

 UNSERE GRÜNE GLASFASER	MICRODUCT QUALITY TESTS	TECHNICAL NORMATIVE	DECEMBER 2023 2 nd Edition
		TEF-NORM-00009	Page 1/16

MICRODUCT QUALITY TESTS

 UNSERE GRÜNE GLASFASER	MICRODUCT QUALITY TESTS	TECHNICAL NORMATIVE	DECEMBER 2023 2 nd Edition
		TEF-NORM-00009	Page 2/16

INDEX

1.	INTRODUCTION	3
1.1	REVISIONS.....	3
2.	MICRODUCT QUALITY TEST FOR THE DISTRIBUTION NETWORK.....	4
2.1	MATERIALS NEEDED.....	4
2.2	PROCEDURE.....	5
2.2.1	<i>DROP INSTALLATION</i>	6
2.2.2	<i>FTTF INSTALLATION</i>	7
2.3	TEST REPORT.....	8
3.	MICRODUCT QUALITY TESTS FOR OTHER NETWORK SECTIONS.....	9
3.1	PRESSURE TEST.....	9
3.1.1	<i>MATERIALS NEEDED</i>	9
3.1.2	<i>PROCEDURE</i>	10
3.1.3	<i>TEST REPORT</i>	10
3.2	CONTINUITY TEST.....	12
3.2.1	<i>MATERIALS NEEDED</i>	12
3.2.2	<i>PROCEDURE</i>	12
3.3	CALIBRATION TEST.....	13
3.3.1	<i>MATERIALS NEEDED</i>	13
3.3.2	<i>PROCEDURE</i>	14
3.3.3	<i>TEST REPORT</i>	15

	MICRODUCT QUALITY TESTS	TECHNICAL NORMATIVE	DECEMBER 2023 2 nd Edition
		TEF-NORM-00009	Page 3/16

1. INTRODUCTION

This document describes in detail the procedure to test the microduct quality for the optical fiber deployment of Unsere Grüne Glasfaser (UGG).

The Contractor must comply with all the requirements that are written in this document.

1.1 REVISIONS

EDITION	DATE	REVISED SECTIONS	CHANGES	OBSERVATIONS
1 st	JULY 2022			
2 nd	DECEMBER 2023	All	New codification of the document	<p>The document is codified with the document code: TEF-NORM-00009.</p> <p>The logo of UGG is updated in the page header.</p> <p>References to other documents are included.</p>

	MICRODUCT QUALITY TESTS	TECHNICAL NORMATIVE	DECEMBER 2023 2 nd Edition
		TEF-NORM-00009	Page 4/16

2. MICRODUCT QUALITY TEST FOR THE DISTRIBUTION NETWORK

The purpose of this test is to assure that every duct joint in the distribution network has been made according to the joint sheet of the project and the applicable normative of UGG.

This test also aims to assure that the microducts installation has been made according to the applicable normative of UGG in a gas and a watertight manner in all the path.

This test only applies to installations carry out in accordance with the Fiber to the Fence (FTTF) procedure detailed in the document “TEF-NORM-00008 - FTTF Construction Guidelines”.

The segregations of microducts from bundles with different capacities are the possible failure points that must be checked.

The correct execution of duct joints is a key factor for future interventions in the distribution network, especially when FTTF is carried out.

2.1 MATERIALS NEEDED

The following materials are necessary to carry out the quality test of microducts for the distribution network:

1. Compressor.

The minimum characteristics of the compressor are:

- Pressure: 8 bar.
- Air flow: 60 l/min.

The air outlet of the compressor must have a connection to a 7 mm microduct. **Note:** This can be done with standard connectors/reducers if necessary.

The compressor can be powered by battery, alternating current at 220v or gasoline/petrol.

2. Electric generator.

It is only necessary if the compressor needs to be powered by 220v alternating current. The electric generator must be powerful enough to power the compressor.

3. Manometer.

The manometer must be valid to measure pressures of at least 10 bar and it must have a connection to a 7 mm microduct. **Note:** This can be done with standard connectors/reducers if necessary.

4. Smart phone with camera and GPS.

The smart phone will be used to do the pictures needed. All the pictures must include overprinted information regarding the GPS coordinates, the date, etc.

	MICRODUCT QUALITY TESTS	TECHNICAL NORMATIVE	DECEMBER 2023 2 nd Edition
		TEF-NORM-00009	Page 5/16



Figure 1. Electric generator and small compressor (left) and manometer (right).

2.2 PROCEDURE

To perform the quality test, the deployment of the distribution network must be carried out from the distribution point (DP) to the FTTF or DROP locations, having continuity all the time with the DP.

Therefore, street crossings should be done before performing the affected FTTFs and they should be prioritized.

It is possible to have two situations depending on whether the client has contracted the service (DROP) or not (FTTF).

The quality test basically consists of carrying out a continuity test and pressure test at 8 bar. The following tasks will need to be performed:

- 1) In the FTTF or DROP location connect a manometer to the microduct.
- 2) In the Distribution Point, connect the compressor to the correct microduct to be tested according to the joint sheet.

Introduce air into the pipeline until achieve a pressure of 8 bars (approx.).

- 3) Take one or more pictures of the connection set-up, showing a general view of the DP and the compressor.

The picture or pictures must detail DP n°, Bundle n°, microduct n°, test side, date, time, GPS coordinates and address.

- 4) Check the pressure achieved in the FTTF or DROP location.

Take a picture or pictures of the manometer connection with the value achieved, showing a general view of the house or trench.

The picture or pictures must detail DP n°, Bundle n°, microduct n°, test side, date, time, GPS coordinates and address.



Figure 2. Scheme of the quality test procedure.

Note: It is possible to do the test in the opposite way. That is connecting the compressor in the FTTF or DROP location and the manometer in the DP.

The pictures must be uploaded in a repository (i.e. SharePoint) to be provided.

2.2.1 DROP INSTALLATION

In this case, the client has contracted the service and the microduct ends up in the private domain while waiting for the installation inside the home to be completed.

Once the continuity and pressure test has been carried out, the microduct must be stored in a coil and sealed with an endcap.



Figure 3. Manometer connection to check the pressure.



Figure 4. Microduct with endcap and stored in a coil.

	MICRODUCT QUALITY TESTS	TECHNICAL NORMATIVE	DECEMBER 2023 2 nd Edition
		TEF-NORM-00009	Page 7/16

2.2.2 FTTF INSTALLATION

In this case, the client has not contracted the service and the microduct ends up in the public/private domain pending its future installation.

Once the continuity and pressure test has been carried out, the FTTF must be completed according to the procedure detailed in the document “TEF-NORM-00008 - FTTF Construction Guidelines”.



Figure 5. Manometer connection to check the pressure during a FTTF installation.

The microduct must be sealed with an end cap and the FTTF installation must be completed using the mining or drilling technique.



Figure 6. Mining (left) and drilling (right) technique.

	MICRODUCT QUALITY TESTS	TECHNICAL NORMATIVE	DECEMBER 2023 2 nd Edition
		TEF-NORM-00009	Page 8/16

2.3 TEST REPORT

For the validation and acceptance of the works of the distribution network of all the DPs, quality test reports are mandatory deliverables.

In the procedure of this specific test, it is said that several pictures must be taken as evidence of the test realization.

Each microduct of the distribution network will have its own test report, that basically will consist of pictures with some important information overprinted on them.

The pictures/reports must be uploaded in a repository (i.e. SharePoint) to be provided by UGG. Provisionally CC's and TO's must store them in their own SharePoint with access to deployment staff from UGG. The storage must have structure. E.g.

CC XXX → Distribution Network Quality Test Report → Shortcut Bundesland → Gemeinde X → DP XX → Files.

The file name will have a defined structure including the following information:

- Bundle name (the official name in the project, including all the information)
- Microduct number (color)
- Execution side (DP side, or FTTF/DROP side)

For example: MRN-001-DP006-B01 - MD13 (red with stripes) – (DP Side).jpg

MRN-001-DP006-B01	MD13 (red with stripes)	DP Side
Bundle name	Microduct number (color)	Execution side

Each picture itself must include all the information required in the normative (the picture must focus the evidence of the test, and include overprinted the information: bundle name, microduct number (color), test side, date and hour, GPS coordinates, address, etc).

NOTE: Applications like “SpotLens” (available in Google play) can be used to simplify the labour of overprint the information, and to give the correct name to each picture/test reports. With that application, this can be done automatically.



Figure 7. Example of picture with overprinted information.

	MICRODUCT QUALITY TESTS	TECHNICAL NORMATIVE	DECEMBER 2023 2 nd Edition
		TEF-NORM-00009	Page 9/16

3. MICRODUCT QUALITY TESTS FOR OTHER NETWORK SECTIONS

For the backhaul, local backbone and feeder network once the installation is complete, it must be ensured that the microduct and its connections have not been damaged and have been performed correctly.

To approve the installations, the tests defined in the following chapters must be carried out.

These tests and its corresponding protocol will be elaborated by a qualified worker of the contractor company (CC) with the support from the Bauleiter or work supervisor.

For the execution of the tests, the tools and materials must be previously prepared according to UGG Normative and the manufacturer's recommendations, the joint must be made according to the joint sheet of the project, putting in the trenches sand bed and covers, making the compaction carefully, avoiding crushes, etc.

3.1 PRESSURE TEST

The purpose of this test is to assure that the microducts installation has been made according to the applicable normative of UGG in a gas and a watertight manner in all the path.

The result of this test is a key factor for future fiber installation in the network.

It must be carried out on 100% of the reserve microducts.

3.1.1 MATERIALS NEEDED

The following materials are necessary to carry out the continuity test for microducts:

1. Compressor.

The minimum characteristics of the compressor are:

- Pressure: 8 bar.
- Air flow: 60 l/min.

The air outlet of the compressor must have adaptors to make possible the connections to a different microducts diameters (14, 16 mm, etc). **Note:** This can be done with standard connectors/reducers if necessary.

The compressor can be powered by alternating current at 220v or gasoline/petrol.

2. Electric generator.

It is only necessary if the compressor needs to be powered by 220v alternating current. The electric generator must be powerful enough to power the compressor.

3. Pressure test distribution unit with valves and manometers

Used to carry out several pressure test at the same time.

4. Smart phone with camera and GPS.

The smart phone will be used to do all the pictures needed as evidence of the set-up of the test and the results. All the pictures must include overprinted information regarding the GPS coordinates, the date, etc.

	MICRODUCT QUALITY TESTS	TECHNICAL NORMATIVE	DECEMBER 2023 2 nd Edition
		TEF-NORM-00009	Page 10/16

3.1.2 PROCEDURE

This test is carried out to make sure that all the microduct connections are airtight and shows that the tube is airtight (any possible damage during the closure installation).

This test should be carried out at the pressure of 8 bar.

This test is carried out with an air compressor, inserting air under pressure at the beginning of the network and with end caps at the other ends. Could be done with more than one at the same time using a coupler.

It is needed to stabilize the pressure up for 5-10 minutes (depending upon microduct length, number of microducts being tested and compressor output). After the pressure has built up, isolate the air supply so the tubes remain pressurized.

It is acceptable for the pressure to drop less than 2 bar in the first 2 minutes. The air pressure slightly expands the tube creating a pressure drop. If the pressure drops more than 2 bar before stabilizing, it is necessary to pressurize the microduct again and check for a maximum drop of 2 bar.

3.1.3 TEST REPORT

The **Duct Pressure Test Report** is a mandatory deliverable for the acceptance and certification of the deployed pipelines.

Each section of the network must have a deliverable pressure test report:

- Backhaul and local backbone: deliverable associated to the POP.
- Feeder network: deliverable associated to the POP.

Information or documentation that should be included in the deliverables of the report:

- Photographic evidence of the test assembly with overprinted information including bundle name, microduct numbers (colors), date, time, and GPS coordinates.
- Photographic evidence of the initial and final pressure with overprinted information including bundle name, microduct numbers (colors), date, time, and GPS coordinates.

NOTE: Applications like “SpotLens” (available in Google play) can be used to simplify the labor of overprint the information, and to give the correct name to each picture/test reports. With that application, this can be done automatically.

- Protocol table with the pressure test made including:
 - o Date, technician, bauleiter, address, description of starting point, GPS coordinates (of the point in which the test is started), tested section, compressor and machinery used.
 - o A table with all the micro-duct inputs (bundle identification, and microduct identification) to be tested from this point. Information related to the setup pressure, initial stabilized pressure (after 10 minutes), the final pressure maintained in the ducts after 2 minutes, the drop of pressure of each duct, the dictamen of the test and observation (if there are).
- Graphical register of pressure test made (Optional, alternative to Protocol table)

	MICRODUCT QUALITY TESTS	TECHNICAL NORMATIVE	DECEMBER 2023 2 nd Edition
		TEF-NORM-00009	Page 11/16

The reports must be uploaded in a repository (i.e. SharePoint) to be provided.

(*) Provisionally CC's and TO's must store them in their own SharePoint with access to deployment staff from UGG. The storage must have structure. E.g.

CC XXX → Duct Pressure Test Report → Shortcut Bundesland → Gemeinde X → POP XX → Files.

The Filename must have also a structure, e.g.

- DPTR (Duct Pressure Test Report)
- Abbreviature of Gemeinde
- BXXX (number or bundle)
- Date

For Example, **DPTR-MRN1-B002-20210322.pdf** (For Duct Pressure Test Report in Maring-Noviad Bundle 002 on 20210322).



Test assembly at test point



Initial pressure. After 10 minutes of stabilization



Final pressure. 2 minutes later

Figure 8. Evidence test assembly.

Information provided will be checked by UGG/TO personal every week.

Defects identified in the reports or inconclusive/badly prepared reports will be derive in action plans or/and serious faults.

Consider data protection laws in Germany, avoid photographing people (employees or not) without their written consent.

	MICRODUCT QUALITY TESTS	TECHNICAL NORMATIVE	DECEMBER 2023 2 nd Edition
		TEF-NORM-00009	Page 12/16

3.2 CONTINUITY TEST

The purpose of this test is to assure that every duct joint has been made according to the joint sheet of the project and to the applicable normative of UGG.

The segregations from microducts from bundles with different capacity are the possible fault points that should be checked.

The correct execution of duct joints is a key factor for future interventions in the network.

It must be carried out on 100% of the reserve microducts when the end of the microduct is available.

3.2.1 MATERIALS NEEDED

The following materials are necessary to carry out the continuity test for microducts:

1. Compressor.

The minimum characteristics of the compressor are:

- Pressure: 8 bar.
- Air flow: 60 l/min.

The air outlet of the compressor must have adaptors to make possible the connections to a different microducts diameters (14, 16 mm, etc). **Note:** This can be done with standard connectors/reducers if necessary.

The compressor can be powered by battery, alternating current at 220v or gasoline/petrol.

2. Electric generator.

It is only necessary if the compressor needs to be powered by 220v alternating current. The electric generator must be powerful enough to power the compressor.

3.2.2 PROCEDURE

This test is carried out with an air compressor, inserting air under pressure between 7 and 15 bars at the beginning of the network and checking that the air comes out at the end of it according to the joint sheet.

This test should be done before performing the calibration test.

NOTE: It is not required a test report for this test since it is assumed that it is done before the calibration test (which will have a mandatory test report).

	MICRODUCT QUALITY TESTS	TECHNICAL NORMATIVE	DECEMBER 2023 2 nd Edition
		TEF-NORM-00009	Page 13/16

3.3 CALIBRATION TEST

The purpose of this test is to assure that all the ducts are in perfect conditions to install cables inside, without crushes or damages that supposes a limitation in the inner diameter of the duct.

It must be carried out on 100% of the reserve microducts when the end of the microduct is available.

3.3.1 MATERIALS NEEDED

The following materials are necessary to carry out the continuity test for microducts:

1. Compressor.

The minimum characteristics of the compressor are:

- Pressure: 5 bar (not recommended to use more pressure for calibration tests)
- Air flow: 60 l/min.

The air outlet of the compressor must have adaptors to make possible the connections to a different microducts diameters (14, 16 mm, etc). **Note:** This can be done with standard connectors/reducers if necessary.

The compressor can be powered by alternating current at 220v or gasoline/petrol.

2. Electric generator.

It is only necessary if the compressor needs to be powered by 220v alternating current. The electric generator must be powerful enough to power the compressor.

3. Calibrated bullets with transmitter.

Used to be blown into the microducts, with the appropriate diameter and with a coupled transmitter that can allow the blocking point in case it occurs.

4. Catcher or collecting device.

Used in the far end in the microduct tested to allow the air flow during the test and to catch and stop the calibrated bullet in a safe way.

5. Locator device

Used to detect the point in path in which the calibrated bullet with transmitter have been blocked (if it occurs).

6. Smart phone with camera and GPS.

The smart phone will be used to do all the pictures needed as evidence of the set-up of the test and the results. All the pictures must include overprinted information regarding the GPS coordinates, the date, etc.

3.3.2 PROCEDURE

This test is carried out to check that the inside diameter (ID) of the microduct is maintained throughout the microduct path. It consists of blowing a calibrated bullet with different diameters depending on the type of microduct.

The following calibrated bullet should be used for the corresponding microduct sizes. No calibrated bullet should be used which is less than 60% of the microduct bore size.

Microducts	16/12	14/10	12/10
Calibrated bullet diameter (mm)	10	8	8

Insert the calibrated bullet into each tube to be tested at the air inlet side. Make sure the air is isolated before starting the air compressor.



Figure 9. Calibrated bullets without transmitter and with transmitter (different sizes).

Connect the catcher or collecting device to the opposite end of the microduct. The catcher needs to be strong enough to stop the bullet at the end of the microduct and have a foam piece added to soften the approach of the bullet. Attach a 250 mm breathing tube (with suitable holes in it to exhaust the air) between the catcher and the end of the chosen microduct.



Figure 10. Ball chain catcher or collecting device.

The air pressure used in this test should be up to a maximum of 4 bar (or the recommended by the manufacturer of the devices used). An air preparation kit must be used to remove oil and water from the compressed air.

Once catchers are connected, it is safe to turn the air supply on.

The bullet should exit the microduct within 5 minutes (in a 1000m length).

If after 5 minutes the bullet has not arrived, release all pressure and reverse the initial configuration by modifying origin and destination.

Once the bullet has been retrieved, blow it back in from the opposite direction.

If the bullet is blocked in the path, detect the blocking point with the locator device, and do all the works needed to fix the pipeline properly.

	MICRODUCT QUALITY TESTS	TECHNICAL NORMATIVE	DECEMBER 2023 2 nd Edition
		TEF-NORM-00009	Page 15/16

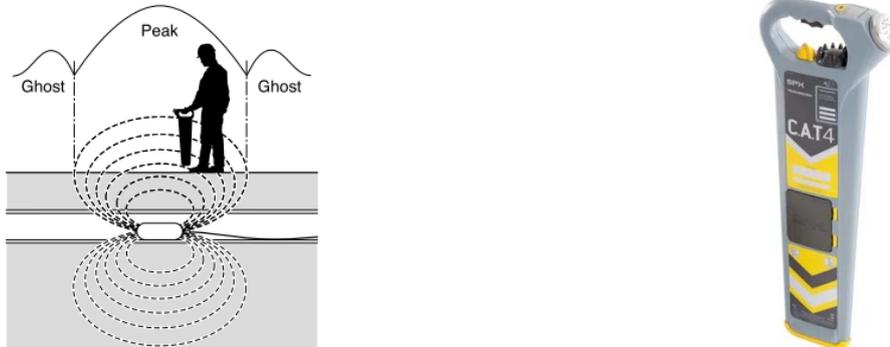


Figure 11. Detection the point of blockage of the calibrated bullet with the locator.

3.3.3 TEST REPORT

The **Duct Calibration Test Report** is a mandatory deliverable for the acceptance and certification of the deployed pipelines.

Each section of the network must have a deliverable calibration test report:

- Backhaul and local backbone: deliverable associated to the POP.
- Feeder network: deliverable associated to the POP.

Information or documentation that should be included in the deliverables of the calibration report.

- Photographic evidence of the test assembly with overprinted information: bundle name, microduct number (color), date, time, and GPS coordinates.

NOTE: Applications like “SpotLens” (available in Google play) can be used to simplify the labour of overprint the information, and to give the correct name to each picture/test reports. With that application, this can be done automatically.

- Protocol table with the test of calibration made including:
 - o Date, technician, bauleiter, address, description of starting point, GPS coordinates (of the point in which the test is started), machinery used. Tested section.
 - o Diameter of the calibrated bullet used.
 - o A table with the microduct input, and the corresponding output expected checked. **Note:** if during the calibration test, is created a loop, and the microducts are tested in pairs, include the detail of it.
 - o Observations.

The reports must be uploaded in a repository (i.e. SharePoint) to be provided.

(*) Provisionally CC’s and TO’s must store them in their own SharePoint with access to deployment staff from UGG. The storage must have structure. E.g.

CC XXX→ Duct Calibration Test Report →Shorcut Bundesland→ Gemeinde X → POP XX → Files.

	MICRODUCT QUALITY TESTS	TECHNICAL NORMATIVE	DECEMBER 2023 2 nd Edition
		TEF-NORM-00009	Page 16/16

The Filename must have also a structure, e.g.

- DCALTR (Duct Calibration Test Report)
- Abbreviature of Gemeinde
- BXXX (number or bundle)
- Date

For Example, **DCALTR-MRN1-B002-20210322.pdf** (For Duct Calibration Test Report in Maring-Noviad Bundle 002 on 20210322)

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