixed Network Facilities Sub Working Group under the Network and Broadcast Infrastructure and Facilities Working Group of the Malaysian Technical Standards Forum Bhd (MTSFB) which consists of representatives from the following organisations:

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Foreword

This technical code for Basic Civil Works - Part 4: Horizontal Directional Drilling (this 'Technical Code') was developed pursuant to section 95 and section 185 of the Act 588 by the Malaysian Technical Standards Forum Bhd (MTSFB) via its Fixed Network Facilities Sub Working Group under the Network and Broadcast Infrastructure and Facilities Working Group.

The *Basic Civil Works* documents consist of the following parts:

Part 1: General Requirements

Part 2: Open Trench

Part 3: Micro Trench

Part 4: Horizontal Directional Drilling

These series of Technical Codes shall replace SKMM/G/01/09, *Guideline on the Provision of Basic Civil Works for Communications Infrastructure in New Development Areas*.

This Technical Code (Part 4: Horizontal Directional Drilling) specifies the requirements for horizontal directional drilling works for the installation and maintenance of communications network facilities. This Technical Code shall be read together with MCMC MTSFB TC G025-1:2020 for the common requirements.

This Technical Code shall continue to be valid and effective from the date of its registration until it is replaced or revoked.

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BASIC CIVIL WORKS - PART 4: HORIZONTAL DIRECTIONAL DRILLING

1. Scope

This Technical Code specifies the requirements for horizontal directional drilling works for the installation and maintenance of communications network facilities which cover:

- a) planning of horizontal directional drilling works;
- b) technical specifications; and
- c) installation procedures.

2. Normative references

The following referenced documents are indispensable for the application of this Technical Code. For dated references, only the edition cited applies. For undated references, the last edition of the referenced document (including any amendments) applies.

MCMC MTSFB TC G025-1:2020, *Basic Civil Works - General Requirement*

ASTM F2160, Standard Specification for Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD)

3. Abbreviations

For this Technical Code, the following abbreviations applies:

GI	Galvanised Iron
HDD	Horizontal Directional Drilling
HDPE	High-density Polyethylene
PVC	Polyvinyl Chloride
OD	Outer Diameter
PN	Nominal Pressure
SDR	Standard Dimension Ratio

4. Terms and definitions

The terms and definitions are as specified in MCMC MTSFB TC G025-1:2020.

5. Planning for Horizontal Directional Drilling (HDD) works

Planning of HDD works shall be done as described in MCMC MTSFB TC G025-1:2020.

MCMC MTSFB TC G025-4:2020

The potential areas that may require for HDD works are as follows:

- a) crossing river;
- b) crossing highway;
- c) crossing railway; and
- d) on carriageway or grass verge as instructed by the relevant authorities.

6. Technical specifications

6.1 Depth and setback

The summary of minimum allowable depths and distance of setback in an area without underground utilities for HDD works is shown in Table 1. The HDD method is not recommended for construction of ductway which is more than 16. The normal duct diameter is 100 mm to 110 mm. The penetration angle for both entry and exit shall be between 10° and 18°.

Table 1. Depth and setback of HDD works

Number of ductway	Depth (m)	Setback (m)
1 to 9	3.0	10 - 16
10 or 12 or 16	3.6	12 - 19

Setback is the distance required from ground penetration to target depth or from target depth to the ground level. The distance between the entry and exit point of High-density Polyethylene (HDPE) ducts to the existing manhole shall be within 2 m to 3 m.

The minimum depth shall not be less than 3.0 m below the finished road or ground surface. The HDD cross sectional layout is illustrated in Figure 1. For river crossing, the depth and distance from riverside is subject to the relevant authorities.

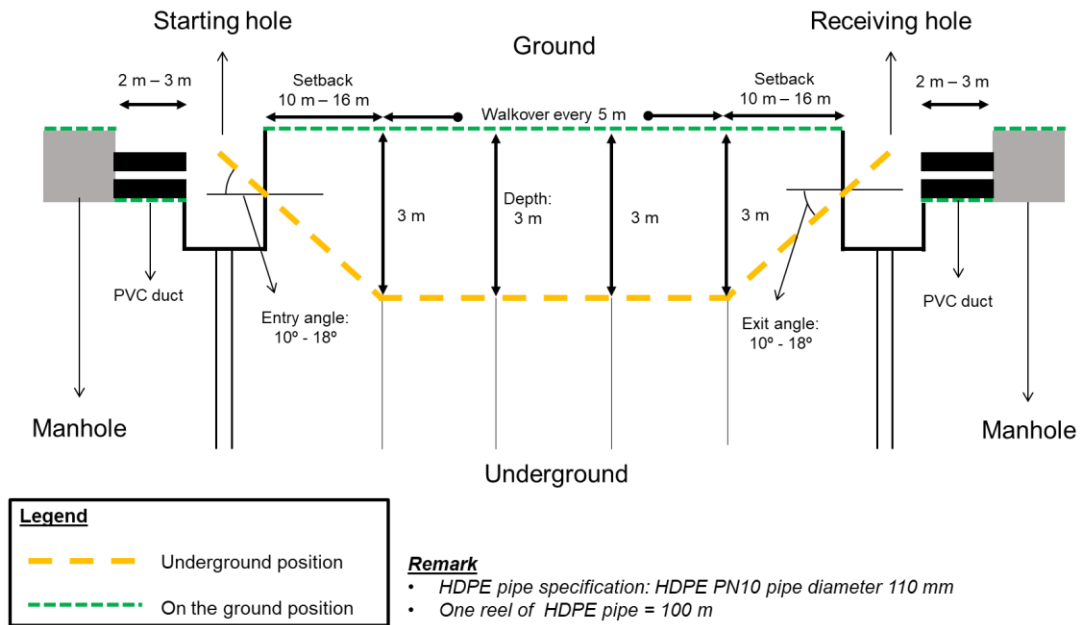


Figure 1. HDD cross sectional layout of HDPE pipe

6.2 Starting and receiving hole

The purpose of starting and receiving holes are as entry and exit points. Starting and receiving holes are required for preparing the ducts for manhole connection. The distance between manhole and starting or receiving holes shall be within 2 m to 3 m.

The starting and receiving holes can be constructed through open trench method and shall be kept as minimum as possible to minimise the surface damage. The recommended size is 1.5 m (W) x 2.5 m (L) x 1.5 m (D).

HDPE or Polyvinyl Chloride (PVC) type of ducts can be used for manhole connection. However, for certain cases that require higher protection, such as manhole located in the middle of the road, Galvanised Iron (GI) pipes shall be used.

The ducts shall be encased in concrete for 4 ductways and above. The concrete used for encasing ducts shall be at least Quality C. The concrete shall be relatively dry with the consistency of wet sand. In no circumstances shall the water content be increased as this will result in a weak concrete, rapid-hardening cement shall be used.

6.3 Crossing river

A proper mapping shall be done to measure the river bed to determine the minimum HDD depth. Figure 2 shows the generic diagram of HDD cross sectional layout for river crossing.

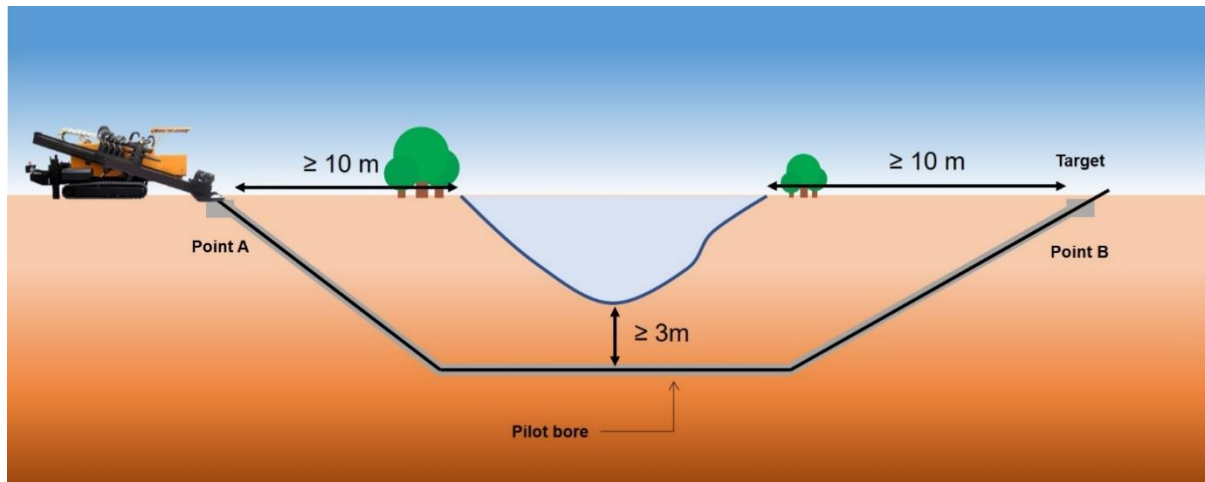


Figure 2. HDD cross sectional layout for river crossing

Duct type shall be strong enough to cover high compression load and longer distance. The setback shall have minimum distance of 10 m from the riverbank to ensure the manhole can be placed at secure and stable location. The minimum depth shall be 3 m from the riverbed to secure the duct.

6.4 Machine

The recommended machine specifications are as shown in Table 2. However, the project manager may use any type of machine that can meet their HDD works requirement.

Table 2. Machine specifications for HDD work

Type of distance	Machine weight (kg)	Machine size (m)	Thrust (kN)	Pullback (kN)	Remarks
Short range (< 100 m)	< 2 000	2 - 4	20	22	Limited work space to place the machine or the newly constructed manhole (e.g. beneath roads, driveways, sidewalks, sensitive landscaping, and other surface obstacles).
Medium range (100 m - 500 m)	3 000 - 5 000	3 - 5	40	40	Ideal HDD construction work.
Long range (> 500 m)	> 8 000	> 5	> 100	> 100	HDD construction which requires a special machinery and requirement (e.g. wide river crossing > 500 m)

6.5 HDPE Duct

The minimum dimension ratio of HDPE pipe shall be according to Table 3.

Table 3. HDPE pipe ratio

RESIN	PE80									
SDR	21		17		13.6		11		9	
PN	6		8		10		12.5		16	
Minimum wall thickness (mm)										
OD (mm)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)
40	2.0	0.245	2.4	0.292	3.0	0.359	3.7	0.428	4.5	0.508
50	2.4	0.370	3.0	0.450	3.7	0.546	4.6	0.664	5.6	0.787
63	3.0	0.574	3.8	0.716	4.7	0.870	5.8	1.049	7.1	1.257
75	3.6	0.822	4.5	1.011	5.6	1.233	6.8	1.465	8.4	1.766
90	4.3	1.179	5.4	1.454	6.7	1.767	8.2	2.123	10.1	2.547
110	5.3	1.769	6.6	2.164	8.1	2.617	10.0	3.149	12.3	3.785
125	6.0	2.261	7.4	2.760	9.2	3.372	11.4	4.085	14.0	4.896

The diameter of HDPE pipe can be 32 mm, 40 mm or 110 mm.

The HDPE material shall comply with ASTM F2160.

6.6 Other materials

The specifications for other materials such as manhole and ducts shall be as specified in MCMC MTSFB TC G025-1:2020.

7. Installation procedures

7.1.1 Pilot hole

The minimum pilot hole size shall be in dimension of 1.5 m (W) x 2.5 m (L) x 1.5 m (D). At least 2 pilot holes shall be excavated along the HDD route. Project manager may instruct the contractor to excavate any additional pilot hole if the route is evaluated as high risk and prone to cable cut.

7.1.2 Pilot drilling

Pilot drilling is a process to create pathway before the reaming process takes place. A drilling bit shall be set up at the proper location and drilling hole (starting hole) is excavated as shown in Figure 3.

Project manager shall determine the location of receiving hole where the bore head will exit. Generators, pumps, storages, and safety materials shall be ready at this stage. Work area shall be confined with safety barricade to avoid any hazard.



Figure 3. Site preparation (starting hole)

HDD machine uses a drill head that will be pushed through the ground. The drill head is usually angled, so that constant rotation of the drill string produces a straight bore, whereas keeping the head in one position causes the line to change in direction. Pilot drilling is done from point A (starting hole) to point B (receiving hole) as shown in Figure 4. At point B, the exit angle shall in range of 10° to 18° .

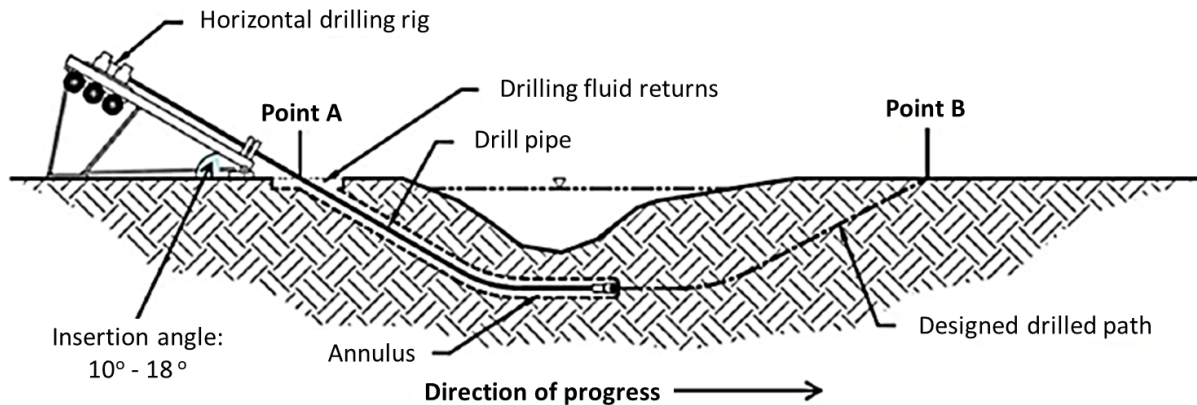


Figure 4. Pilot hole process

Figure 5 shows real image of drill head. As the drilling process takes place, drill pipe is drilled into the ground continuously until the exit is reached.



Figure 5. Drill head - angled bit

The contractor shall monitor and record the depth of the drilling to ensure that the specification is complied. Walk-over tracking system shall be used to determine the depth, location and direction of the bore head during the pilot hole process.

In walk-over system, a sonde (transmitter) is installed inside the bore head. Sonde will transmit electromagnetic information signal of angle rotation, direction (magnetic direction) and temperature data to the receiver as in Figure 6.



Figure 6. Sonde (transmitter)

Position the receiver over the sonde signal. The signal is decoded and steering directions relayed to the operator of the drill machine using communication devices (e.g. walkie-talkie, smartphone). The walk-over is illustrated as in Figure 7.

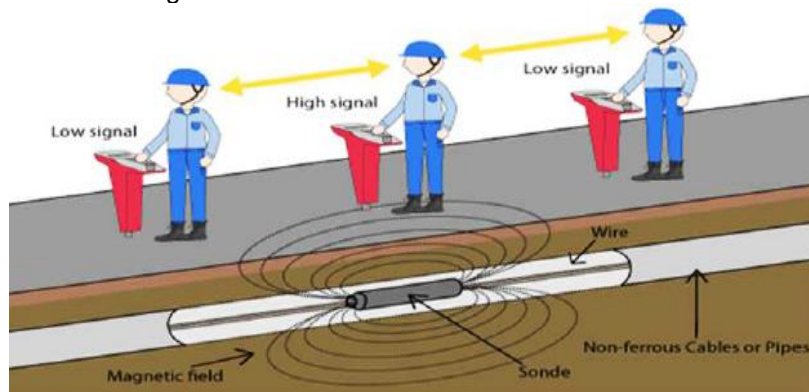


Figure 7. Walk-over process

Figure 8 shows the positions of angle bit during inclined and declined direction.

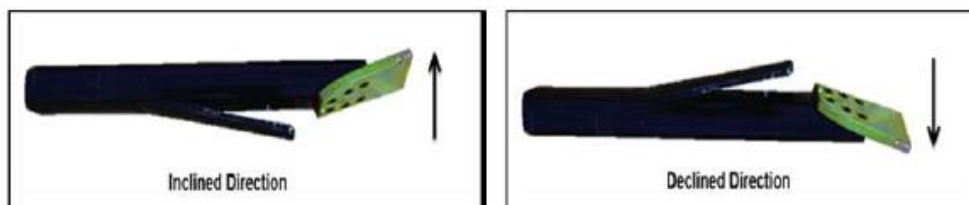


Figure 8. The position of angle bit during inclining and declining

The drill head flows a high-pressure jet of drilling fluid. Finally, the boring is accomplished through the cutting action of the jet of fluid and/or rotating a drill bit. The contractor shall plot and record the actual of horizontal and vertical alignments of the pilot bore for every interval of 6 m (point of walk-over) or maximum of 9 m.

7.2 Reaming

Reaming is a process of enlarging the bore hole after drilling process as shown in **Figure 9**.

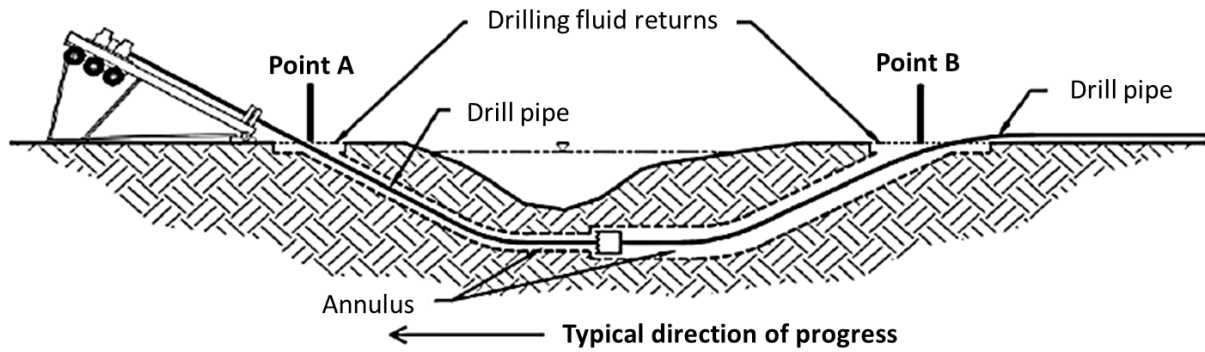


Figure 9. Reaming process

The steps of reaming process are as follows.

- a) Upon reaching at point B, the reaming process will start.
- b) Replace the angle bit at the end of the drill pipe with a reamer size 16 inch to enlarge the bore hole (4 ductways).
- c) Pull back the reamer from point B.
- d) Add drill pipe behind the reamer so that there is always drill pipe in the bore hole.

Use swivel to prevent the rotation of drill pipe behind the reamer during the reaming process. The suitable reamer size depends on the number of ductway as shown in Table 4. The reaming tools for reaming process are shown in Figure 10.

Table 4. The size of reamer for HDD work

No	Size of reamer (inch)	Number of ductway
1	12	2
2	16	4
3	20	6
4	24	8
5	36	12

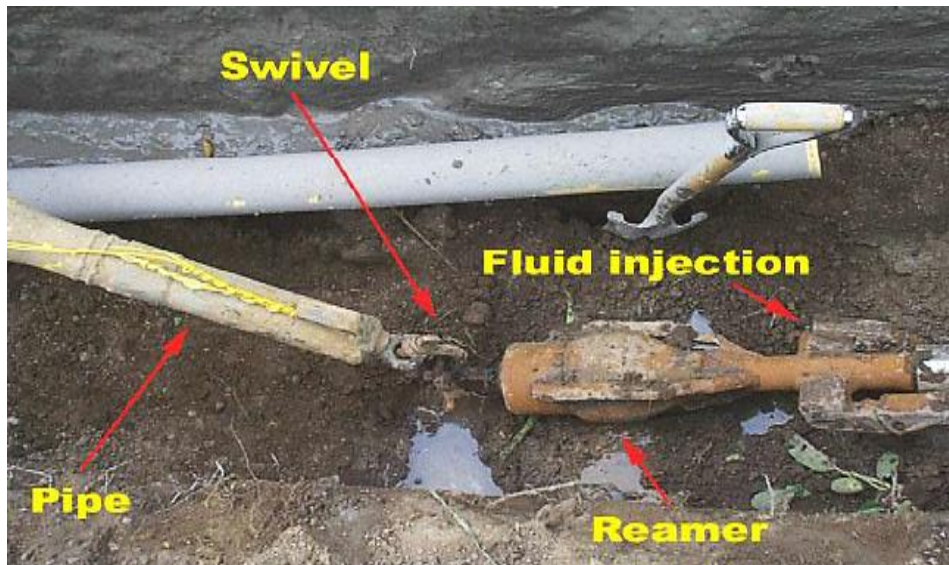


Figure 10. Tools for reaming process

7.3 Laying of HDPE duct

Once the reaming process is complete at point A, the HDPE duct shall be pulled back into the reamed hole from point B to point A as shown in Figure 11.

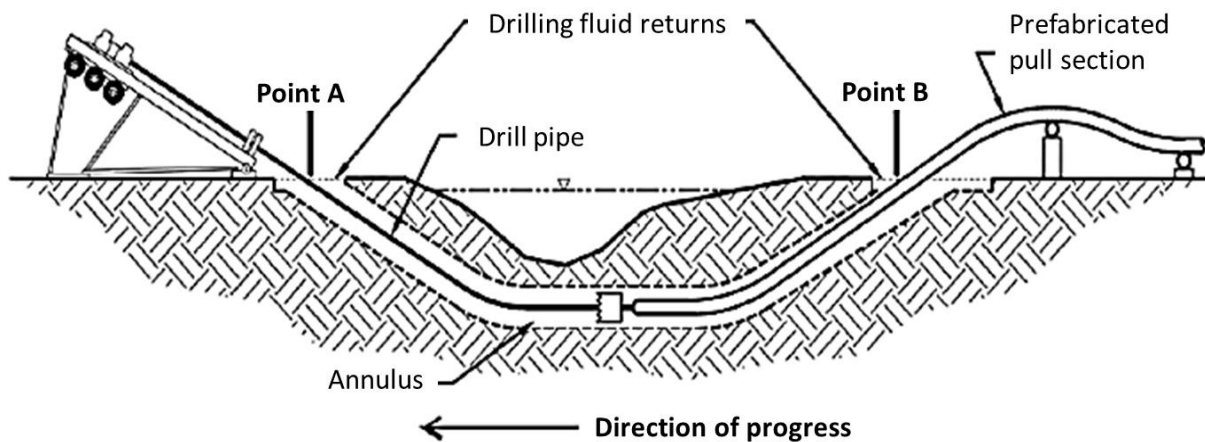


Figure 11. Pull back process

The steps of pull back process are as follows:

- a) Using a pull head and a swivel, connect the HDPE duct to the drill pipe.
- b) To ensure the hole remain open, locate a reamer between the pull head and HDPE duct. It is also to allow lubricating fluid to be pumped into the hole during the laying process.
- c) The laying process will continue until the HDPE duct reach at the point A.
- d) Once the laying process of HDPE is complete, disconnect the pull head.
- e) Then, remove the drill and start the clean-up process as shown in Figure 12.

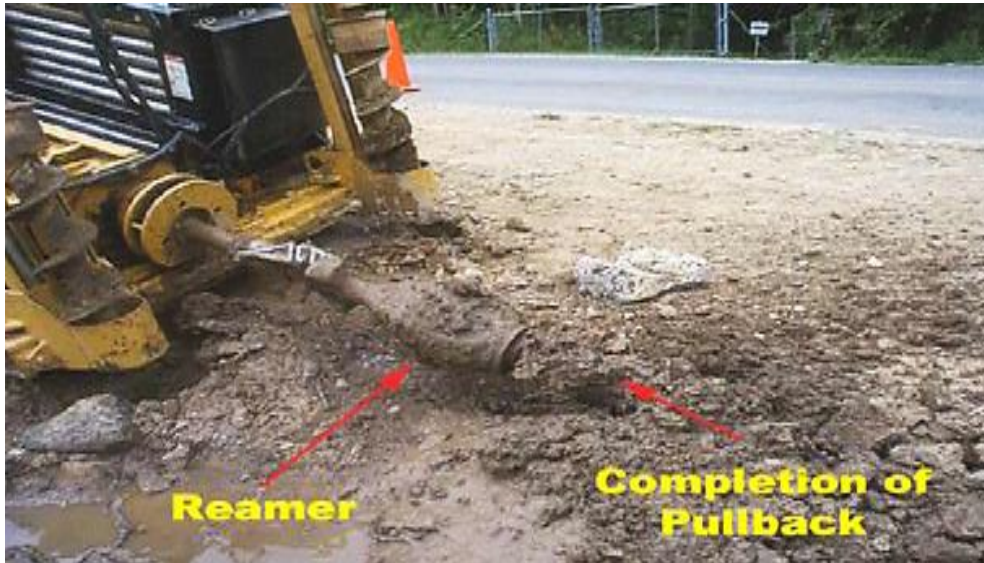


Figure 12. Reamer during completion of pullback process

7.4 Jointing of HDPE to existing manhole

Jointing of HDPE ducts to the existing manhole shall be done by connecting existing HDPE to PVC duct which has connection to the existing manhole. The process is illustrated in Figure 13.

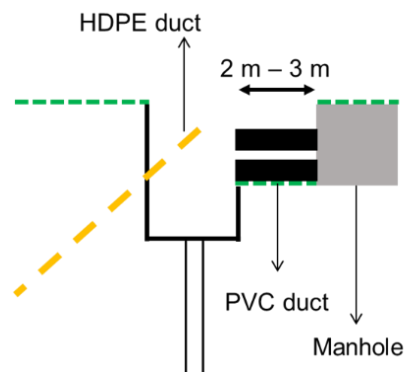


Figure 13. HDPE to PVC layout

Excavate a new trench with suitable depth to allow connection between existing PVC and HDPE duct as illustrated in Figure 14.

The steps of jointing HDPE to PVC are as follows:

- a) Wipe and clean both end of the ducts.
- b) The outer surface of the HDPE duct shall be smoothed by using sand paper.
- c) The inner surface of HDPE shall be trimmed by using grinder.
- d) The end of the PVC duct shall be heated to expand the diameter of the ducts.
- e) The HDPE duct is inserted into the PVC duct where PVC glue is applied to join the ducts.

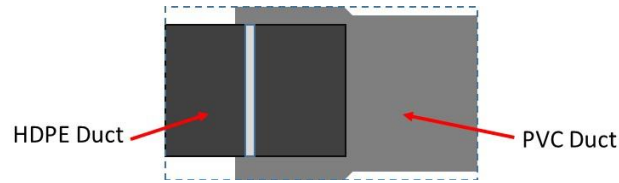


Figure 14. Jointing HDPE to PVC

7.5 Lead-in duct to manhole

Lead-in duct to manhole shall be as specified in MCMC MTSFB TC G025-1:2020.

7.6 Duct test

Upon the completion of work between any two-jointing manholes, all ducts shall be tested using mandrel test as specified in MCMC MTSFB TC G025-1:2020.

8. Completion of works

Completion of works shall be as specified in MCMC MTSFB TC G025-1:2020.

Acknowledgements

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