Gigaclear Engineering
Third Party Infrastructure Usage Guide

1. Table of Contents

1. Table of Contents 2
2. Introduction 3
2.1. Implications of third-party infrastructure for the network 3
3. Rules and Requirements 4
3.1. Openreach PIA Ducts 4
3.1.1. Cost calculation example 5
3.1.2. Openreach RAG status 5
3.2. Openreach PIA Poles 6
3.3. DNO Poles 6
4. Construction Method 7
4.1. Openreach PIA Ducts 7
4.2. Openreach PIA Poles 7
4.3. DNO Poles 7
5. Component Specification 8
5.1. Openreach PIA Ducts 8
5.1.1. Ducts 8
5.1.2. Cables 8
5.1.3. Closures 9
5.1.4. Labels 9
5.1.5. Pulling Equipment 9
5.1.6. Investigation and Proving Equipment 10
6. Version History 11

2. Introduction

This document provides guidance, design rules and product information for Gigaclear's use of third-party infrastructure including:

- BT Openreach's Physical Infrastructure Access (PIA) duct sharing products
- BT Openreach's PIA overhead pole sharing products
- Designated Network Operator (DNO) pole sharing agreements

It should be considered the canonical reference for use of these assets on the network. It replaces the *Interim PIA Duct Product Guide*, which should no longer be used.

This document should be read alongside the *Network Build Specification* document pack, which all contractors and staff have access to in the External Sharepoint. These documents explain the basic standards and processes for building the network. The *Civils Construction Guide* and *Optical Build and Testing* documents cover much of the detail needed for construction works.

This document is intended to be read by designers, planners, managers, and contractors to aid in planning the use of third party infrastructure.

Gigaclear has never used third party infrastructure to build the network, and the rest of industry is still learning lessons from attempting to use products such as PIA. Gigaclear's approach is one of moderated risk and limited exposure in this adoption phase; this will change over time as we make more use of these assets and learn more about the typical costs and risks of usage.

2.1. Implications of third-party infrastructure for the network

Third-party assets add significant operational complexity and ongoing cost overheads to the network. This is due to the complexity of involvement of third parties in maintenance or commissioning of the asset, and risks introduced using third party networks such as:

- Process complexity introduced in making an asset ready to use (defect poles, damaged or blocked ducts, cable recovery/congestion)
- Risk of damage to cables from third parties
- Likelihood of damage to cables due to copper recovery works
- Potential for liability/ownership of poles and ducts as copper switch-off progresses
- Impact on our repair SLA where third parties need to make repairs prior to Gigaclear repairs commencing

In general, third party infrastructure should only ever be used where normal construction methods cannot be used or are cost-prohibitive. The decision to use PIA assets will be taken by Gigaclear's Design team in consultation with Commercial Finance and Engineering.

The overhead of using third-party assets is not well understood at this time, and this makes them unsuitable for general usage as a replacement for normal construction activities to build our own network "from scratch". This policy may change over time as we better understand the in-life overhead of managing third party infrastructure and as the market develops.

3. Rules and Requirements

3.1. Openreach PIA Ducts

Openreach ducts can be used where there is no cost-effective mechanism for trenching in an area or where trenching has been tried but is not possible. This means ducting should only be considered post-validation, not at the first design phase.

Ducts have several limitations:

1. Branching of main cables en-route should be kept to an absolute minimum, as this complicates the ordering process and requires the installation of Gigaclear chambers at branch points or expensive facility hosting charges to install closures in BT joint boxes
2. The total cable diameter must not exceed 25mm, as calculated with Openreach's diameter calculation examples (total diameter * 0.7); see the table below
3. Only spine ducts should be used. Lead-in ducts may only be used where absolutely required
4. Ducts and chambers must not enter BT's defined "sensitive areas", locked chambers, or areas where security clearances are required
5. All directly cabled routes must reserve 12F spare capacity in total on the route for open access/passive access products and our own expansion. Where cables branch, 12F capacity must be available on all branches of the route; this is not required for lead-in branches

If the link meets these requirements, then PIA ducting may be used. The allowed usage per bore is detailed below for Fibrain DCC C0 cables and microducts, with each row representing a valid bore configuration.

Table 1: Permitted PIA single-bore duct configurations using Fibrain DCC C0 cables and Emtelle microduct

12-72F Direct Burial Cables	96-144F Direct Burial Cables	288F Direct Burial Cables	Drop (8/4.5mm) Microduct	Main (16/12mm) Microduct
2	0	0	0	0
1	1	0	0	0
0	2	0	0	0
0	0	1	0	0
0	0	0	4	0
0	0	0	0	2
1	0	0	2	0
0	1	0	2	0
0	0	0	2	1

For instance, you could install two 144F cables side-by-side or use a 144F alongside two drop microducts. You could also install two main microducts and blow 144F through them if more convenient in the network area. You could not install 4 drop microducts and a 72F in the same bore, however.

Sub-ducting is recommended where it is convenient to enable continuation of existing microduct runs and no branching is required, or on longer runs of duct where a single continuous pull is not possible to install the cable and splicing along the route would be required.

Direct-burial rated cable is preferred if a joint is already required at each end of the duct run, either for branching or to extend a blown cable, as the armoured cable will be more robust and typically easier to install. Gigaclear's current preferred cable is Fibrain DCC C0, available between 12F

and 288F. Gigaclear's older TKF cabling stock may be used but much be grounded in each chamber it terminates in as per the Gigaclear standards for cabling with metallic armour. Planners should use their judgement as to the appropriate option to use.

More cables may be installed in multiples of the above rules, but will require a second bore rental fee, so larger cables are preferred where possible. Gigaclear Engineering can advise on higher fibre count cables if >288F is required or space for larger cables is not available; this requires the use of pliable ribbon cables and non-standard joints at each end of the cable.

In terms of cost, simple cases of single bore spine duct links normally cost more than Gigaclear's own soft dig rates, even before operational costs are considered. However, the cost of carriageway rates quickly outstrips the cost of duct rental on longer stretches. Therefore, PIA duct usage should be considered where:

1. The trenching route requires significant (>100m) carriageway usage, or cannot be used due to other issues that cannot be resolved by other means (land rights, wayleaves, etc)
2. Usage of all self-build trenching and trenchless methodologies have been explored (microtrenching or narrow trenching, impact moling, directional drilling, etc)
3. Alternative routes cannot be used to resolve the issue in a cost-effective manner
4. The total cost of the route, calculated over a 20 year period with a 2.2% CPI increase annually incorporated, does not exceed the planned trench cost

When used for "installation" scenarios where significant quantities of duct are needed – for instance, to connect buildings on a business park – the monthly cost of the installation may be weighed against the ARPU to determine viability. Where the monthly cost of rental exceeds likely revenue, it may be better to insist on a standard installation.

3.1.1. Cost calculation example

One kilometre of spine duct costs £280 a year. While this does not sound like much, it soon adds up. We add in £8.20 for our required joint box entry charges (in and out of the BT chamber at each end). After a year that cost is now £294; after 10 years, it is £351, and after 20 years it is £435 a year.

This is due to the compounded effect of BT's regulated price rises which are in line with the consumer price index (CPI). The total cost of our £288.20 a year kilometre of duct is over £7,100 by year 20, not the £5,800 you might otherwise come to. If you needed to install twelve drop tubes, you would need three bores – this brings the duct cost up to just shy of £15,000 over 20 years, easily twice the cost of installing and using our drop ducts in soft ground using traditional installation techniques.

Over a longer period, those costs keep ratcheting up – after 50 years we would have paid for ourselves to install that entire route in carriageway by quite some margin, and we get much less capacity out of it! We are also subject to any changes in pricing that BT might agree with Ofcom, and may see increased maintenance fees as BT recover their copper cabling (and, in areas where they abandon infrastructure, leave us to maintain the ducts or poles). This is part of the reason we do not recommend using PIA except where it is needed.

3.1.2. Openreach RAG status

Openreach data includes a red/amber/green coding to indicate capacity. This should not be relied upon as a final indicator, but routes which are red/amber along their entire length should be considered high risk and are likely not to be viable.

Green and amber ducts will likely be usable for our typical installations but only one bore's worth of space may be available in an amber duct. It is likely that a red duct will not have sufficient capacity for a full bore of cable. It may still be possible to install a smaller cable.

Short segments of ducts which are marked as red should normally be explored, particularly if they feed onto an otherwise green cabling route; the segment may be erroneously marked as red, or the rest of the route may be erroneously marked as green.

3.2. Openreach PIA Poles

There is currently no mechanism for Gigaclear to make use of overhead poles from Openreach.

Development of the overhead product is being planned for trials in January 2020 with general usage for point to point deployments in early 2020.

3.3. DNO Poles

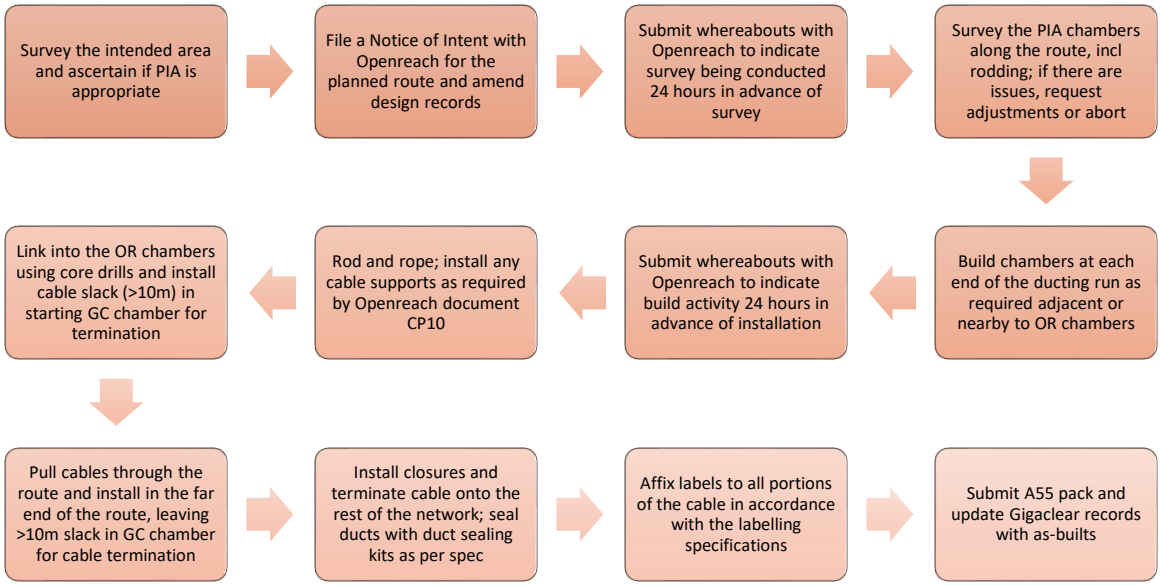
There is currently no mechanism for Gigaclear to make use of poles from any Designated Network Operators in the UK.

Negotiations are ongoing to establish the ability to use DNO pole infrastructure.

4. Construction Method

4.1. Openreach PIA Ducts

The general process is as follows:



The Notice of Intent and Whereabouts processes on the Openreach portal are documented in the "Openreach Portal User Guide" document, available separately.

Where blockages or capacity limits are identified they must be confirmed with Openreach and remediated in accordance with the Openreach processes for network alterations. Rodding is encouraged along the whole route prior to confirmation and commencement of build to de-risk the route; a rope *may* be installed at this time but this is considered an installation activity, so appropriate whereabouts must be submitted. We do not recommend installation of a rope until just before installation commences, to reduce the risk of third parties reusing the rope on congested routes.

Best practice with respect to cable installation must be followed; this includes but is not limited to the use of tension-limiting pulling fuses, tension-limited winches, cable sealing during pulling operations to prevent water/dirt ingress and use of a suitable pulling lubricant. These topics are covered in more detail, if needed, in the Network Build Specification.

4.2. Openreach PIA Poles

There is currently no mechanism for Gigaclear to make use of overhead poles from Openreach.

Development of the overhead product is being planned for general usage in 20H1.

4.3. DNO Poles

There is currently no mechanism for Gigaclear to make use of poles from any Designated Network Operators in the UK.

Negotiations are ongoing to establish the ability to use DNO pole infrastructure.

5. Component Specification

The components used in this section *must* be used to maintain compliance with third-party technical requirements.

Deviation from the specified components is not allowed under any circumstances without written permission from the Chief Engineer's office. Due to the need to meet third-party requirements, deviation from the specified components will not generally be permitted.

Gigaclear Engineering may audit work done on third party assets and will require the replacement of any non-compliant components found to maintain compliance.

5.1. Openreach PIA Ducts

5.1.1. Ducts

Single Emetlle 16/12mm duct may be used, but sub-ducts from a multiduct assembly cannot be used as they are not marked appropriately. Emtelle specification MHT1604 (product code 64327) for PIA duct usage can be used, which is a single 16/12mm duct suitable for use within PIA ducts as a sub-duct. This duct is translucent with an orange stripe, and can be directly attached to existing sub-ducts in multiduct assemblies without adaptation.

The sub-ducts used in the construction of Gigaclear's 7-way multiduct assembly are not, on their own, compliant ducts for use in PIA; they must not be used.
Gigaclear's 7-way multiduct is not suitable for PIA usage due to the size of the assembly.

Emtelle 8/4.5mm duct (Gigaclear's standard drop duct) may be used directly.

5.1.2. Cables

Cables to be used in BT ducts:

1. MUST have an outer diameter below 20mm
2. MUST be certified for direct burial/duct usage by the supplier
3. MUST have a black outer jacket
4. MUST be marked with a printed legend at a regular interval that includes the "GIGACLEAR LTD" indicator
5. SHOULD have a short-term tension limit of at least 3500N
6. SHOULD have an installed/static tension limit of 1000N
7. SHOULD have a crush resistance of 2000N/10cm (measured to IEC 60794-1-2 E3)
8. MUST have a stationary minimum bend radius of no less than 300mm

This allows the use of:

1. Fibrain DCC-C0 cables between 12F and 288F
2. TKF LTC-S cables between 12F and 144F (not to be ordered anew)
3. Emtelle ULW cables between 24F and 48F (not recommended for long cable runs)
4. Prysmian ULW cables between 24F and 48F (not recommended for long cable runs)

This does not permit the use of Emtelle Fibreflow or other cables specified for blown fibre applications. We do not recommend the use of ULW cables intended for aerial use except for short spans,

as their limited tension strength requires careful handling and their crush resistance is significantly worse than the other cables available, increasing the risk of damage. Their use is anticipated only to link aerial sections where it is already being used overhead.

For use in lead-in/low-impact scenarios only, Commscope HMFOC, RealFlex 3, or 3.6mm indoor/outdoor 12-fibre cable, or direct burial fibre cable from Hexatronic may be used. This is appropriate only for "last leg" connections, for instance as part of MDU or lead-in installations; where there is a significant risk of damage or other use of the ducting an armoured cable should be preferred.

5.1.3. Closures

Closures used in chambers for terminating PIA network sections shall be standard Gigaclear network closures such as the FDN59 closure. Larger fibre counts and branching may require the use of a UFC closure.

Metallic armoured cables *must* be grounded at least once every 1km; this requires the earthing kit be fitted to any closures used. This is the EK-FDN kit for the HellermannTyton FDN59 closures. See the *Civil Construction Guide* for details, section 7.

Other closures may be available for specific situations on request.

5.1.4. Labels

All cables MUST be labelled at all chambers, including chambers where the cable passes through, as well as at the terminating closure. Cables should be labelled as soon as they are pulled through, so that cables are identified correctly along the entire span. Alternatively, use cable serial/drum numbers or metre markers to identify cables. Handwritten labels may be used as a temporary measure during construction if needed, but must be replaced with printed labels before acceptance.

Labels will be HellermannTyton TipTag 15x100mm labels. Labels must be printed using the "Gigaclear 15x100mm PIA Cables" template distributed with the Network Build Specification pack, and will at minimum read:

GIGACLEAR LTD – OPTICAL FIBRE CABLE
PIA NoI [NoI Number] – [Fully Qualified Cable Identifier]

For instance:

GIGACLEAR LTD – OPTICAL FIBRE CABLE
PIA NOI0001253 – SW-NRTH-CBL005

In congested or large chambers, labels should be applied at both entry and exit points to aid identification. Labels may also feature a standard QR code which encodes the notice of intent reference number; this is included in the standard label template.

5.1.5. Pulling Equipment

Suppliers must have equipment to allow for installation of cables in a way which limits the pulling tension and twisting on the cable. At minimum this requires:

- Anti-torsion pulling socks (with a swivel link) be used on all pulls
- Fused pulling links to be used on all pulls with a limit matched to the cable being pulled
- Tension-limiting winches to be used to perform all pulling

Pulling socks should always be used to avoid damage to cable.

Ducts and cables must always be sealed prior to pulling; cold seal caps are recommended and can be sourced from Filoform.

Cable pulling lubricant should always be used, along with any bellmouth/guiding hardware required for the smooth entry of cable into ducts. Polywater F, FO, or M lubricants, as well as IDEAL Yellow 77 are recommended. Lubricant should generally be applied to the cable as it is pulled through; lubricant application devices are available to ensure a consistent application of lubricant.

Draw rope used must be rated for a minimum 3kN load.

5.1.6. Investigation and Proving Equipment

All suppliers must have a set of cable rods of approx. 10mm diameter and adequate length for proving the runs they are working on.

It is recommended that all suppliers are also equipped with a video borescope for the inspection of blockages, equipped with a sonde for location of blockages. This will allow for rapid and accurate identification of blockages in ducts.

6. Version History

Version	Date	Notes
1.0	Set this	First issue