

# **DROP SECTION**

## **(CENTRALIZED SPLITTING ARCHITECTURE)**

**NOTE:** This document is only referring to the centralized splitting architecture that UGG uses for rural areas

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(CENTRALIZED SPLITTING ARCHITECTURE)  
(Centralized Splitting Architecture)

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## 1. INTRODUCTION

This document aims to give a general view of the construction instructions that must be considered to make the drop section of the outside plant network needed for the FTTH deployment of UGG (Unsere Grüne Glasfaser) in Germany.

**NOTE:** This document is only referring to the centralized splitting architecture that UGG uses for rural areas.

Other norms focused on more detail for some parts of the network must prevail over the content of this document in case of conflict.

This document does not detail how must be carried out the civil works, or the cable installation in detail. For this purpose, there are available the norm “TEF-NORM-00001 - Civil Works for fiber deployment” and the norm “TEF-NORM-00002 - Blowing Procedure for Cables and Fiber Units” that should be followed.

### 1.1 REVISIONS

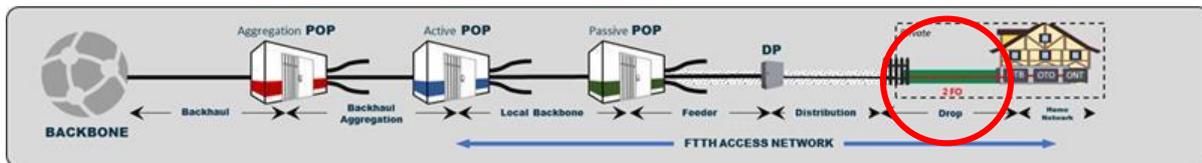
EDITION	DATE	REVISED SECTIONS	CHANGES	OBSERVATIONS
1 <sup>st</sup>	DECEMBER 2022			This document is extracted from the document “Construction Instruction for fiber deployment”
2 <sup>nd</sup>	DECEMBER 2023	All	New codification of the document	The document is codified with the document code: TEF-NORM-00007.  The logo of UGG is updated in the page header.  References to other documents are included.
		2.2. Construction of the Drop Section pipeline	Deleted case of distribution network with fibers already blown in	
		2.4. Work with the bundle of the Distribution Network	Deleted case with fibers already blown in	

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## 2. DROP SECTION

### 2.1 DESCRIPTION OF THE DROP SECTION

The drop section is the last part of the FTTH network between the distribution network (at the customer premises) and the optical termination point of the network inside the home of the client in the OTB (Optical Termination Box).



**Figure 1. Network architecture scheme (Drop Section)**

In the general deployment, all the houses connected will have an individual microduct of 7/4 mm (outer/inner diameter), from the sidewalk until the Optical Termination Box (in case of SFU could be OTB/OTO), installed inside the house.

**NOTE Exception:** for MDU scenarios with more than 12 houses in the building, the microduct that will be laid to connect the building will be a 14/10 mm (outer/inner diameter). These microducts will not pass through the distribution point like in other cases. For these cases, the OTB has enough entity to be considered as an indoor DP, with direct connection to the POP. 2 microducts 14/10 will be installed (like other DPs).

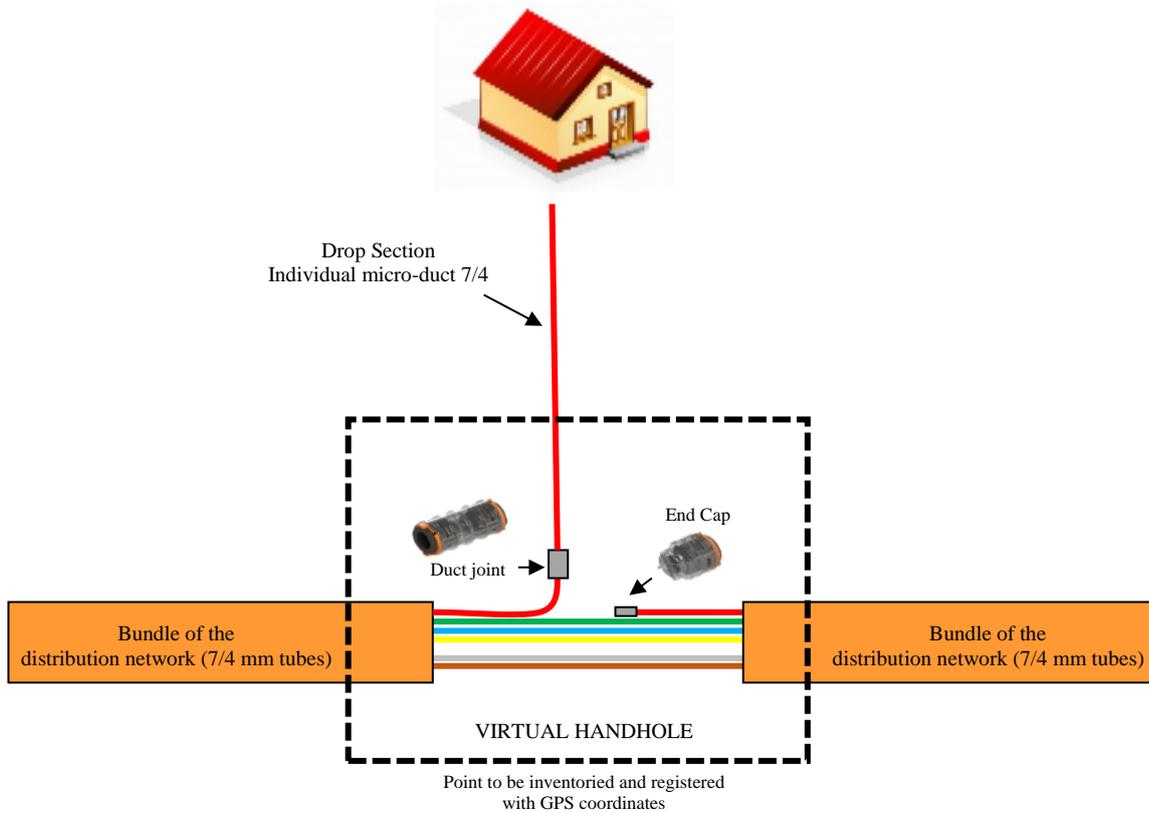
This individual microduct must be connected to one microduct of the bundle of microducts that pass in front of the house (in the sidewalk, for example). Once the connection of this last drop section is made, the house will have an individual microduct path from the house to the distribution point (DP) that is normally a street cabinet.

The connection or joint between the individual microduct, and the microducts of the bundles must be done with the adequate connector or “duct joint”.

In the bundle, the microduct to be used, must be selected according to the color code and the project instructions.

The microduct selected inside the bundle must be cut and connected (with an appropriated connector or joint) to the individual microduct for the customer. The other end of the microduct selected, that continue inside the bundle and could be used in the future in maintenance tasks, must be sealed in a water and a gastight manner with an appropriated end cap.

The microduct joint will be installed and left directly buried. The point in which the connection between microducts is done must be registered as a “Virtual Handhole” in the inventory system with GPS coordinates (tolerance +/- 2 cm), in order to know in the future the exact point of the joint of microducts for maintenance purposes. A photo will also be registered on the IT systems.



**Figure 2. Scheme of pipelines connection for the final drop section (home connected)**

The homes that are not connected during the deployment, will be left prepared with a partial installation of the drop section up to the limit between the public and the private soil (F<sup>T</sup>T<sup>F</sup> – Fiber To The Fence). In the next chapters of this document this possibility will be lightly explained.

**NOTE:** there is a specific normative for the execution of the F<sup>T</sup>T<sup>F</sup> in the UGG deployment: “TEF-NORM-00008 - F<sup>T</sup>T<sup>F</sup> Construction Guidelines”.

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## 2.2 CONSTRUCTION OF THE DROP SECTION PIPELINE

There are different scenarios **from the point of view of drop section pipelines construction** that must be considered, related to the way in which the deployment of this last section (the individual connection to the customer's home) is expected to be done:

### **CASE 1: Drop section pipeline laying DURING the deployment of the distribution network:**

1. From the distribution network until the optical termination box (OTB) inside the building. **Homes connected.**
2. From the distribution network to an intermediate point (FTTF- fiber to the fence) inside the property of the customer (but not until the building/house). **FTTF – Fiber to the fence.**

### **CASE 2: Drop section pipeline laying AFTER the deployment of the distribution network:**

1. From the distribution network until the optical terminal box (OTB) inside the building.
2. From the **FTTF point** until the optical terminal box (OTB) inside the building.

#### *2.2.1 CASE 1: DROP SECTION LAYING DURING THE DISTRIBUTION NETWORK DEPLOYMENT.*

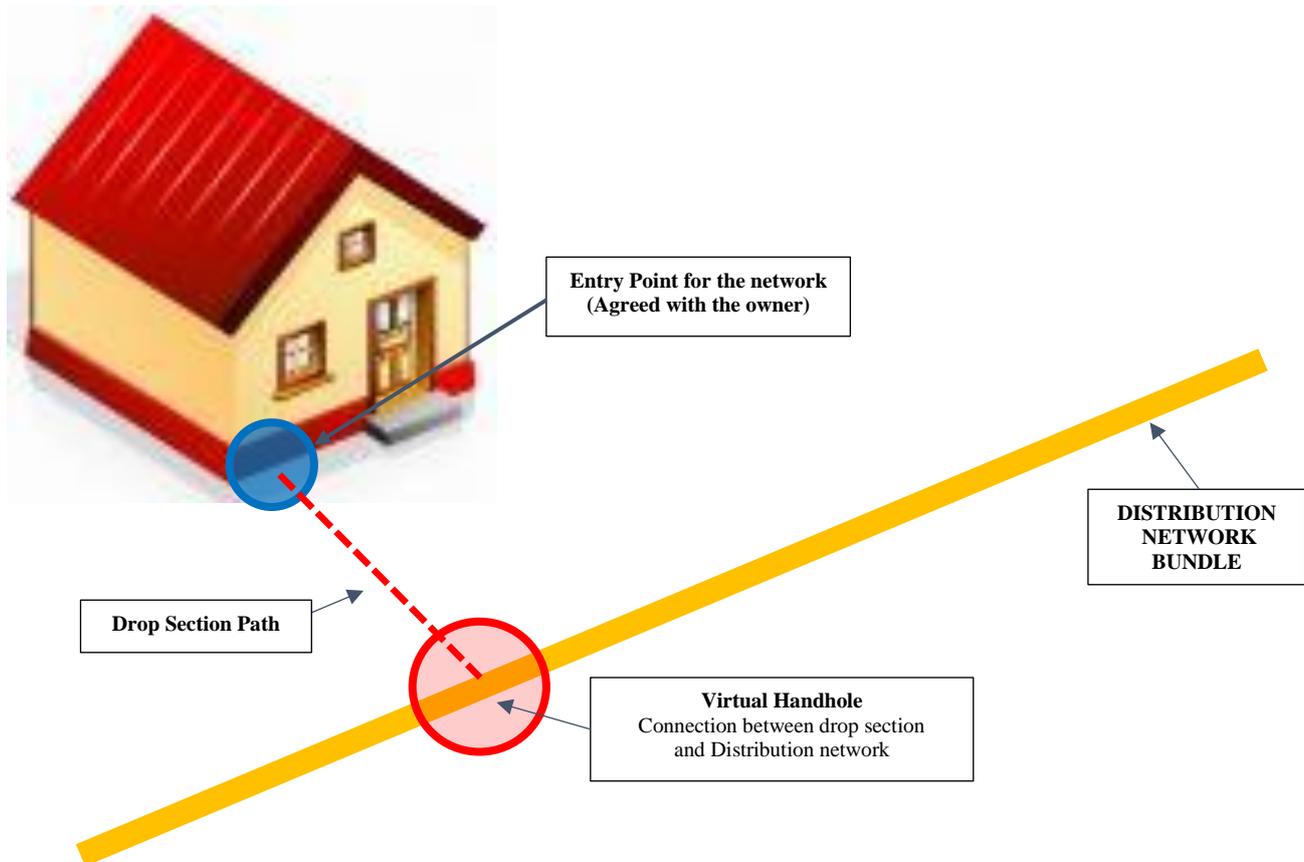
In this case, the drop section is deployed at the same time of the construction of the distribution network. There are 2 scenarios from civil work point of view:

1. **Civil Works for Homes connected.** In this scenario, the homes are completely connected to the optical network during the Distribution Network deployment. The pipeline of the drop section must go inside the house or the building.
2. **Civil Works for FTTF (Fiber to the Fence).** In this scenario the property is going to be prepared for an easy connection in the future. The pipeline must reach the land of the property, but it is not carried into the house or building until the client hire the service.

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### 2.2.1.1 CIVIL WORKS FOR HOMES CONNECTED

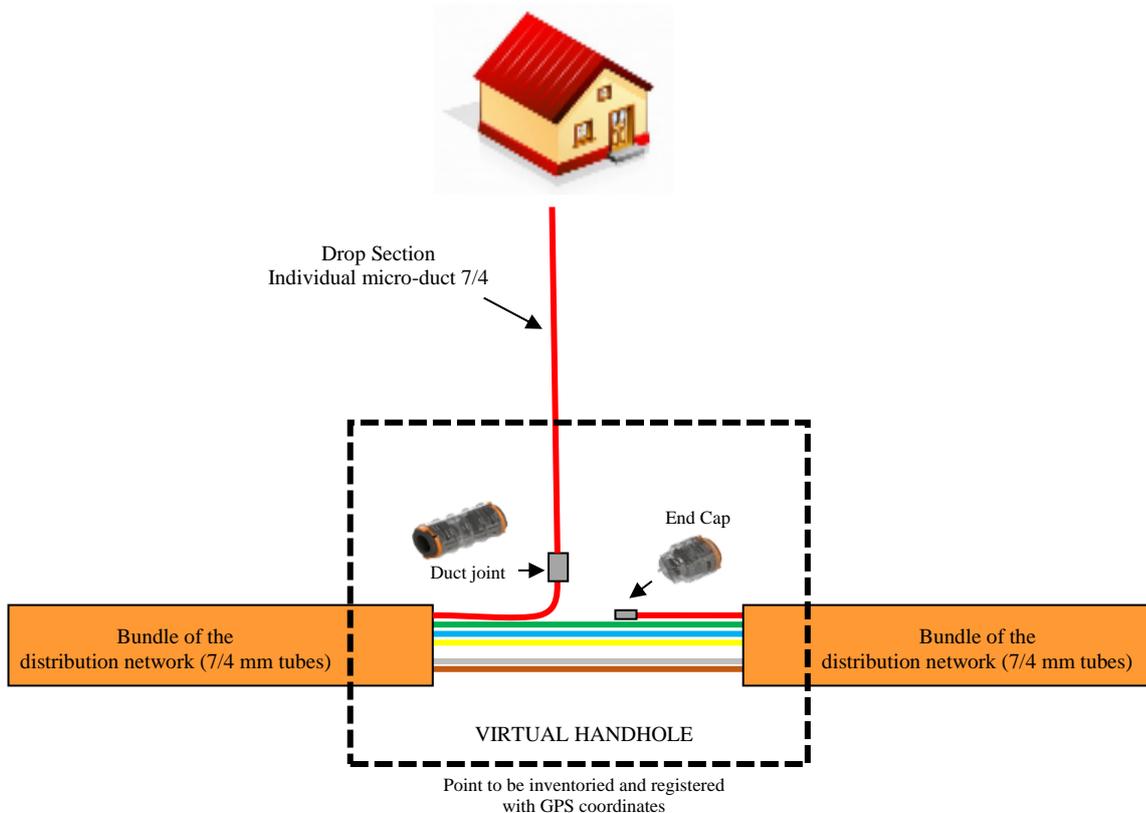
Before starting the civil works for the distribution network, the contractor must have an agreement with the customer to know in which place he wants to finish the network inside his home (Entry point). This point must be registered in the inventory system of UGG with GPS coordinates and pictures.



**Figure 3. Scheme of Virtual Handhole and the entry point in home connected**

**IMPORTANT:** This agreement with the customer will also determine the point in which the distribution network will segregate the dedicated micro-duct to the customer house (normally the point with the minimum distance between the distribution network, and the place selected by the customer in his house to enter with the network). This point will be selected by the contractor, it will be called “Virtual Handhole” and it should be registered in the inventory system with GPS coordinates. In this point, the bundles of micro-ducts of the distribution network will be identified with tags of different colors.

While the trench is open to lay the bundle of micro-ducts that pass in front all the houses (Distribution Network), an individual micro-duct of 7/4 mm must be deployed (Drop Section), to join the distribution network to the house of the customer. The point of this joint, will be the “Virtual Handhole” that was mentioned before.



**Figure 4. Scheme of Virtual Handhole**

To lay this individual micro-duct, three techniques could be used, but the most common will be the impact mole. Nevertheless, if its necessary other techniques could be used.

- Impact mole: making a horizontal drilling, from the sidewalk to the wall of the house, avoiding opening a trench in the private domain of the client.
- HDD (Horizontal Directional Drilling): if the soil is not compactable for the use of the impact mole, or if there are some obstacles that do not allow the use of a non-directional drilling: rocks, tree roots, etc.
- Mini trenching: if the other alternatives are not suitable.



Starting pit to use the impact mole (close to the distribution network bundle)



Destination pit for the impact mole (close to the customer house wall)

**Figure 5. Starting and destination pits needed to use the impact mole**

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**NOTE:** The starting pit will be made in the position in which is registered the “Virtual Handhole”. The destination pit will be made in the point that was agreed with the owner of the property (close to the wall of the building).

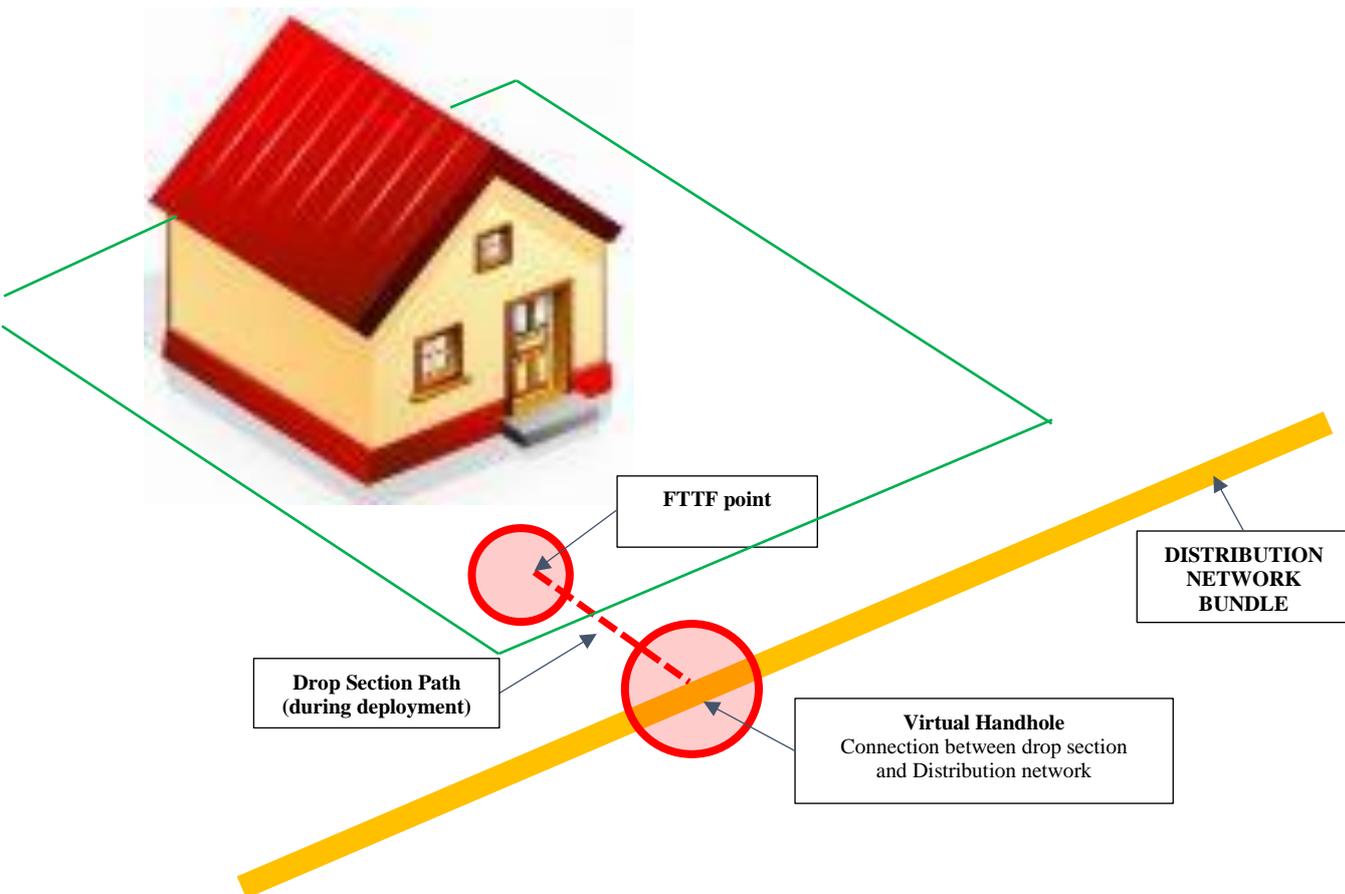
Once laid the individual micro-duct between the distribution network and the customer wall (reserving a length of microduct that allows to finish the installation inside the customer's home), this micro-duct will be introduced into the customer’s house.

On the other side of the drop section, the micro-duct must be connected to one of the micro-ducts of the distribution network, as was mentioned before.

*2.2.1.2 CIVIL WORKS FOR (FTTF – FIBER TO THE FENCE)*

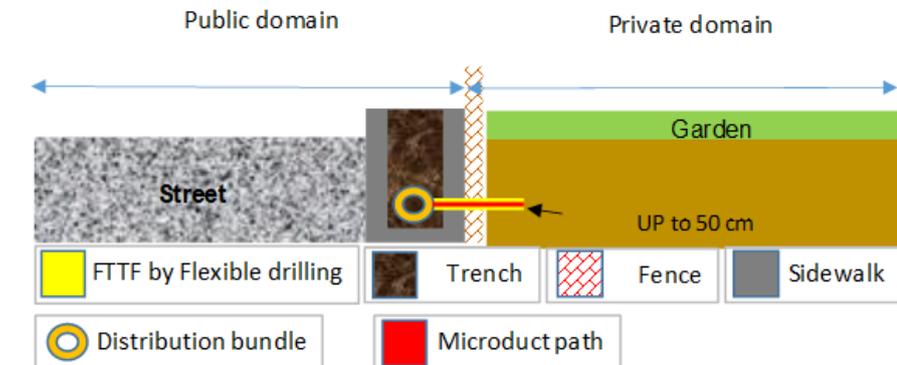
In this scenario, the network will be prepared to make easy the future connection of the house to the optical network, avoiding making civil works in the public domain. The idea is to reach the private property (near the public soil limit) with the micro-duct and store there directly buried waiting for a future use.

**IMPORTANT NOTE:** the surface of the private land must not be affected.



**Figure 6. Scheme of Virtual Handhole and FTTF point**

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**Figure 7. FTTF Scheme**

The drop section micro-duct should be laid from the distribution network to the FTTF point in the private land. The point in which the drop section intercepts the distribution network is the “Virtual Handhole” that was mentioned before.

In this case the microduct is finished in the FTTF point (underground in the private domain), waiting for a future connection. The end of the micro-duct must be correctly sealed with an end cap or with an electromagnetic marker (end-cap type).

An electromagnetic marker must always be used to mark the FTTF point.

Depending on the CW technique (mining, drilling, etc) used to reach the FTTF point, the micro-duct could be finished in the FTTF point stored in a coil with the appropriate diameter (200 mm diameter), or stored in straight line, directly buried into the ground.

**NOTE:** For more detail of the CW techniques applicable for the different situations that can be found in the field and for recommendations and criteria for the FTTF point definition, refer to the “TEF-NORM-00008 - FTTF Construction Guidelines” document in which it is included in detail.

### 2.2.2 CASE 2: DROP SECTION LAYING AFTER THE DISTRIBUTION NETWORK DEPLOYMENT.

In this case, the drop section (or a part of it) is deployed after the construction of the distribution network. Also, in this case, we have 2 possibilities from the point of view of pipeline construction: the starting point of this drop section laying:

- **From the distribution network (virtual handhole) to the house.**
- **From the FTTF point to the house.**

#### 2.2.2.1 FROM THE DISTRIBUTION NETWORK TO THE HOUSE

As it was explained before, the distribution network is a pipeline network directly buried into the ground, that pass under the sidewalk of the street close to all the houses that serves. Because of this, it is needed to make a dig in the sidewalk to achieve the bundle of the distribution network and to make possible the connection between the individual micro-duct that must be laid until the customer house with the distribution network.

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The point where the dig should be done in this moment, is the “Virtual Handhole” that was defined and registered in the inventory system (with GPS coordinates) during the distribution network construction. In this point, the bundles will have an identification label, in order to make easy the selection of the correct bundle (if there are more than one bundle in the path).

Before starting to dig, the contractor must locate the exact point in which the “Virtual Handhole” is in the field with a GPS device (consulting the inventory system of UGG).



**Figure 8. Example of using a GPS device and the application to locate the exact point to dig**

Once the position of the virtual handhole is located in the field, it is needed to dig in order to find the distribution network bundle, and then from this point lay the individual micro-duct for the drop section until the customer house, using the same techniques as in the cases detailed before.

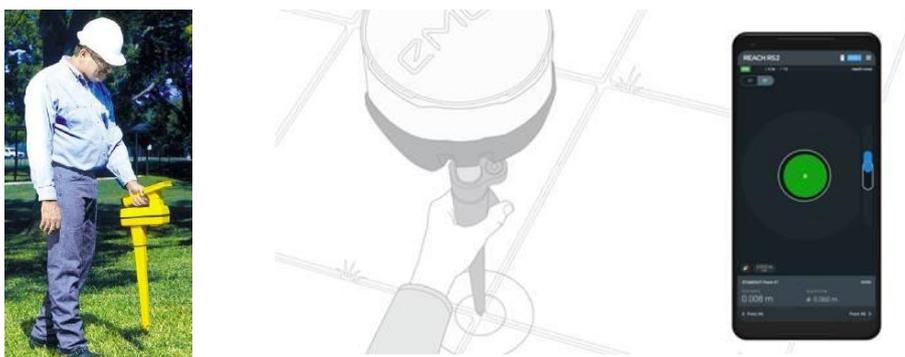
The contractor must have an agreement with the customer to know in which place he wants to finish the network inside his home.

### 2.2.2.2 FROM THE FTTF POINT TO THE HOUSE

As it was explained before for this case, the drop section pipeline was directly buried into the ground, inside the private domain of the customer house.

The point where the dig should be done in this moment, is the “FTTF Point” that was defined and registered in the inventory system (with GPS coordinates) and marked with an electromagnetic marker during the distribution network construction.

Before starting to dig, the contractor must locate the exact point in which the “FTTF point” is in the field with an electromagnetic marker detector and/or with a GPS device, consulting the coordinates registered in the inventory system of UGG.



**Figure 9. Location of the FTTF point with EM detector or with GPS**

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As the storage point is underground, it is needed to dig in order to find the drop section micro-duct that is buried there and then from this point lay the individual micro-duct until the customer house.

The contractor must have an agreement with the customer to know in which place he wants to finish the network inside his home.

### 2.3 CUSTOMER HOUSE WALL DRILLING

The micro-duct will pass the customer wall through a bore made by drilling. This drilling bore, will connect the inner stance of the house, with the outside one. The size of this drilling must be the minimum that allows the pass of the micro-duct that is being installed (typically the 7/4 mm one) and the installation manual of the sealing system.

The drilling must be correctly sealed (according to the regulation/norms) after the micro-duct installation.

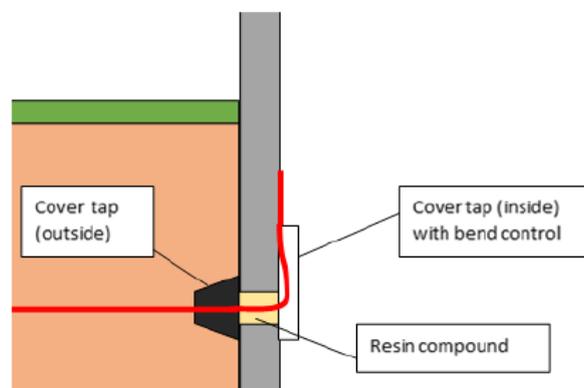
Two main different cases could be found in the field to go into a customer house:

- **Underground pipeline entry.** In this case, the microducts reach the wall of the house underground and enter to the house to the basement at the same level (underground).
- **Overground pipeline entry.** In this case, the microducts reach the wall of the house underground and enter to the house over the ground level into some stance inside the customer house.

#### 2.3.1 UNDERGROUND PIPELINE ENTRY

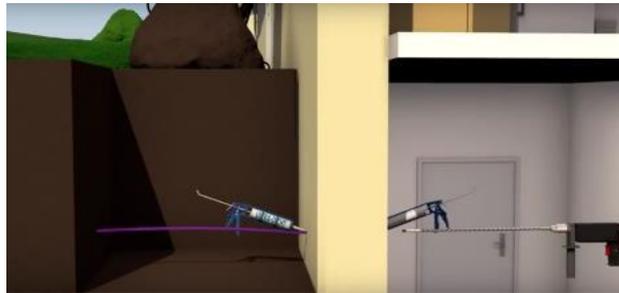
In this case the micro-duct will access to the house underground, so the installation must seal waterproofing and gas-proofing the entry. The waterproof seal must also provide the groundwater pressure (up to 0.5 bar).

The scheme for this scenario can be seen in the next picture:



**Figure 10. Underground pipeline entry scheme**

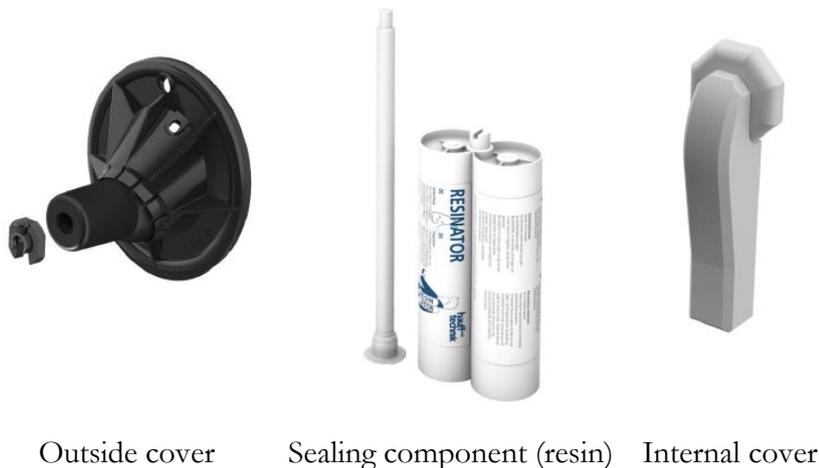
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**Figure 11. Scheme of customer house wall drilling procedure**

**NOTE:** the previous picture is a basic scheme to represent the sealing procedure, but the material used to seal must have the corresponding certification.

For these installations **an authorized product** of “house entry sealing system” must be used. This kind of systems normally are composed by 3 main elements: outside cap, sealing component and internal cover. The sealing system is normally based in a silicone mixture or resin-based mixture must be used to guarantee this requirement.



Outside cover      Sealing component (resin)      Internal cover

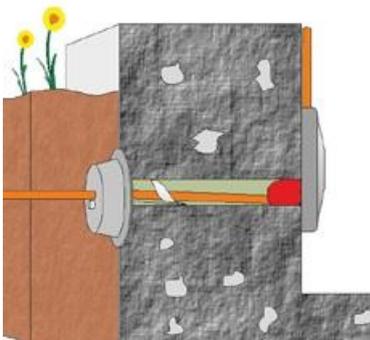
**Figure 12. Example of components of a kit of “house entry sealing system” for underground scenarios**

There are several types of “house entry sealings systems” depending on the quantity and the size of the microducts to be installed:

- Only 1 micro-duct of less than 10 mm (7 mm normally) is needed to pass. SFU scenarios and MDU up to 6 customers.
- 2 micro-ducts of less than 10 mm (7 mm normally) are needed to pass. MDU with 7 - 12 customers
- 2 micro-ducts of 14 mm are needed to pass. MDU with more than 12 customers.

**NOTE:** in the case of 2 micro-ducts of 14 mm, 2 borings and 2 sealings entries systems are needed to install.

The following picture shows an example of a house pipe sealing entry system (underground).



General scheme of the house entry sealing system



Example of cover tap of the system (outside of the house)



Example of the inside cover of the entry system (to control the curvature of the duct).

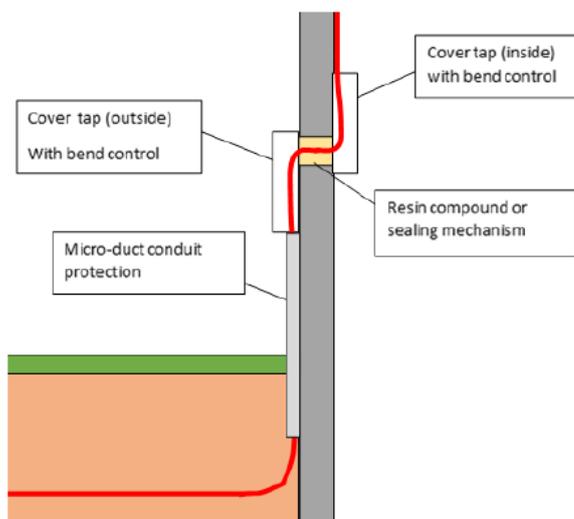
**Figure 13. Example of a house pipes sealing entry system (underground)**

### 2.3.2 OVERGROUND PIPELINE ENTRY

In this case the micro-duct reaches the house wall underground, but the micro-duct will access to the house over the ground. The installation must seal in a gas and waterproof way, but the requisite is lower than in the underground scenario (up to 0.2 bars).

In the overground scenario, the micro-duct must be protected over the ground with a cover to avoid damages, so the “house entry systems for overground” must include a protection tube/gutter.

The scheme for the overground scenario can be seen in the next picture:



**Figure 14. Overground pipeline entry scheme**

**Note:** during the installation it is necessary to keep a minimum radius of curvature for the microducts according to the manufacturer instructions. 20 cm could be a reference.

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For this type of installation, an authorized of “house entry sealing system” must be used. the sealing mechanism could be based on a resin or in a sealing mechanism formed by different rubbers.

There are several types of “house entry sealings systems” depending on the size of the microducts to be installed:

- For only 1 micro-duct of 7 mm.
- For 2 micro-ducts of 7 mm.
- For only 1 micro-duct of 10 mm.
- For only 1 micro-duct of 14 mm.

**NOTE:** in the cases in which 2 micro-ducts (bigger than 7 mm) are needed to pass through the wall (2 borings and 2 sealings entries systems are needed to install adapted to the diameter of the microducts.



**Figure 15. Example of a real installation of a “house entry sealing system (over-ground)”**

## 2.4 WORK WITH THE BUNDLE OF THE DISTRIBUTION NETWORK FOR THE BRANCH OFF AND CONNECTION WITH THE DROP SECTION

To make the joint between microducts, it is necessary to open the bundle of micro-ducts, retiring the sheath of the bundle, to have access to the individual micro-ducts of the bundle. Once retired the sheath, the correct micro-duct must be selected and cut, and joined with the individual microduct of the drop section. The other side of the microduct cut in the bundle must be sealed with an appropriated end cap.



Ripping the sheath of the bundle



Retiring the sheath of the bundle



Bundle without sheath. Access to the individual microducts.



Cutting the selected microduct of the bundle according to the project.



Connecting the individual microduct of the bundle to the individual drop microduct. Also sealing the cut microduct of the bundle with an end cap.



Adding the sheath retired in order to give some extra-protection to the individual microducts.

**Figure 16. Detail of the process to make the joint between the drop micro-duct for the customer and the micro-duct of the distribution bundle**

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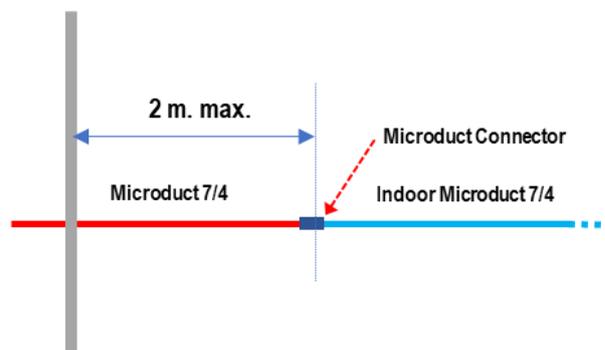
## 2.5 DROP SECTION PIPELINE TERMINATION INSIDE THE BUILDINGS

### 2.5.1.1 FOR SFU AND MDU UP TO 6 HHPP

An individual microduct of 7/4 mm will arrive to every building/house connected to the FTTH network. This microduct must be finished in the inner stance of the building as soon as possible, avoiding guiding this kind of microducts inside the property of the customer.

**NOTE:** the micro-duct is very rigid and is difficult to work with it and to bend. Also, the tube is made of high-density polyethylene and with this material it is not valid to make installations inside the customer house. It is common to install a small distance inside but less than 2 meters.

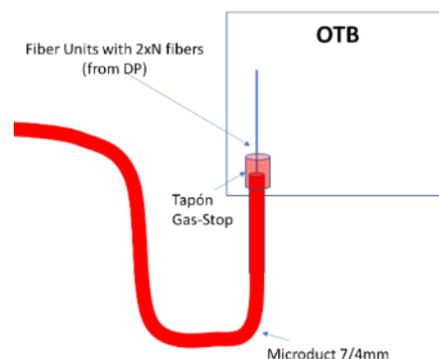
**IMPORTANT:** If the OTB is more than 2 meters away from the microducts house entry, it is necessary to make a transition to LSZH microducts (maintaining the size of the microducts).



**Figure 17. Transition to LSZH microducts inside buildings**

The microduct must be finished in the Optical Termination Box (OTB), in the case of Multi Dwell Units (MDU) (box for more than one customer), or in the Optical Termination Outlet (OTO, working as an OTB for only one customer), in the case of Single Family Units (SFU) scenarios.

**NOTE:** in the SFU scenarios, the OTO could be considered also as an OTB for only one customer.



**Figure 18. Scheme of micro-duct termination inside the customer house**

The microduct must be sealed in a gastight and a watertight manner using the appropriated gas-blockers.

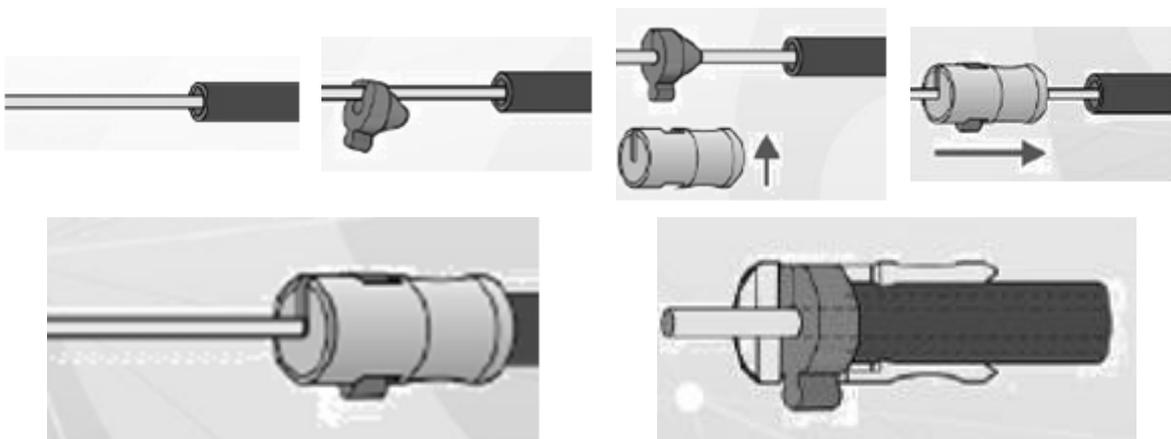
**Notes:**

- The gas-blocker that must be used have to support up to 0,5 bar pressure.
- The gas-blocker must be adapted to the diameter of the microduct (7/4 mm) and to the diameter of the fiber unit that the microduct has inside.
- Only a gas-blocker with the appropriate dimensions could be used because the gas-blocker must be installed inside the OTB or OTO. The shape of the gas-blocker that must be used can be seen in the following image:



**Figure 19. Example of gas-blocker valid to seal microducts of 7/4 mm with fiber units inside**

The way in which this kind of gas-blocker must be used can be seen in the following images:



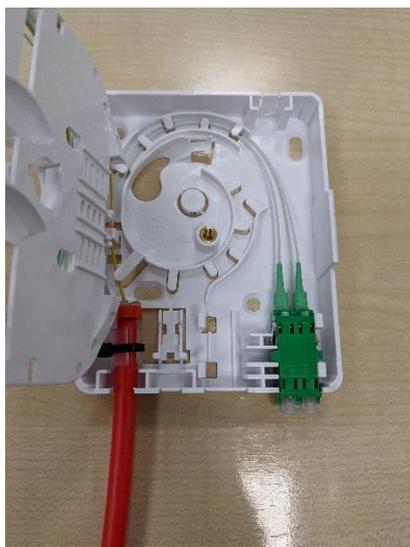
**Figure 20. Example of how must be installed the gas-blocker to seal micro-ducts 7/4 against fiber units.**

The microduct must be fixed to the OTB or OTO, with a cable tie or other mechanism that ensure a correct retention.

In the next image, is possible to see how a micro-duct 7/4 is finished inside the OTB with the correct gas-blocker sealing the micro-duct against the fiber unit.



**Figure 21. Example of a micro-duct 7/4 termination in an OTB for up to 6 customers.**



**Figure 22. Example of a micro-duct 7/4 mm termination in an OTO/OTB for 1 customer.**

#### 2.5.1.2 FOR MDU FROM 7 TO 12 HHPP

The same pipeline scheme of the case up to 6 HHPP, but in this case 2 micro-ducts of 7/4 should be deployed.

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### 2.5.1.3 FOR MDU FROM 13 TO 48 HHPP

For these scenarios, the drop section is not a drop section like in the other cases, since it is also part of the feeder network, because for these cases an indoor Distribution Point will be installed inside the building making a big difference with the other scenarios.

Nevertheless, due to the particularity that it is installed inside a building, it is included in this part of the document.

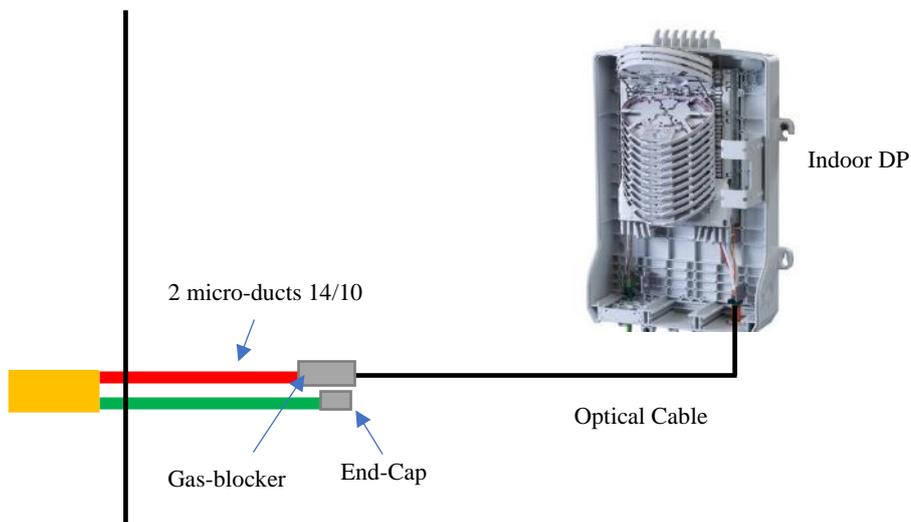
For these cases, 2 micro-ducts of 14/10 mm will arrive to every building with more than 12 homes, like happens in a street cabinet distribution point.

These micro-ducts must be finished in the inner walls of the building as soon as possible, avoiding guiding this kind of microducts inside the property of the customer.

In this case, it is not needed to guide the micro-ducts into the box (since this environment is controlled, and the optical fibre cable that are going to be used to serve the indoor DP is strong enough to enter to the box alone). So, the pipeline formed by 2 micro-ducts 14/10 could finish just in the entrance of the customer house, and from this point to the indoor DP, the cable will be laid without protection.

**IMPORTANT:** If the indoor-DP is more than 2 meters away to the micro-duct house entry, it is necessary to make a transition to LSZH microducts (maintaining the size of the microducts).

Both micro-ducts, must be sealed with the appropriate gas-blockers or end caps.



**Figure 23. Scheme of micro-duct termination for MDU with more than 12 homes**

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### 3. FIBER UNITS BLOWING CRITERIA (DISTRIBUTION NETWORK AND DROP SECTION)

#### 3.1 FIBER UNITS COUNT

Through the distribution network of 7/4 mm micro-ducts, fiber units will be deployed (drop cables). Depending on the type of building to be served, different fiber units should be used.

##### 3.1.1 FIBERS FOR SFU

For the SFU scenarios a fiber unit (with 2 fibers) will be deployed for every home connected.

##### 3.1.2 FIBERS FOR MDU UP TO 6 HHPP

For the MDU scenarios up to 6 customers, a fiber unit with the correct fiber count of fibers must be blown (at least 2 fibers per customers).

For example, if the building has 4 apartments, a fiber unit with 8 fibers should be deployed through the micro-duct.

If the building has 6 apartments, a fiber unit with 12 fibers should be deployed.

##### 3.1.3 FIBERS FOR MDU FROM 7 TO 12 HHPP

For the MDU (scenarios from 7 to 12 customers), where there are 2 micro-ducts deployed between the DP and the building, a fiber unit with the correct fiber count of fibers must be blown (at least 2 fibers per customer) independently and according to the capacity of each OTB installed.

For example, if the building has 8 apartments:

- Fiber Units of 8 fibers should be deployed for each OTB.

If the building has 10 apartments:

- A fiber unit of 12 fibers should be deployed for one of the OTBs.
- A fiber unit of 8 fibers should be deployed for the other OTB.

If the building has 12 apartments:

- 2 fiber units of 12 fibers should be deployed, one for each OTB.

HHPP in the building	Fiber Unit Count
1	2 fo
2-4	8 fo
5-6	12 fo
7-8	2 x 8 fo
9-10	12 + 8 fo
11-12	2 x 12 fo
> 12	- this case is solved with another architecture

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### 3.2 CASES IN WHICH THE FIBERS UNITS ARE BLOWN

The fiber unit must be blown from the DP into the micro-ducts of the distribution network in all the cases that the project requires it.

For all the houses or building connected during the construction phase of the distribution network, the corresponding fiber unit must be blown from the DP towards the customer premises.

Also, for all the houses that have been prepared for a future connection, reserving the micro-duct stored beyond the ground inside the private property must be blown also.

In no other case the fiber unit must be blown inside the micro-ducts.