Gigaclear Engineering
Third Party Infrastructure Usage Guide

PIA/PON Trial Document

This document is a more recent version than that distributed in the Network Build Specification (NBS) or has not yet been distributed through the NBS and supersedes the contents of NBS 2019.12-1.

This document version must only be used for trial builds under close supervision of Gigaclear PIA/PON project teams while HSEQ guidance, as-built management tools, and other associated business processes are developed for safe and scalable build to be undertaken.

This document is provided to make internal teams, Contractors, and the wider supply chain aware of an upcoming change to the Network Build Specification and to allow for work to be conducted by Contractors as part of trial and soft-launch programmes.

Queries relating to this document should be addressed to the network-standards@gigaclear.com email address.

This document should not be solely relied upon to provide complete or adequate guidance on PIA network build operations.

Further guidance is required to successfully construct PIA network segments, including HSEQ guidance on safe working practices.

This document should only be used alongside guidance and supervision from Gigaclear teams during PIA/PON trial builds.

1. Table of Contents

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 other documents in the *Network Build Specification* document pack. 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 and optical testing, which still apply to works performed through third-party infrastructure.

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

Gigaclear and the rest of industry is still learning lessons in how to use products such as PIA. Gigaclear's approach is one of moderated risk and limited exposure in this adoption phase; this may change over time as we make more use of these assets and learn more about the typical costs and risks of usage.

2.1. Glossary of Terms

This document uses a number of acronyms which are described below as a reminder and explanation for those unfamiliar:

ACRONYM	DESCRIPTION
PIA	Passive Infrastructure Access
DNO	Designated Network Operator (electricity network)
SLA	Service Level Agreement
BTOR/OR	BT Openreach
NOI	Notice of Intent (PIA term)
MDU	Multiple Dwelling Unit
ULW	Ultra-Light Weight (cable style)

2.2. 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, tree cutting, duct desilting)
- Substantially increased as-built accuracy and completeness requirements above and beyond typical Gigaclear processes (e.g. Openreach A55 processes)
- Risk of damage to cables and other assets from third parties using the underlying infrastructure

- Potential for future liability/ownership of poles and ducts as copper switch-off progresses and DNOs move infrastructure underground
- Impact on our operational network SLAs where third parties need to make repairs prior to Gigaclear repairs commencing or where third parties' SLAs do not meet or exceed our own

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 teams in consultation with Commercial and Engineering. This does not apply for selected pilot areas where PIA will be used as a first option after survey, though these pilot areas are typically in areas where PIA is the only commercially viable mechanism for build.

3. Construction Method and Processes

The general process for installation into PIA/DNO assets is as follows once PIA has been identified as a requirement. The owner of each step is defined elsewhere and will vary depending on contractor engagement.

1. Prepare survey by desktop planning tools
2. If the assets are viable and suitable, update design with proposed PIA design and components to prove validity of design approach
3. Raise Notice of Intent (NOI) with BTOR and any required noticing with DNO, and issue survey whereabouts to BTOR+DNO in advance of survey works
4. Survey the proposed route and assets, rodding and measuring wire heights as required to prove viability of assets
5. Raise any required missing/incorrect inventory cases with BTOR/DNO and resolve
6. Produce final design variation with costings
7. Update NOI with final design plan
8. Issue whereabouts to BTOR+DNO and proceed with build activities, following network adjustment process for duct blockages and pole adjustments as required
9. Produce as-built documentation for A55 packs (box-to-box diagrams, photos)
10. Submit as-built records to BTOR+DNO

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

3.1. Safe Working and Public Safety

Working on overhead network segments is a riskier activity than underground working and, done incorrectly, puts both operatives and the public at risk. Training and accreditation for working on overhead networks is the starting point for safe working, along with a cautious and attentive construction process.

It is not hyperbole to say that cutting corners and saving time can easily cost lives, more so than working underground; overhead working is the most dangerous facet of the UK telecoms industry and fatalities are only low through continuous vigilance from all involved.

Gigaclear HSEQ are the authority on safe working practices and these must be followed, along with guidance on proper construction methods issued in the specification.

At all times, we expect all contractors, operatives, and supervisors to stop work and find a safe way forward if they have concerns about safety before or during the undertaking of any operations.

3.2. Blockages, Tree Cutting, and Desilting

Where blockages or capacity limits are identified they must be confirmed with Openreach and remediated in accordance with the Openreach processes for network adjustments.

Desilting is a common requirement, along with tree cutting, and crews working on PIA should consider taking desilting equipment to jobs routinely to avoid revisits.

Rodding is encouraged along the whole route for high-risk sections – such as those routes with substantial existing cabling, marked red on Openreach's RAG, or key routes which have potential to severely delay feeder/distribution routes – prior to confirmation and commencement of build to de-risk the route.

We do not recommend installation of a rope until just before installation of Gigaclear apparatus commences to reduce the risk of third parties reusing the rope on congested routes. Installation of a route requires an installation whereabouts submission so cannot be considered part of a survey.

3.3. Attention to Best Practices

Best practice with respect to cable installation must be followed in PIA ducts; this includes but is not limited to the use of tension-limiting pulling fuses, tension-limited winches, cable end sealing during pulling operations to prevent water/dirt ingress, and use of suitable cable pulling lubricants. These topics are covered in more detail, if needed, in the Network Build Specification. These methods are not routinely used at scale in the building of Gigaclear's standard network and so may be a gap for existing contractors.

It is important to follow these practices attentively to avoid damage to existing plant for which Gigaclear and contractors would be liable. This is particularly important when laying in new subducts and direct-in-duct cables where our apparatus is installed in direct contact with existing copper or fibre plant.

3.4. Accreditation Requirements

All operatives working on the PIA network must be accredited to BTOR's standards which are listed on the Openreach portal, along with a list of approved training companies and courses.

https://www.openreach.co.uk/orpg/home/products/ductandpoleaccess/ductandpoleaccess.do

Gigaclear managers must check NOPS cards for all staff working on PIA to ensure 100% compliance with this requirement. Gigaclear staff supervising survey or installation works must also be accredited.

4. Rules and Requirements

4.1. Openreach PIA Ducts

Openreach ducts are often useful infrastructure where ducts are clear and uncongested. We recommend strongly that ducts are surveyed carefully prior to planned usage, and that construction teams include desilting capabilities.

There are some basic design rules to follow:

1. Branching of ducts should be kept to a minimum along a route to minimise cost of entry/exit
2. The total cable diameter per bore rental must not exceed 25mm, as calculated with Openreach's diameter calculation examples (total diameter * 0.7 for >=3 elements, total diameter summed for <3 elements)
3. Only spine ducts should be used for main cables; only drop cables should be used in lead-ins ducts except 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 at minimum 12F spare capacity in total on the route for open access/passive access products and our own expansion. Where cables branch, 12F capacity should be available on all branches of the route, following the design sparing rules; this is not required for lead-in branches serving properties or MDUs

If the designed route can accommodate these restrictions, then PIA ducting may be used. Sub-ducting is recommended wherever possible for main cables to enable continuation of existing microduct runs where no branching is required, and to ease installation along longer routed where it may not be possible to pull a cable through in one operation. Standard 16/12mm microducts are used; these can accommodate all of our current cable sizes and can be easily pulled through even congested duct routes.

Direct-burial rated cable may be used for short runs if a joint is already required at each end of the duct run, either for branching or to extend a blown cable. Armoured cable is more robust in heavily congested routes where cable pull-back is expected; this makes it more appropriate for SEDs such as bridge crossings. Gigaclear's current preferred cable for such purposes is Fibrain DCC C0, available between 12F and 288F. Gigaclear's older TKF cabling stock may be used but must 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; blown fibre in a sub-duct will generally be the preference.

More cables may be installed in multiples of the above rules, but may require a second (or third, etc) bore rental, 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.

In terms of cost, simple cases of single bore spine duct links normally cost more than Gigaclear's own soft dig rates, particularly mole ploughing rates. 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 self-build trenching and trenchless methodologies have been explored (microtrenching or narrow trenching, impact moling, directional drilling, etc) or have been confirmed as less cost/time-effective
3. Alternative routes cannot be used to resolve the issue in a cost-effective manner
4. The total cost of the route, calculated as per the guidance in section 3.1.1, does not exceed the planned trench cost

These rules may be ignored for "PIA first" build areas where PIA has been agreed as the primary mechanism for build. In these cases, alternative trenching routes should still be explored and understood prior to investment sign-off as PIA is not guaranteed to be available.

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.

4.1.1. Wayleaves

Wayleaves are generally still required wherever we are installing new structures (poles, chambers, etc) or undertaking any trenching work.

Where poles have been established in 2017 or later, wayleaves may not be required for pole routes; Openreach can be consulted on each individual case. For installation of new plant on poles earlier than 2017 a wayleave will be required.

Wires over land between existing poles with no additional plant on poles, as well as additional cables installed through existing duct will not generally require a wayleave but individual cases should be referred to the network access team. Access to plant on private land will normally require an access agreement.

4.1.2. Cost calculations

All cost calculations for PIA assets considering like-for-like comparison to self-built network *must* include increases in line with inflation of rental costs at 2.2% annually, and be based on a 20 year period. Annual price increases in line with the consumer price index (CPI) are standard on Openreach product pricing and agreed by the regulator. Failing to incorporate CPI or the 20 year view can lead to overly optimistic TCO comparisons.

For actual build costing, rate card items relating to the cost of activities and materials are costed. These are added to the total rental cost for like-for-like TCO calculations such as those used for cost-per-premise-passed calculations.

4.1.3. 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 sub-duct or cable worth of space may be available in an amber duct. It is likely that a red duct will not have sufficient capacity for a larger sub-duct or multiple sub-ducts/cables. It may still be possible to install a smaller cable or duct.

In all cases, Engineering strongly advises that surveys including exploratory rodding should be undertaken prior to confirming PIA as the route to be taken, and that desilting and duct location equipment (video borescopes/sondes) should be standard equipment for duct installation gangs.

4.2. Openreach PIA Chambers

Chambers on the Openreach network may be used to pass cables through or to host equipment (e.g. drop nodes, closures).

Gigaclear will generally use a standoff chamber – that is, a chamber built by Gigaclear near to the Openreach network – for all closures handling more than two cables to avoid congestion and cable loops in Openreach chambers. Any closures handling microducts should also be located in standoff chambers to avoid congestion from duct-to-cable transitions.

All equipment mounted in Openreach chambers or standoff chambers must be mounted on a Mobra arm, either of a screw/bolt-mounted frame or expansion frame type, with the correct adaptor plate for the part used to secure the closure or terminal in place with bolts; cable ties, Velcro, or other straps are not acceptable means of attachment. Cable loops for removal of joints for external splicing must not be used in Openreach chambers; cables should enter joints with only the required working and motion slack, with no coiling in the chambers.

All cables and closures must be labelled clearly with Gigaclear's name, NOI number, and contact details at least once in every chamber. Assets must also be marked with Gigaclear's standard markings, e.g. closure/cable name or reference.

4.3. Openreach PIA Poles

Openreach poles are an excellent lower-cost option for small fibre counts on long routes (up to 48F if no DNO poles are involved; up to 36F otherwise) where mole ploughing and other low cost build methods are not available. Poles can also be used to distribute fibre to drop terminals, and to provide final connections to homes. Where they are available, and the route meets the fibre count criteria, they are an option that should generally be used.

BT classifies cables as "dropwires" and "aerial cables" depending on their breaking load and other characteristics. The latter require surveys for all installations. All Gigaclear overhead apparatus is designated as a dropwire.

There are some key design considerations:

1. Minimum clearance above ground for *any* carriageway, private driveways, field entrances, or routes for accessing private lands shall be 5.9m, with 5.5m as an absolute minimum (and all routes with <5.9m flagged as a risk). CP8 section 9 shall be followed for all cable height minimums.
2. Poles with any cables with less than 5.2m clearance across carriageway, private driveways, etc must not be climbed and will require a mobile elevating work platform (MEWP) to access. This may have practical implications for usability of poles for installations. Wires found below 5.2m must be reported to Openreach using the A1024 process, and wires between 5.5m and 5.2m should also be reported.
3. All fibre splicing work is done at ground level, so a service loop for drop cables and feeder cables must be accommodated on the pole if splicing is required (to allow the joint to be demounted without an outage); for this reason splicing should generally be performed underground

4. Drop terminals should be within two pole spans of the property being served; generally, properties are served by a terminal on each pole
5. Fibre cables are limited to 36F (48F with no joint user designated electricity network operator (DNO) poles on route) and should contain a minimum 12 fibre spare capacity as per the design sparing rules
6. More than one cable may be run between poles (CP8 section 89); however this should only generally be used to enable MST tails to reach a closure alongside ULW cable, or to run two ULW cables side by side
7. Extended (>100m) overhead routes for aggregation or backhaul reserved fibre should only be used in consultation with the Networks team, and will normally only be permitted where more than one aggregation route is available for a cabinet
8. Poles approaching dropwire limits (CP8 section 7) require special treatment during installation processes to arrange for removal of existing wires after installation, and should be avoided where practicable
9. Congested poles may require additional mounting hardware to accommodate drop terminals, or an adjustment performed by Openreach, or adjustment of bass steps (the uppermost pair of steps on a pole, which may be at or near the ring head)
10. Trees and other vegetation along the route should be considered during design validation; tree cutting is frequently required to establish cabling routes

Compared to ducts, poles are clearly much more complex to work with and on. This should be taken into consideration when planning to use poles.

4.3.1. Pole identification and markings

Poles should be inspected carefully to ensure that poles are Openreach owned and not joint user poles or owned by third parties. Where DNO poles are identified or suspected, the local DNO should be contacted to confirm ownership.

Poles must be marked with an Optical Fibre Cable warning label, available from Mills/Ellen Comms. Note the label used for DNO poles should not be used.

BT document CP08 should be read for a full understanding of markings, and the BT Pole Climb Pre-Check Guide should be used to review poles for defects prior to any climbing work or as part of survey activities to identify high-risk poles.

4.3.2. Cable clamping, limitations, and separations

Cable clamps required will depend on the cables in use. For ULW cables and other round cable types, Telenco spiral wraps will normally be used. For flat cables (figure-8 etc) Telenco clamps with V-blocks to clamp the strength members must be used, unless otherwise noted in the components section.

For customer drop cables, currently approved cables can be secured with standard figure-8 clamps and break at the required limits. Future drop cables – which omit the copper stranding – require specific, matched clamps to ensure the break occurs at the correct limit.

The number of cables mounted to poles is limited; this is described in sections 7 and 8 of CP8.

4.3.3. Mounting closures and drop terminals

Generally, we will only mount drop terminals overhead. This is because splicing activities normally involve larger cables than can be routed overhead, and splicing activities must be conducted at ground level so management of cables must allow for removal of joints for working without excessive slack on the pole.

Drop terminals are mounted directly to the pole with fixing screws or are mounted on a 2 or 3 way standoff bracket if the pole is already congested and does not have space for more than one terminal.

The upper bass step may be lowered to be in line with the lower bass step to produce additional clearance at the top of the pole if required.

Splice closures are generally mounted in the lower envelope of the pole (as per CP8) along with a cable coiling device to secure slack. Smaller closures may be mounted onto the coiling device to minimise space used on the pole. Drop/splice closures – which support both customer drops and splicing – are not recommended at this time and should only be used where absolutely required.

4.4. Designated Network Operator (DNO) Poles (Electricity)

Enquiries should always be made to the Chief Engineer's Office and HSEQ leadership prior to engaging with a contractor to build on DNO poles to ensure all required training is understood and undertaken, and any particulars of an agreement are covered off.

Gigaclear will use only LV poles (<11kV), and will not generally interact with poles which we consider high risk (exposed conductors/existing power company equipment pole-mounted) unless safe separations can be achieved for all activities.

ENA Technical Specification P05 and Engineering Recommendation EB/TP should be used as a reference for engineering principles to be followed. This document does not attempt to replicate the full detail of these documents as they may change out of sync with this document; ENA P05 and EB/TP should be read alongside this and other Gigaclear documents. Gigaclear employees may find these documents on the Chief Engineer's Sharepoint site; contractors must obtain their own copies from the Energy Networks Association.

DNO poles generally follow the same rules and engineering principles as PIA poles, but with additional constraints placed on equipment placement and cables. We will generally avoid using DNO poles unless there is no other way to complete a build, both to reduce risk for engineering staff and to avoid operational complexity.

4.4.1. Pole Identification and Markings

Poles will generally be marked with a circular or square label, black on white, with the letter "J" to indicate they are a designated joint user pole. This label must be affixed if a pole is on-boarded as a new joint user pole. Pole labels may vary from DNO to DNO and teams must confirm label meanings with individual DNOs if in doubt.

If a circular label with a number – again, black on white – is affixed to the pole, this indicates the maximum number of attachments permitted differs from the standard.

As with PIA poles, a D label indicates a defective pole that will require replacement.

A Gigaclear-branded label indicating the presence of optical fibre cables and Gigaclear's emergency contact information must be installed on the pole when cabling is installed. This label is free issued by Gigaclear at the present time and supplied as a custom part from Omser Scotland/Brady, Y4908208.

Cables must be labelled to indicate the operator name and logo, as well as the cable identifier (fully qualified with the cabinet name) and NOI/DNO references as appropriate.

4.4.2. Cable clamping, limitations, and separations

Generally, the minimum separation on the pole between the first telecoms equipment – cable anchors or block terminal/closure – is 500mm from the lowest wire and 800mm from the live wire in an open wire system. Assume 800mm minimum separation by default, as live wires may come off the pole lower than the neutral.

All telecoms cables will be below the DNO plant except with prior agreement with the DNO where all plant is insulated.

Crossings between cables must achieve at least 600mm clearances with a 45-degree swing in either direction of either cable. Where bare wires are used, this clearance must increase to 900mm. Within 600mm of pole/building fixings, only 400mm clearance is required.

Clearances above ground must be maintained at all times as per the PIA pole section.

Equipment such as fibre joints and terminals must be at least 50mm from DNO cables or equipment, or protected and insulated street lighting equipment.

All equipment and cables must be at least 800mm from any DNO equipment not insulated and protected; as a rule, we will not work on poles with uninsulated or unprotected equipment. Where such poles must be used, consultation with the DNO should be undertaken to achieve a safe outcome.

Cable clamping is achieved either with standard cable clamps hanging on a standoff “step” mounting bracket or a “J” hook clamp. Small non-standoff brackets may also be used for “through” applications using two clamps back-to-back. Pole rings are not typically used on DNO poles due to conflict with DNO apparatus.

Cables should be tensioned to match power conductor sagging, maintaining a minimum 600mm gap from power conductors (900mm for bare wires); see PO5 D.1.2 for more detail.

At most 10 attachments to a pole may be made, plus a pass-through cable (for a total 12 attachments).

Cables are limited to a 1.8kN breaking load and max 180N initial installation tension. This means that the only cables currently approved are up to 36F ultralightweight cables from Prysmian and Emtelle. 48F cables cannot be used due to the breaking strain limits and other restrictions in the DNO documentation. Customer drop cables may not be used on DNO poles at the present time.

Only two stand-off rings may be fitted to a DNO pole, in-line with the power conductors; all cables must connect to the DNO pole within a 180 degree arc of each ring in line with the longitudinal axis (i.e. cables may not obstruct a clear route up the side of a pole).

Stays must be insulated; generally, the DNO should be asked to fit stays where they are required or supply the materials for their construction.

4.4.3. Mounting closures and drop terminals

We will seek to avoid either closures or drop terminals on DNO poles to reduce the risk of working at height near LV power, and this should be considered at design time. Pole steps are not permitted on DNO poles, meaning access is not straightforward.

Where required, drop terminals may be installed anywhere on the pole below DNO equipment, maintaining the required spacings (normally 800mm from the bottom of the DNO cables, and 50mm from any other equipment).

Splice closures should not be installed on DNO poles.

4.5. Overhead Routes onto Buildings

While not strictly speaking a third-party route, presently only PIA/DNO poles present a route to connect onto buildings via overhead means and the relevant rules and considerations are therefore included here.

4.5.1. Termination Types

For most properties a single fibre cable will be sufficient. This is our standard overhead drop product, served from a drop terminal.

For MDUs, more than one fibre is required. This requires a ULW cable to be run from a nearby closure. We would generally recommend seeking to use underground routes to serve MDUs to simplify cabling.

The required cable clamps differ between cable types, but fixation points do not; all fixation points are adequate for all cable types.

4.5.2. Fixation Points

On a pole, either a ringhead or standoff bracket is used to attach the dropwire clamp.

On the side of a building – either on barge boards, stone, or brickwork, but never a chimney – a variety of fixings are available. Most commonly an eyebolt 1A is used directly into brickwork, but other options include a “J” style rising bracket 32 for additional height clearance or triangular bracket 22 for wooden attachments.

Care must be given to selection of fixation points, particularly to maintain separation from power cabling, where a minimum 600mm should be maintained (PO5 D.2).

4.5.3. Cable Routing and Termination

Cable is routed down the side of the building to the ground floor and terminated in a wall box outside the premise, with the cable entering from the bottom with a drip loop to prevent water ingress.

For MDUs this wall box is likely to be a BUDI-1S/2S; for standard dwellings this will be a standard wall box (e.g. HellermannTyton CCE, Commscope CTU, etc).

Within the wall box the cable is cut to length and a splice-on connector or pigtail spliced onto the cable to terminate it. The interior cable is then connected and routed into the home. For MDUs, the connector may be omitted for larger cable sizes and interior cable directly spliced on.

Installation within the home is entirely standard from this point.

5. Component Specification

The components used in this section *must* be used to maintain compliance with third-party technical requirements. This section is not exhaustive but calls out key requirements and product families; specific part codes and ordering information can be found from the Chief Engineer's Office as this list is liable to vary more rapidly than this specification changes.

Deviation from approved components is not allowed under any circumstances without written permission from the Chief Engineer's Office, no matter how small the deviation may appear at first glance. Always ask first. Even and "simple" small parts like clamps must be correct.
Gigaclear Engineering and HSEQ will regularly audit work done on third party assets and will require the replacement of any non-compliant components found in order to maintain compliance.

5.1. Openreach PIA Ducts

5.1.1. Ducts

Single 16/12mm duct should 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 should generally 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 in PIA ducts.

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. SHOULD 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 – stock rundown only)

Technically the following cables are not compliant on marking and so their use is not encouraged except for short runs:

3. Emtelle, Prysmian, Hexatronic 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 less than other cables available, increasing the risk of damage. Their use is anticipated only to link aerial sections where it is already being used overhead.

Tails used by Commscope MST and FST terminals, and Corning MPT terminals also follow the above requirements and may be routed through ducts.

For drops, Commscope H01K, H01V, HMFOC, RealFlex 3, or 3.6mm indoor/outdoor 12-fibre cable, Corning ROC Drop, Corning Dual Drop, Corning Hybrid, or direct burial fibre cable from Hexatronic may be used.

5.1.3. Closures

All closures must be fitted to mounting arms within chambers. Suitable frames and arms are available from Cubis/Mills. Closure-specific mounting hardware is required to ensure that closures are properly secured on the arm.

Closures used in and around PIA will typically be the Commscope TENIO or FIST-MSC joints. For smaller cable sizes, Commscope OFDC-A4 joints may be used. HellermannTyton FDN joints may also be used but are not recommended.

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; equivalents are also available for Commscope joints. See the *Civil Construction Guide* for details, section 7.

Other closures may be available for specific situations on request.

5.1.4. Drop Terminals

Drop terminals such as Commscope MST/OTE series terminals may be installed in BTOR chambers.

All drop terminals must be fitted to mounting arms within chambers. Suitable frames and arms are available from Cubis/Mills. Terminal-specific mounting hardware is required to ensure that terminals are properly secured. All terminals must be mounted with their cables facing downwards or to the side to minimise the risk of dirt ingress or damage; all cables must be secured such that the motion of the arm cannot induce damage to the cables.

5.1.5. 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 either HellermannTyton TipTag 15x100mm or Brady BM71-25x75-B7598-YL labels. Labels should be printed using the templates distributed with the Network Build Specification pack, and will at minimum read:

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

For instance:

GIGACLEAR LTD – OPTICAL FIBRE CABLE
PIANOI 0001253 – 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 or fully qualified cable number; this is included in the standard label template.

5.1.6. 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.

5.1.7. Investigation and Proving Equipment

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

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.

5.2. PIA Overhead, DNO Overhead

Apparatus for PIA and DNO overhead pole applications is aligned where possible to minimise the risk of mix-ups and to simplify materials required in the field.

5.2.1. Cables

Overhead cables are precisely specified and must meet specific requirements outside the scope of this document. Other cables require approval by Openreach along with mounting hardware etc.

The cables approved for use today are:

1. Emtelle CP2976 4-48F ULW dropwire
2. Hexatronic H4036011 4-48F Aerial ULW dropwire
3. Commscope H01K (with copper pair)
4. Corning Hybrid Drop (with copper pair)

No other cables are permitted without prior written approval from the Chief Engineer's Office. This will typically involve submission of samples to Openreach for approval.

Two cables are currently under trial with BTOR and will require specific clamps to achieve their breaking loads:

1. Commscope Easy Access H01V
2. Corning Aerial ROC Drop

These cables may not be used today, but may become available in future, and have been tested to meet Gigaclear's requirements. They should not be used without written approval from the Chief Engineer's Office.

Cables integrated into MPT/MST drop terminals may be used only with specific approved clamps, and should generally only be used for short routes. For the Corning SST cable this is the Corning AB910 and matching carabiner (available from Comtec). For the Commscope LightScope cable this is the Telenco Hypoclamp F (available from Mills).

5.2.2. Closures

A variety of closures are available and approved for use on poles. The mounting regime will differ based on the closure; some closures include a pole mount or can be screwed directly to a pole through their backplate; others require standoff brackets.

1. Commscope OFDC-A4 – splice-only up to 24F for small applications
2. Commscope OTE200 – splice-and-drop up to 36F/6 ports, mid-span up to 72F
3. Prysmian UMJ – splice-only and mid-span up to 72F

We expect that mostly the UMJ joint will be used for in-line splice applications, with the OFDC-A4 used for small-scale drop feeder joints.

The MALLICOIL-L bracket is used for cable slack storage for joints where needed, and can accommodate closures on a standoff bracket mounted in front of the cable coil.

5.2.3. Drop Terminals

Gigaclear is aligned to the Commscope/Corning strategy pursued by Openreach and recommends Commscope drop terminals. Corning equivalents may be permitted on request.

Commscope MST drop terminals are used and can be directly mounted onto poles or mounted onto the Mills 2-way/3-way CBT standoff brackets S00-0978/S00-1741. These terminals are pre-terminated and can optionally contain 1:4/1:8 splitter modules, which may be required in some areas.

Corning MPT drop terminals can also be used and are mounted in the same way as Commscope MSTs. These products are not available with integral splitters.

Flexible terminals may be used on hollow poles and, in consultation with Gigaclear, may be permitted as a solution for heavily congested poles where few drops are required. The Commscope FST series drop terminals are recommended in this application.

5.2.4. Labels

Two main fibre warning labels are required – an overhead fibre label supplied by Mills Ltd P/N S83-0634, which is used for PIA poles, and a branded label supplied by Gigaclear (free issued) manufactured by Brady, which is used for DNO poles.

Cable labels shall use the same Brady or HellermannTyton labels as used underground, and must show the NOI number and Gigaclear cable reference. Cables should at a minimum be labelled once per pole. When transitioning U/G, labels should be affixed either adjacent to closures or at the bottom of the lower envelope.

Closures shall be labelled externally on the outer casing or on the main incoming cable. Labels must be printed.

5.2.5. Tools and Consumables

Gigaclear recommends and works closely with Mills for supply of overhead tools and the following tools should be considered essential for works overhead:

- Dropwire dispenser 2B (S00-8426)
- Dispenser sash line (S83-0782)
- Tensioner 2B (S83-0925)
- Coach screw brace (S83-0765)
- Dropwire Pulley No. 4 and 6 (S83-2685, S83-2685)
- Telenco pole band mounting kit (S83-1667)
- OPT ULW dropwire stripper (E00-5751)
- Polemate kit (S83-9327)

Various consumables are required for working on poles. Particular attention should be paid to fixing clamps; Mills supply suitable cable clamps for ULW cables, pole furniture, and other materials which are approved by Openreach and meet Gigaclear's quality requirements. Other vendors' materials may be accepted but this is conditional on approval per material by the Chief Engineer's Office.

6. Version History

Version	Date	Notes
1.0	2019-02-12	First issue
1.1	2020-08-20	Revised for PIA and DNO pole works