Installation Instructions

Micro Cables

Content

1 Introduction

This document is a description of Hexatronic's air blown micro cable system that is mainly used in a feeder network. The Hexatronic Micro Cable system is designed for blowing multiple micro cables with a high fiber count into a duct system.

1.1 Scope

This document covers the methods for blowing multiple micro cables with a high fiber count into a duct system.

1.2 Target Group

This document is primarily targeted at installation technicians. Hexatronic recommends that personnel have an adequate professional background and have attended product training arranged by Hexatronic.

1.3 Prerequisites

In this document, it is assumed that the reader is familiar with concepts, terminology, and abbreviations, concerning the Fiber Optic deployment.

2 Overview

This section provides information about the Hexatronic Micro Cable system, planning and preparation of a blowing route, and describes some methods forincreasing the blowing length.

2.1 General Description of the Hexatronic Micro Cable System

The Hexatronic Micro Cable system is a flexible and cost-effective cabling system or installing optical fibers in all types of metropolitan and access networks, and also in backbone networks. Built to last, it delivers unlimited bandwidth capacity as well as capability to grow with user needs, and as new users is added.

The system meets the demand for nearly unlimited bandwidth, which creates a future-proof network ready for tomorrows demanding applications. It also gives a cost-efficient rollout and maintenance, which creates the opportunity for increasing broadband penetration and reaching out to new users.

The Hexatronic Micro Cable system consists of the following parts:

- Micro cable, outdoor and indoor version
- Microducts for installation in existing cable ducts 10 or 12 mm
- Microduct assemblies for direct burial, 1, 4, and 7 ducts
- Accessories, duct branches and duct joints

For micro cables, up to 96 single fibers, the outer diameter is approximately 6.5 mm. This supreme capacity makes the Hexatronic Micro Cable system the preferred choice when installing metropolitan and access networks. This concept can also be utilized for backbone networks due to small cable and cable drums to be handled. Additional cables can easily be deployed in empty spare microducts. For more information about the Hexatronic Micro Cable system, see the following document:

- Micronet System Description, Reference [3]

2.2 Planning a Blowing Route

This section describes the planning principles using an example of a blowing route, see Figure 1.

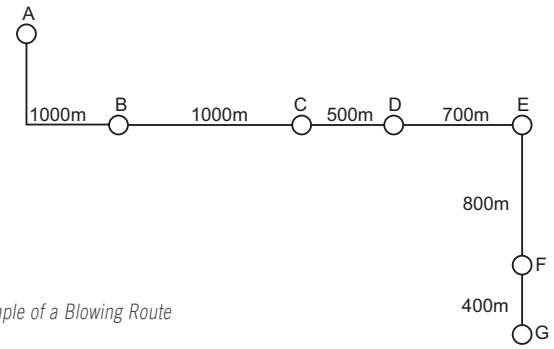


Figure 1 – Example of a Blowing Route

The goal is to reach from point A to point G. The total length is 4400 meters, which is impossible to reach in one go. In this case it is recommended to start at point C, and blow the cable to point G, see Figure 2.

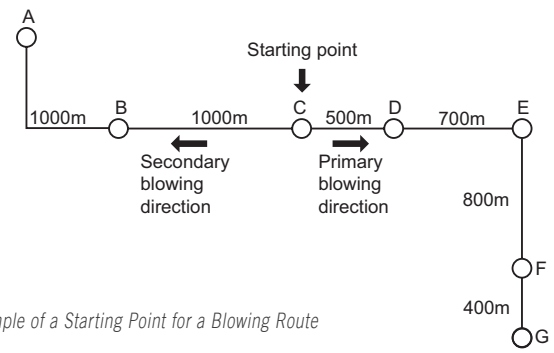


Figure 2 – Example of a Starting Point for a Blowing Route

Even though the distance is 2400 meters, there are a lot of possible coiling positions along the route, in order to increase the blowing length. After reaching from point C to point G, the needed 2000 meters of micro cable are coiled off the drum using a Figarino type of device, see Section 2.6.1 on page 7, or using the alternative, Figure-8 shape coiling method, described in Section 2.6.2 on page 8. Then the inner end of the cable from the drum can be blown from point C to point A with a possibility to coil again at the intermediate point B.

2.3 Blowing Cable Trough Curves and Bends

The cable blowing tool is using a pushing force to push the cable into the duct. After a distance, the friction between the cable and the duct has increased to a level which slows down the feeding speed of the cable. Then the air will carry the cable. The air does not provide any pushing force, but more of a carrying force. This carrying force is usually not high enough to get the cable through sharp curves, or many bends and curves. If the blowing route has a lot of curves and bends, it is usually better to blow in the direction in which the bends are at the beginning of the route, since the pushing force from the cable blowing tool is still high. This will make it easier to reach from point A to point E in one go without coiling, see Figure 3.

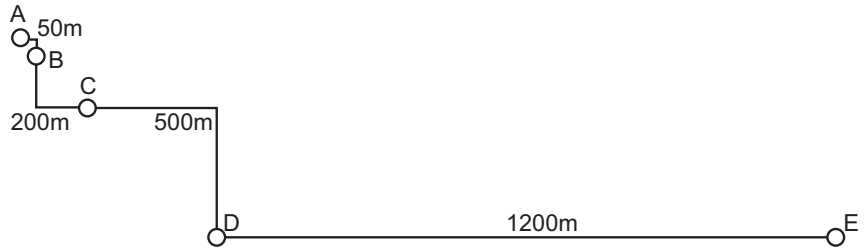


Figure 3 – Starting Point at the Beginning of the Route

2.4 Blowing Cable in Varying Topography

When blowing a cable in an environment where the topographic levels differ a lot, the blowing direction must also be considered, see Figure 4.

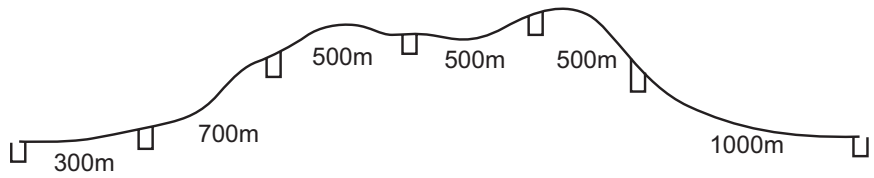


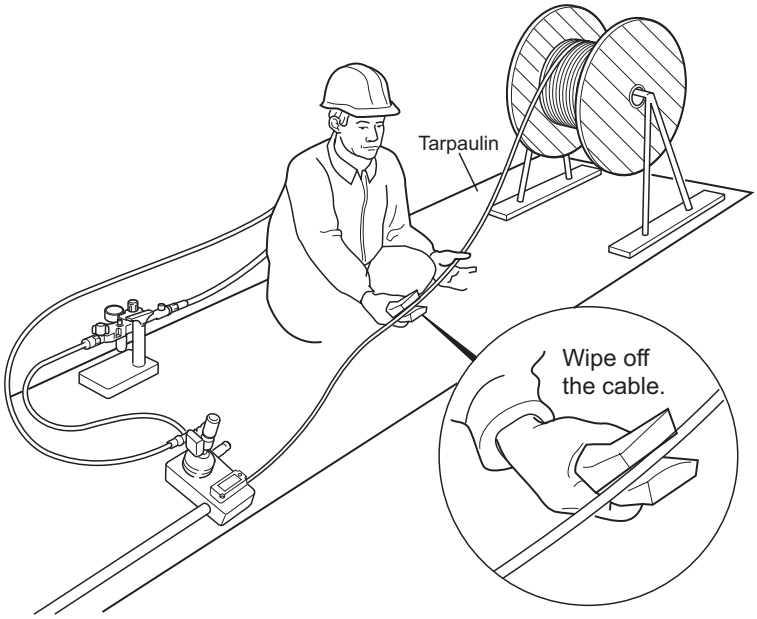
Figure 4 – Varying Topography

Since blowing downhill is easier than uphill, these conditions must also be carefully checked on topography maps before a cable blowing is started. Aim to start at the highest point and blow in two directions. Sometimes it is not enough to blow a cable in two sections, but three or four sections if the topography is difficult.

2.5 Preparing the Blowing Site

To prepare the blowing site, ensure the following:

- If possible, arrange the equipment in a straight line, in order to keep the friction as low as possible.
- Always use a tarpaulin on the ground, in order to keep the cable and equipment clean.
- Wipe off the cable with a dry cloth, before it enters the cable blowing machine.



Note: Every now and then, the cable will touch the ground between the cable drum and the cable blowing equipment. For this reason, the tarpaulin is important, as well as wiping off the cable before it enters the machine.

2.5.1 Preparing the Blowing Site in Manhole

If it is not possible to use a piece of duct to set up the equipment above the ground, keep the cable blowing machine in the manhole, and run it from there. However, this is not the best choice, since it is a lot harder to control the cable drum and the blowing speed from there, see Figure 5.

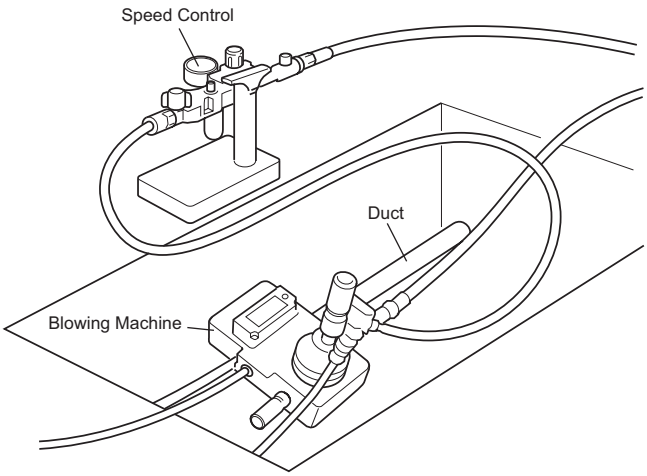


Figure 5 – Blowing Site in Manhole

In order to increase the blowing length, position the equipment in the manhole in tandem, see Figure 6.

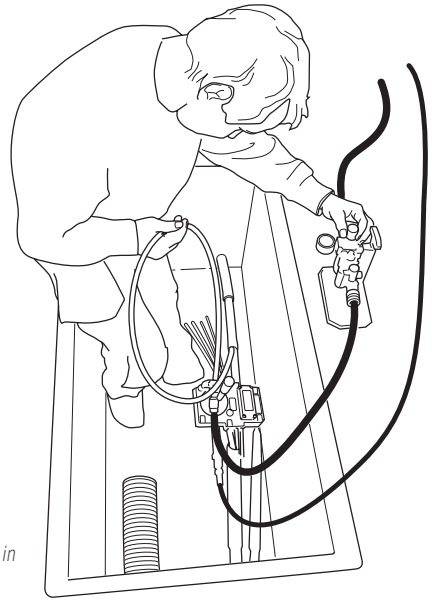


Figure 6 – Positioning the Equipment in Manhole in Tandem

2.6 Coiling Methods

To reach longer blowing lengths without fiber splicing, it is necessary to coil the cable at intermediate positions. The following sections describe some coiling methods.

2.6.1 Figarino

The Figarino is a passive intermediate cable storage device for fiber optic micro cables, see Figure 7.

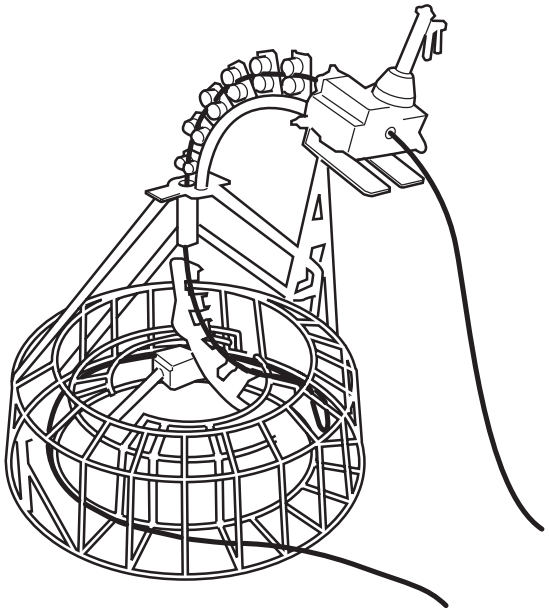


Figure 7 – Figarino Cable Storage Device

Using Figarino allows the winding and unwinding of a cable without starting from the cable end. The method can store approximately 4 kilometers of micro cable in a safe, secure, and efficient way.

2.6.2 Figure-8 Shape

If the Figarino is not available, the method of coiling cable in a Figure-8 shape is very efficient. It will prevent the layers from falling through and crossing each other, by keeping them in order. A good aid to keep the Figure-8 in place is to use cones to shape the 8, see Figure 8. Make sure to keep track of the starting end of the cable.

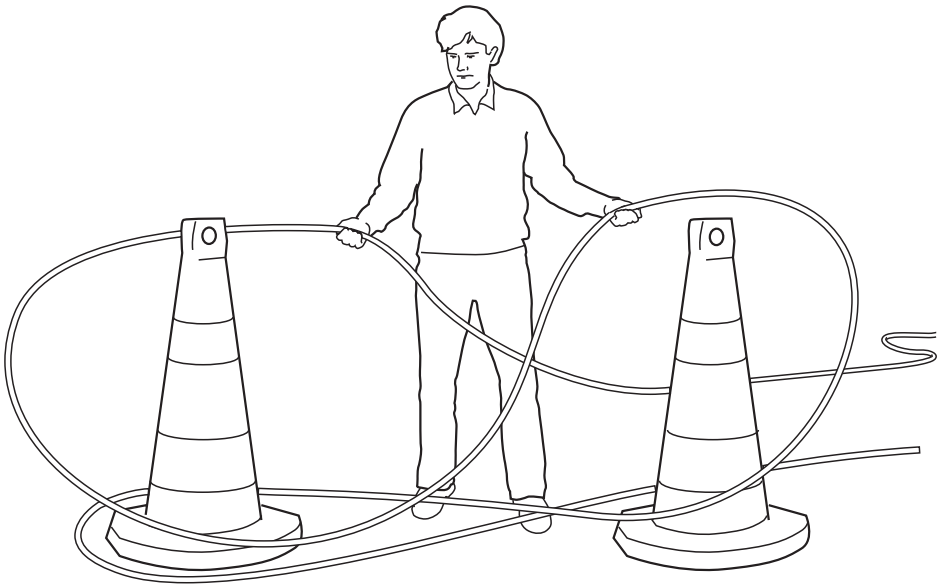


Figure 8 Coiling in Figure-8 Shape

If the Figure-8 coils need to be stored in a manhole, it can easily be done by first securing the coils with tape, then folding the sides against each other, and finally storing them until the next day, see Figure 9. When taping the cable, make sure to use the first layer of tape with the sticky side out. Otherwise some residue of the adhesive may be left on the jacket of the cable, thus increasing the friction.

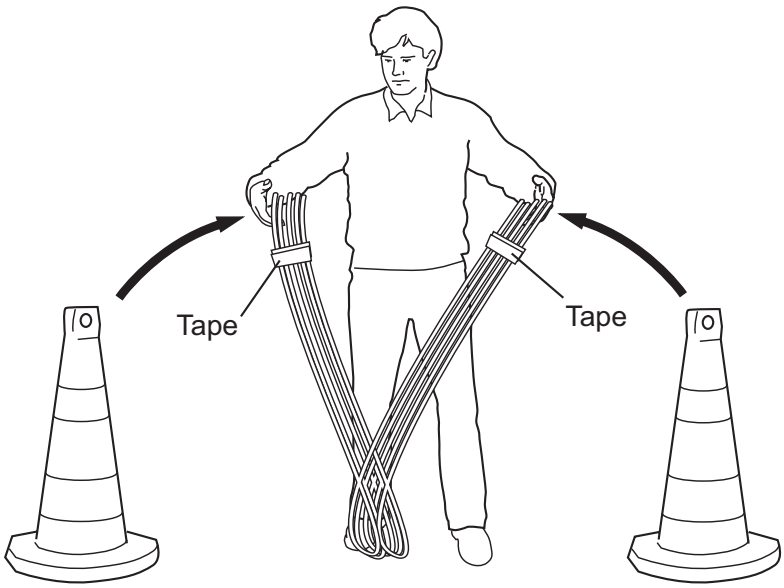


Figure 9 - Storing the Figure-8 Coils

Note: In general, when handling coils, it is important to keep track of the start and stop layers. Sometimes the coil also needs to be flipped before blowing further.

2.7 Blowing Cable in Tandem

Another way to increase the blowing length is to place the blowing equipment in tandem. With this blowing technique the blowing distance can be increased considerably.

This method requires the blowing setups in more than one location. A good instant communication between the blowing setups is also needed, see Figure 10.

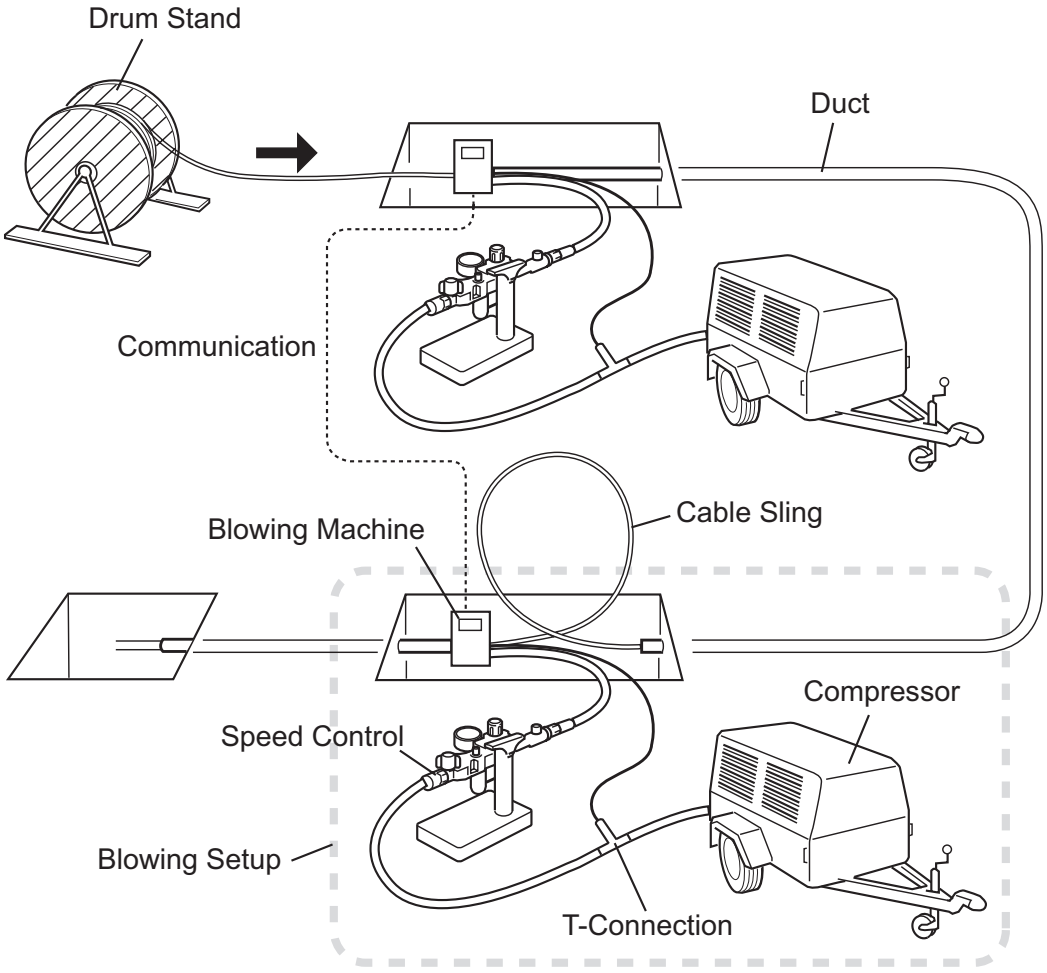


Figure 10 – Positioning the Equipment in Tandem

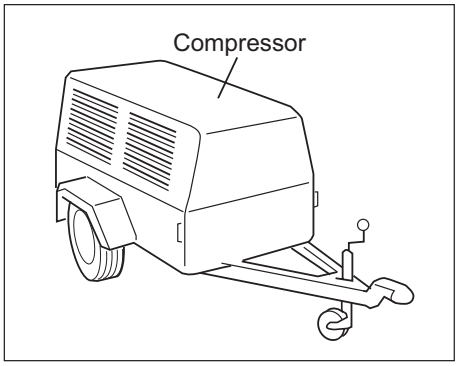
3 Prerequisites

This section provides information on required equipment, tools, materials, and conditions that apply to the installation procedure.

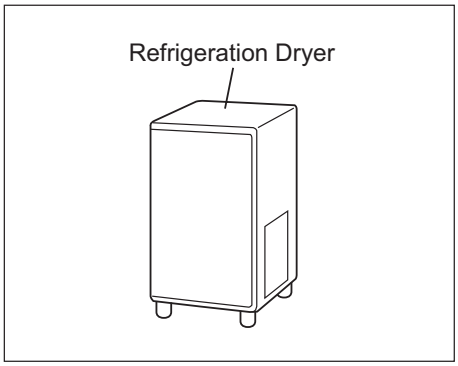
3.1 Equipment

In order to blow the cable and reach long blowing lengths, the following equipment is needed:

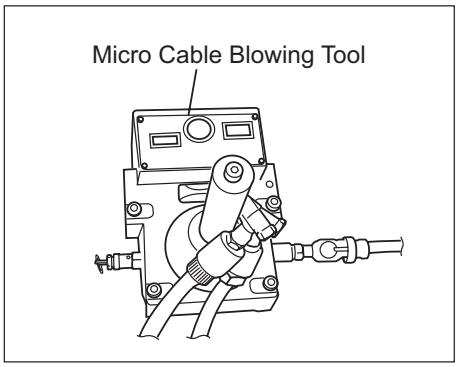
- Compressor with a capacity of up to 15 bars and 1000 liters per minute or more



- After cooler and refrigeration dryer



- Micro cable blowing tool



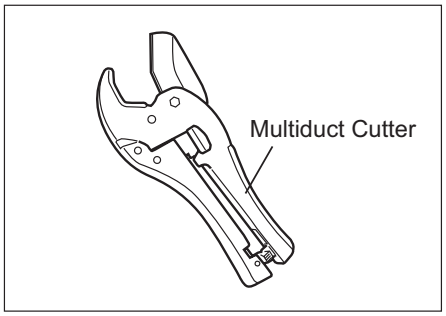
- Drum stand

- Good radio communication– sometimes it takes too long to place a phone call. Many unwanted things can happen during the seconds it takes for the call to be established.

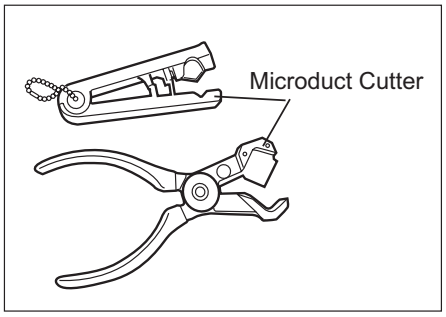
3.2 Tools

The tools required for installation are shown in the following list:

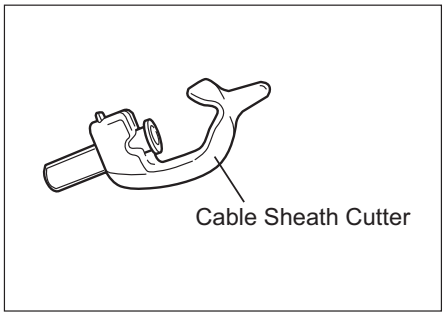
- Multiduct cutter– this multi purpose cutter is handy to use when dismantling any round multiduct.



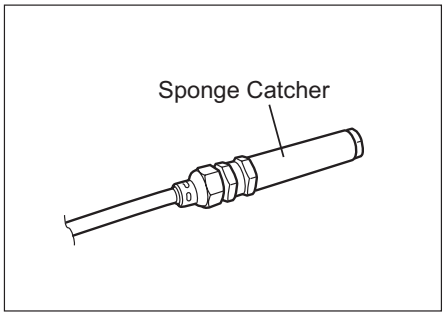
- Microduct cutter– this tool is used in order to get clean 90° cuts necessary when jointing (connecting) microducts.



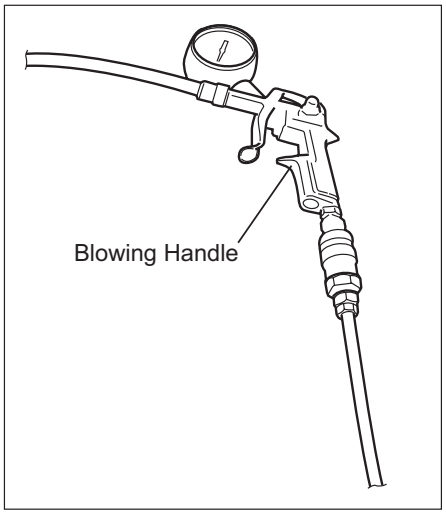
- Cable sheath cutter– to slit open a temporary microduct. With this tool, the cutting depth can be set, which is vital to avoid damage to an already installed cable.



- Sponge catcher– since the cleaning sponges need to be examined when they reached the far end, the sponges has to be collected in a secure and proper way. A sponge catcher is a useful tool for this.



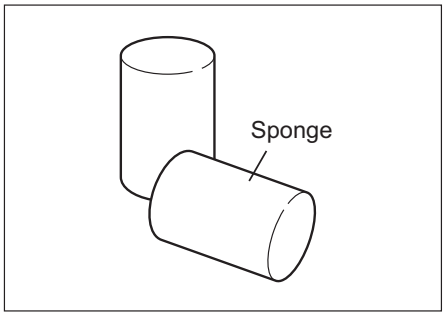
- Blowing handle– it is useful to have a blowing handle with which the pressure behind the sponge can be controlled. It is possible to use the cable blowing machine for this, but a separate handle saves a lot of time, especially when several sponges have to go through the duct.



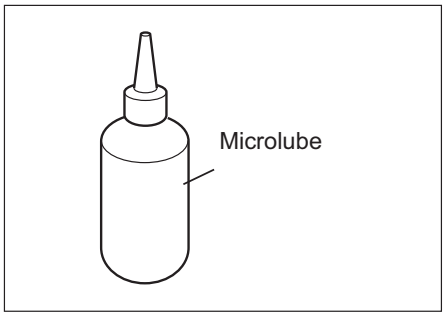
3.3 Materials

The materials required for installation are shown in the following list:

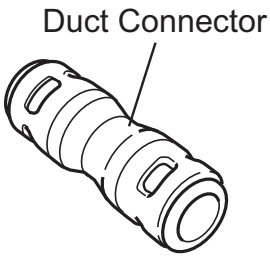
- Sponges– to clean and to lubricate the duct.

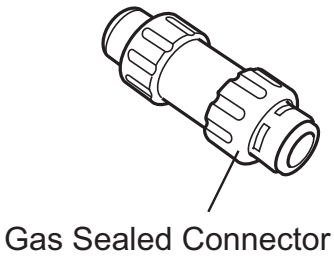


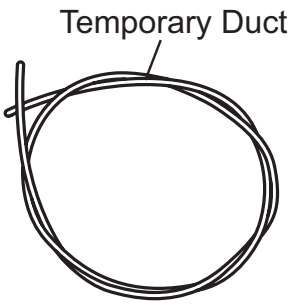
- Microlube– for lubrication, always use only the Microlube. Lubrication designed for tandard cables may increase the friction instead of decreasing it.



- To reach into the manhole, some extra length of microduct and duct connectors are also needed.







3.4 Conditions

This section describes the conditions that must be fulfilled before any work is started.

3.4.1 Safety

When planning the cable blowing, the safety must be the primary concern. Therefore, before going to the site, always check that the following safety conditions are fulfilled:

- It is of vital importance that all local safety regulations are carefully and thoroughly followed.
- Make sure to fence the working area, so that bystanders do not get in the way.
- Compressed air is stored power and therefore check its safety concerns.
- Working with high air pressure is very dangerous. Make sure to secure all connections and hoses properly, since they can be lethal if not properly secured.
- Only use low air pressure when testing.
- Open the air valves slowly, in order to slowly increase the pressure until the desired pressure has been reached.
- Always wear safety goggles.
- When working along the roadside, make sure to follow regulations for safety and closing off the traffic close to the work perimeter.

For further information on personal health and safety for Hexatronic system products, see also:

- Personal Health and Safety Information, Reference [1]
- System Safety Information, Reference [2]

3.4.2 Before Going to Site

In order to conduct the cable blowing safely and efficiently, ensure the following before going to the site:

- The work instructions for the team, as well as a map with the planned cable route, is available. On the map, the lengths between manholes and the locations of existing duct joints are specified. The locations of the duct joints is valuable in case it is impossible to reach the entire blowing length in one go. Then the duct has to be opened, and the cable coiled before continuing. It is also of great value that the checked and suggested places for setting up the equipment are already marked out on the map.
- Make sure to prepare for different plan alternatives. For example, if it is not possible to reach 2000 meters of cable blowing as in the original plan, the backup plan must be available. Always prepare a plan B, plan C, and so on. This will save a lot of time and therefore money. For an example of planning the blowing route, see Section 2.2 on page 2.

3.4.3 Before Starting the Installation

The following conditions must be fulfilled before the work is started:

- Make sure to perform the blowing in the correct duct.
- Check that the duct is not water filled, since water may be blown into the customer property.
- If there is only one duct at the opposite end, use a smaller compressor and pressurize the duct to see which duct has pressure at the blowing end. Only use low pressure until it is sure the correct duct is used and it is cleared.

4 Installation Procedure

To perform Hexatronic Micro Cable blowing, shown in Figure 11, perform the following steps:

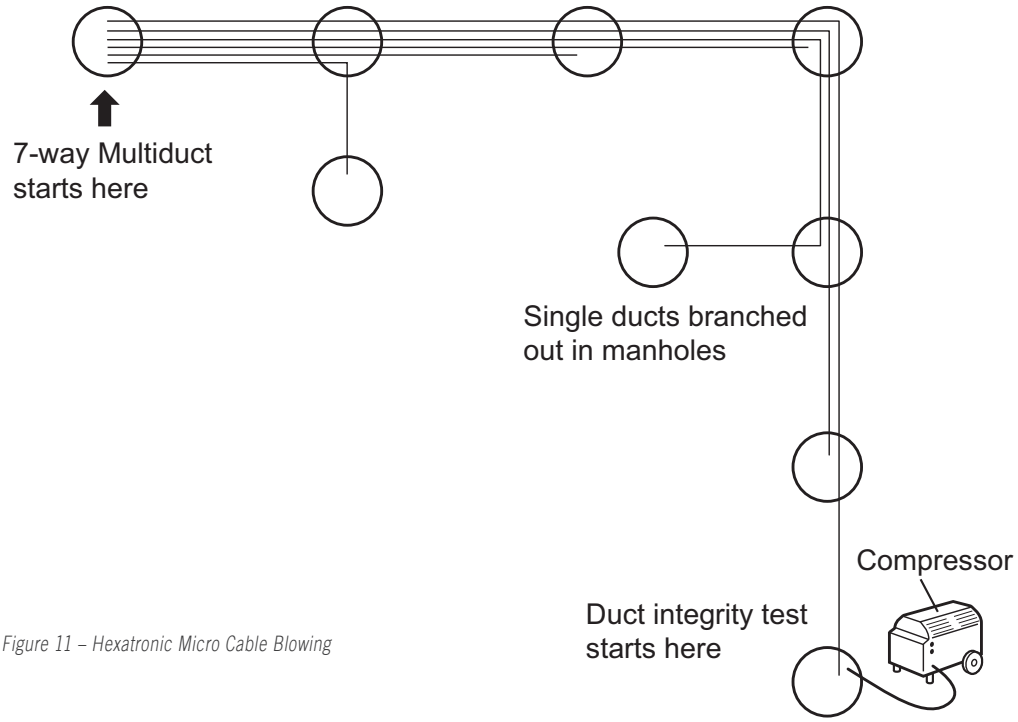
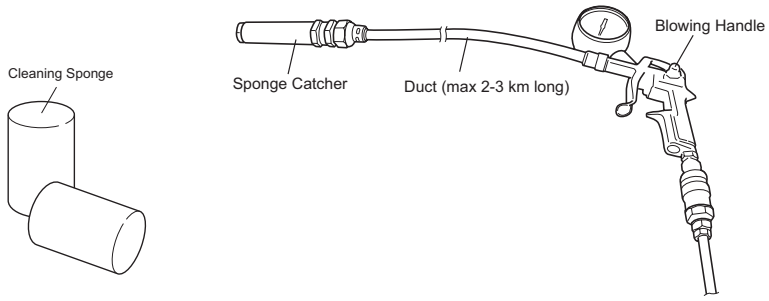
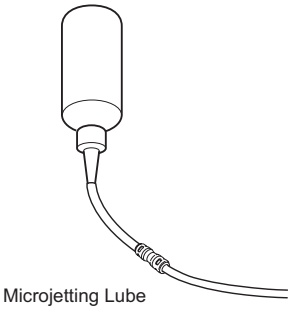


Figure 11 – Hexatronic Micro Cable Blowing

1. After the correct duct is identified, send a sponge through to clean the duct. Repeat until the sponge comes out clean and dry. Use the lowest pressure possible to send the sponge through to avoid damage to people or equipment.

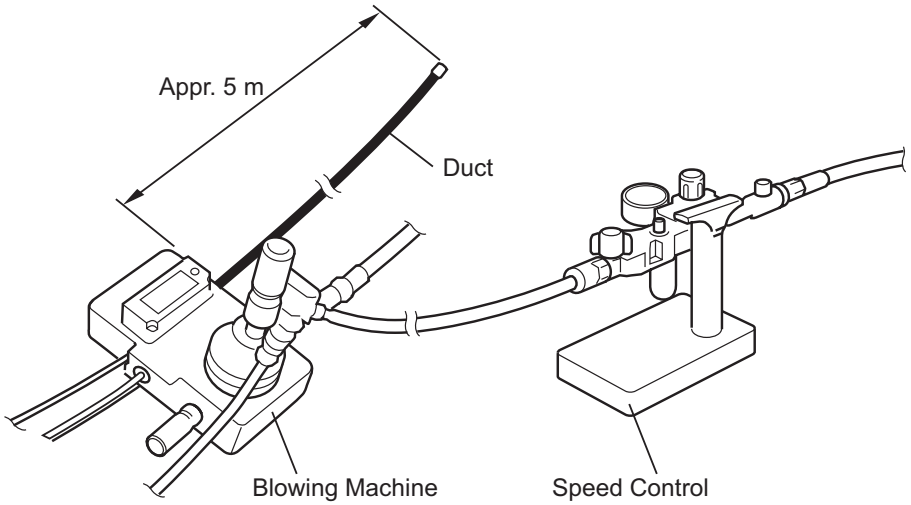


2. Lubricate the tube according to the specifications, for example, which kind and amount of lubrication. Only use the correct lubricator for the duct in question.



3. Perform the crash test.
   Before starting to blow the micro cable, a crash test has to be performed, in order to determine the maximum feeding force to the motor of the cable blowing machine. Typically this requires 5 metres of blocked duct. Perform the crash test according to the manual instructions of the machine or procedure taught at a separate Hexatronic Micro Cable training.

   Also remember to check the lubrication of the pneumatic motor on the machine, see specification manual for the corresponding machine.



4. Blow the micro cable.
   When the integrity of the duct has been checked and the duct is clean and lubricated, it is time to start the cable blowing. However, from the start, no air pressure is used in the duct. Start with the pneumatic motor only, pushing the cable into the duct. The speed can be increased and is kept below 60 metres per minute, in order to be able to stop the motor quickly in case of cable slipping, spinning, or any other problems.

Caution!
The pressure to the motor must never exceed the pressure determined during the crash test.

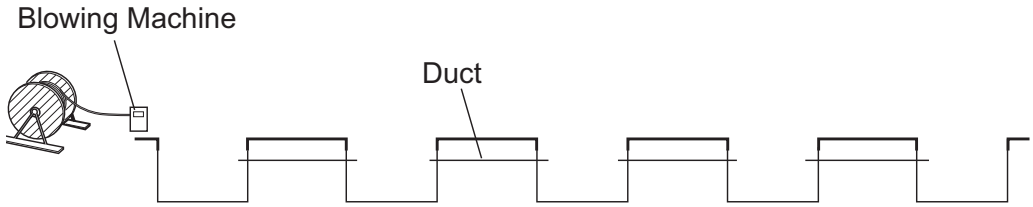
When the speed slows down, add a little bit of air pressure. One or two Bars may be enough to get the speed back up. The settings are kept until the speed drops again. Then the air pressure is increased by one Bar or by the minimum increase, until the cable blowing speed is reached again.

Note: If the air pressure is increased too much or too early in the process, the speed may be reduced due to a counter pressure. Always monitor the speed with the manometers.

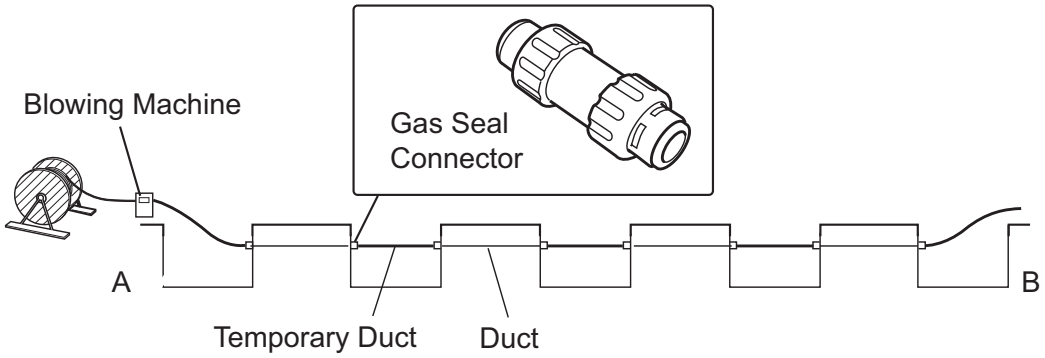
4.1 Blowing Cable for Maintenance Loops

When a route is supposed to contain maintenance loops in strategic positions, the method is as follows:

1. Set up the equipment and open up the intermediate manholes. The temporary duct and gas sealed connectors are needed for this method.

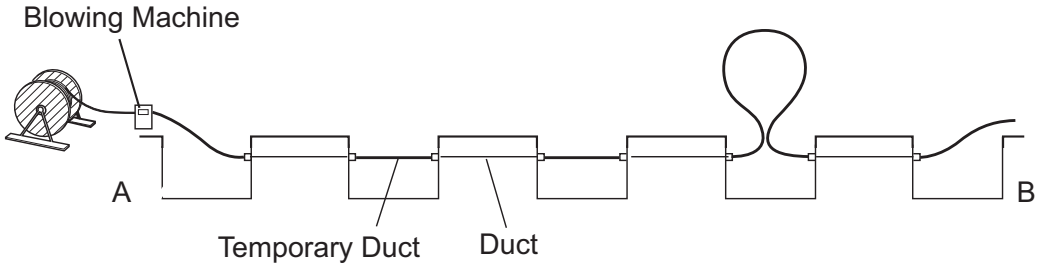


2. Add the gas seal connectors in every manhole where maintenance loops are stored. Add a temporary duct in every manhole.

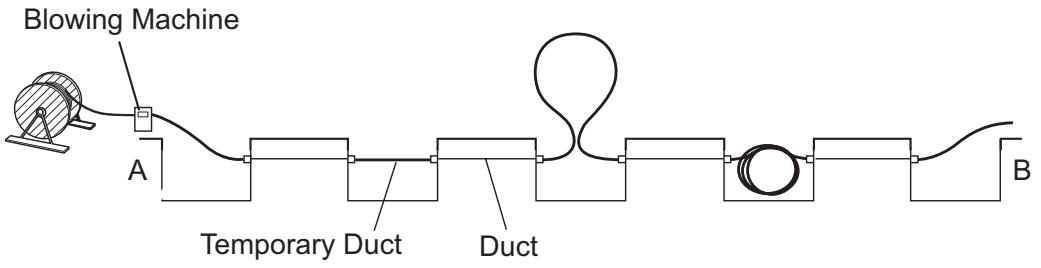


3. When the cable has been blown all the way from point A to point B, remove the temporary duct that is closest to point B. Once the cable is in place in the manhole, tighten the gas seal connector closest to point B. Create a loop by blowing the desired length. The slack, which is created in the manhole, is coiled down. If protection of the micro cable loop is needed, see the following document:

- General Handling Instructions Micro Cables and Microduct Assemblies, Reference [4]



4. Repeat the procedure at the manhole one stop closer to the point A.



5 Reference List

Hexatronic Documents

[1] Personal Health and Safety Information
PERSONAL HEALTH AND SAFETY INFORMATION, 124 46-2885

[2] System Safety Information
SYSTEM SAFETY INFORMATION, 124 46-2886

[3] Micronet System Description
OPTICAL FIBER MICRO CABLE SYSTEM, 28701-1/FGB101254

[4] General Handling Instructions Micro Cables and Microduct Assemblies
DESCRIPTION, 1551-TOL 401 90