Gigaclear Engineering
Multi Dwelling Unit (MDU) Guidance

This is a preview document

The contents of this document do not form the final position of Gigaclear; policies, procedures, and equipment may change.

This document is provided to make 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.

The network components and parts described in this document are not yet available as they are being trialled and developed by Engineering; kits are being configured, supply agreements established, and so on. Trial installations are being organised and carried out to validate the complete solution, and systems are being updated to accommodate these changes.

Multi-dwelling unit solution components, systems changes, and a final version of this document are anticipated to be rolled out generally to all regions in early 2020.

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

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2. Scope

This document covers design and build of multi-dwelling units, including (but not limited to):

- Blocks of flats or apartments
- Shared office buildings
- Multiple occupancy units

Any building which requires more than two fibre services *may* be considered a multi dwelling unit (MDU), and thus subject to the rules in this guide. The judgement of the validating planner should be used.

The guiding principles of our MDU policy are:

- MDUs will be built to as part of the network delivery programme where permission to build can be obtained (and permission *must* be sought as part of the build programme)
- Where permission cannot be obtained within the scope of the build programme, capacity shall be left in the network for future installation, and a demarcation point built to the property boundary so that installation requires no additional wayleaves
- Where it is possible, pre-installation of fibre to individual units within an MDU shall be performed at build time to further reduce the installation time and reduce risk of a failed installation
- Installations at a "built" MDU should take no longer than a typical installation and require minimal specialist equipment

This document outlines the components available and the typical configurations used to connect several types of MDU. It also explains the process which should be followed.

3. Build Processes

Gigaclear will seek permission from identified MDU land/property owners well in advance of delivery starting, so that build can proceed smoothly. This process may, where complexity of a building merits it, include a detailed design being conducted for the MDU so that agreement on a specific installation method and components can be reached prior to signing of an agreement.

3.1. Where permission cannot be obtained

Where permission to build cannot be obtained the required capacity should be left at the nearest aggregation node and a duct built to the property boundary. This should enable an installation to proceed with no changes to the network.

See the *Civil Construction Guide* document, section 10, for guidance on what chamber or duct should be left at the boundary; generally for installations up to 12 properties an 8/4.5mm microduct and single pot can be used, above 12 properties a main duct and chamber will be required.

Testing must be performed for the installed duct and for the fibres reserved for the MDU prior to completion; refer to the *Civils Construction Guide* and *Optical Build and Testing Guide*, section 8.1.

3.2. Where permission is obtained

Where we have obtained permission to build, a joint survey shall be conducted with the property owner to validate the design if this was not done as part of negotiation to obtain permission. Permission must be granted from any other required parties, such as landowners, if they are not the same as the property owner.

The network should then be built directly into the property; a demarcation point (such as a chamber or pot) is not required outside the property, though may be included as part of the design if appropriate (for instance, to terminate an external use cable onto cable for internal use).

3.3. Testing and Commissioning

As part of building the network, testing of the built network is required prior to acceptance into service.

Tests shall comprise OTDR (iOLM) tests as detailed in the *Optical Build and Test Guide*, section 8.1.

The network shall be tested between the active cabinet port and the port in the building which the installer will connect to. This is typically in the connection point for a floor or building but may be an individual property connection point if the building is pre-installed.

In addition to the standard tests, microscope images must be provided for *all* connectors mated in the process of building the network, including any intermediate connectors such as MPO connectors.

3.4. Special Considerations

Care must be taken to ensure that all works comply to fire safety standards including BS 7671:2018 (IET Wiring Regulations, 18th Edition).

Contractors must be able to verify compliance and provide required documentation for all components used.

Particular attention should be paid to firestopping, and support of cables run across doorways, which requires the use of metallic clips to avoid cables collapsing in the event of a fire (BS 7671:2018 521.10.202).

4. MDU Components and Assembly

Any MDU installation can be broken into three categories of equipment:

- Building aggregation point (also known as a distribution point), where cable entering the property or grounds is connected onto the serving equipment
- Connection points, where connectors are left for a floor or riser to connect multiple properties, and which connect to the aggregation point
- Customer termination points, where a final connector is left for direct connection to the network termination equipment (NTE)

Between these points either internal, external, or hybrid cable can be used. Gigaclear, in designing the components, has opted to use splicing only where required, typically in the building aggregation point. Between the aggregation point and connection points, for instance, pre-terminated multi-fibre cables may be used.

All MDU components use green APC connectors which are not compatible with other (blue, UPC) connectors used in the Gigaclear network. APC-specific tools and inspection equipment are required to correctly install MDU network components, including for installers.

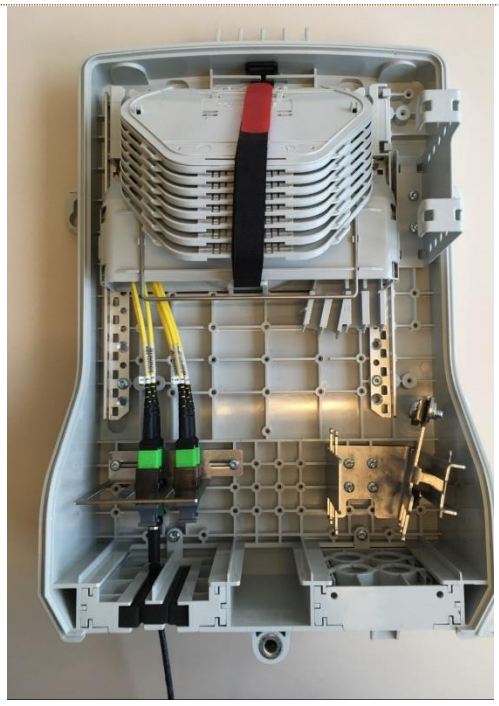
Do not attempt to mate APC and UPC connectors! Both will be damaged and need replacement. The final connection to the NTE must be an SC/APC to SC/UPC lead to avoid equipment damage.

APC connectors have been used to futureproof components for PON network usage; other components in the Gigaclear network will be migrated to APC connectors over time.

4.1. Building Aggregation Points

4.1.1. Internal and Ground Level External Use

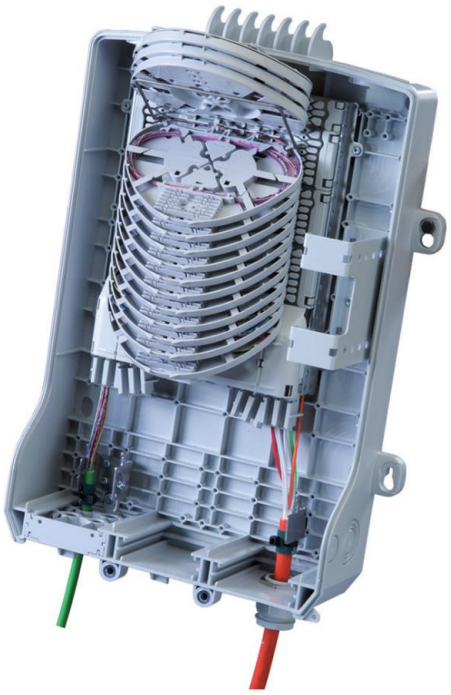
Where the aggregation is achieved internally – for instance, a building with a central comms room or riser cupboard – or there is a natural external location for aggregation on the façade of the building, such as next to a power or water meter cupboard, then the following products and configurations can be used:



- BUDI Medium with 4 or 8 MPO connectors for other connection points (shown to right)
- BUDI Medium with no MPO connectors, for splicing of up to 8 cables for connection points
- BUDI Small with up to 8 SC/APC connectors for direct connection of properties

The medium box is 420mm high, 240mm wide, and 120mm deep. The small box is 285mm high, 155mm wide, and 60mm deep. 50mm above the box and 100mm below the box should be available for cover removal and cable entry. The splice-only and SC/APC connector variants can be combined, but generally a connection point (BUDI Small) should be placed near the aggregation point.

The image to the right shows a BUDI Medium box configured for splice only.



4.1.2. External, Underground Use

Where aggregation must be conducted externally, such as where buildings have multiple externally-entered utility cupboards or risers, an underground closure and splicing is used to connect the building's various connection points back to the network. Direct connections to the external aggregation node are possible, but not recommended, as the drop cable required is high cost.

The following products and configurations can be used:

- TENIO closure with up to 144F splice trays and 3-5mm drop glands (FW4 chamber required)
- Novux closure with up to 24 splices/4 tube loop through and 6 SC/APC connectors for direct connection of properties (FW2 chamber required, or wall mountable)

4.2. Connection Points

Connection points are typically installed internally. External connection is possible with the BUDI Small product but the RDT component is not weatherproof.

The following products and configurations can be used:

- Mini-RDT with MPO connector for 12 SC/APC drops (includes internal/external rated cable spool for the feeder, also available with stubbed cable suitable for internal duct; not recommended for underground/BT duct use)
- BUDI Small with up to 8 SC/APC connectors and splice capacity up to 12F

To link the aggregation and connection points, the mini-RDT is ordered with the correct cable length pre-configured; splicing after the fact in the mini-RDT is not possible. An additional "HMFOC" pre-terminated MPO extension cable is available to extend the mini-RDT cable up to 50m externally.

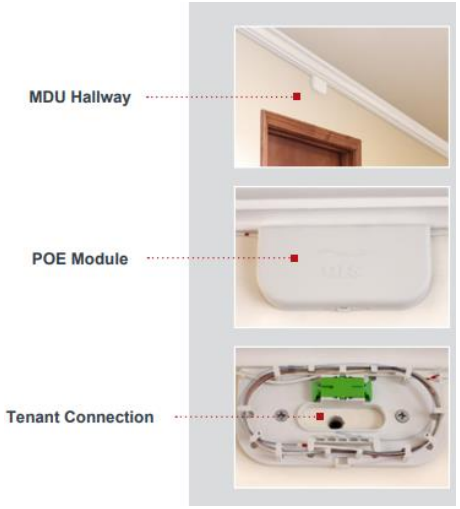
In the BUDI Small, convertible indoor/outdoor cable or indoor InvisiLight 12 fibre cable can be used to connect the box back to the aggregation point, depending on where the aggregation point is located.

4.3. Customer Termination Points

It may be possible to follow a standard installation regime, where an NTE is affixed to the wall and a drop cable is connected and then run back to the connection point, following walls or using existing ducts. In this case, this can be done at point of installation; this is suitable for small MDUs where only one or two cables are required. An InvisiLight cable (right) may be used to reduce the visual impact of cables internally.

Figure 1 OFS InvisiLight drum - 30m of 900 micron cable and 2.5m of 2mm cord

Where it is not possible or desirable to run multiple cables from NTEs to the connection point, such as along a corridor, it is possible to use 12 fibre miniature drop cables such as OFS InvisiLight 12F. Alternatively, trunking can be used along with a single fibre miniature cable. This must be installed at the point of build, with bare fibres spliced onto connectors outside the premise.



Where pre-cabling to the outside of the premise is done the connector must be left outside the premise in a customer connection point box (CCP) for the installer to drill in through for the final connection.

In either case the infrastructure must be left such that the building owner has identified and approved the installation method, so that any customer installations can proceed rapidly and without further negotiation. Splicing shall not typically be required for installations.

4.4. Cabling

Gigaclear's standard direct burial or microduct blown cables and ducts can be used to reach the closure or external aggregation point on the building. Care should be taken to seal ducts appropriately (with gas blockers e.g. Emtelle or Filoform clip-on or divisible seals) where they sweep up to building-mounted infrastructure. Ducts should terminate outside the building.

Normally, cable will also be terminated outside the building, in compliance with fire regulations. Blown fibre cable is not suitable for interior use, . If a section of cabling (>1m) is required within the building to reach an internal distribution box, internal-rated cables must be used; a closure in the planned demarcation point (chamber or pot outside) will be used to transition between cable types outside the building.

For in-building cabling outside of ducts and risers, the OFS InvisiLight cables are preferred. They are 900 micron (0.9mm diameter) cables which are secured into place with adhesive and, around doorways, small metal clips. They have a very low visual profile and are supplied either as bare cable, pre-terminated SC/APC cable, or on a small wall-mounted drum which is suitable for use next to a Gigaclear NTE and contains up to 30 metres of cable. There is a 12F version available in bare fibre format only, which is slightly larger but still very easy to conceal.

For in-building cabling inside existing ducts or risers an OFS EZ-Bend drop cable can be used.

For intra-extra building use (e.g. coming from an external box to an internal box) a convertible cable can be used – this has an external HDPE sheath suitable for external usage, which can be stripped back to reveal an interior rated, fire rated Cca cable. Other cable options are available.

Where multiple external connections need to be made a retractable cable may be appropriate. This is not covered in this version of the guidance but may be made available in future. Catenary wire supports may be used if required.

5. Reference Designs

This section provides guidance on the use of the MDU components by illustrating some typical MDUs and the designs that might be used.

The categories are defined as:

- Small – between 2 and 5 properties
- Medium – between 5 and 30 properties
- Large – more than 30 properties, potentially spread across multiple buildings

However, these are only guidelines. Every MDU will be bespoke.

5.1. Small MDU with external distribution

The BUDI Small fitted with SC/APC connectors will typically be suitable for these premises.

Normally, the BUDI box will form the final part of build and at the point of order the installer will run cable around the outside of the building to connect the NTE back box to the BUDI box. Alternatively, cable can be pre-installed to each property and left in an NTE back box.

5.2. Small MDU with internal distribution

The BUDI Small fitted with SC/APC connectors will typically be suitable for these premises.

Either an InvisiLight spooled unit or standard drop cable can be run directly to the BUDI box from each apartment if there is only an occasional cable.

Alternatively, a 12F InvisiLight unit can be run from the BUDI box along a route to connect apartments, with an SC/APC connection point installed outside each property for installation.

5.3. Medium MDU with external distribution

For medium-sized buildings where multiple floors may be served a BUDI Medium and several BUDI Small boxes (one per floor) can be used, or direct cabling back to the aggregation point can be used to minimise visual impact. Pre-installation is usually preferable for larger premises. Convertible drop cable should be used, with excess stored clipped to the outside of the building, with termination internally in an NTE back box.

5.4. Medium MDU with internal distribution

With internal distribution routes, a mini-RDT connection box can be installed in each floor riser using pre-terminated cables. InvisiLight spools can then be used to connect each premise for small numbers of premises. If cabling needs to be pre-installed then a BUDI Small and 12F InvisiLight cable should be used, with an SC/APC connection point installed outside each property for installation.

5.5. Large/Multi-Building MDU

Normally, each large site can be subdivided into “medium MDU” builds connected to a central aggregation point located in a central building in a BUDI Medium box or in a chamber using a TENIO closure. This allows for a single incoming cable to be branched off to serve multiple properties.

Larger buildings may require multiple BUDI Medium boxes to serve multiple comms risers. The BUDI Large box can also be used to accommodate larger fibre counts as a central branching point. Beyond this, Engineering should be approached for a bespoke solution.

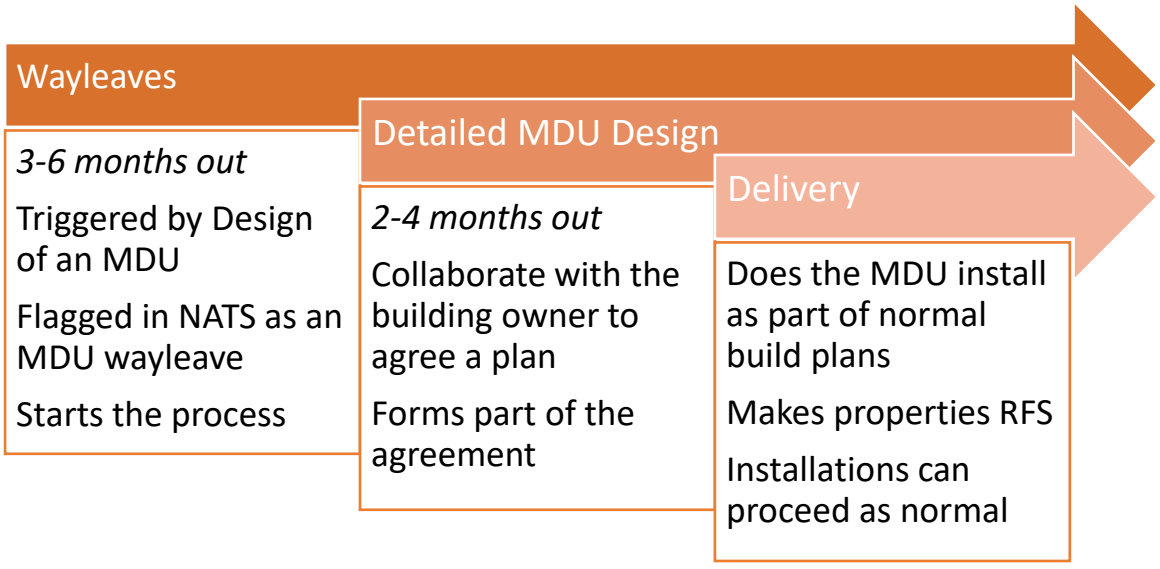
6. Network Planning and Process Guidance

In the current (as of 2019-10-04) network design software, there is no mechanism for designing MDUs. Therefore, designers should place closures (if required) and pots on the property boundary for the MDU, to ensure that sufficient capacity is designed into the network.

Designers *may* place the pots closer to the property (i.e. on the property's land parcel) if the situation requires it, but this is not a requirement; the wayleaves system will (in future) continue to flag this as an MDU.

When MDU support is introduced, the process will be as follows:

- All properties in the MDU are assigned to a closure – this will normally be the closure within a drop cabinet, but where more capacity is needed another closure may be inserted into the design. This reserves fibre for capacity planning purposes within blowing distance of the MDU.
- All properties are assigned to a "demarcation point" – this is either a pot or a FW2 chamber as required. This should be placed on the property boundary, not in the property itself.
- All properties are marked as being part of an MDU.
- The demarcation point should be designed as normal, using either a single 16mm duct, a 16mm duct in a multiduct assembly, or 8/4mm drop duct as appropriate.
- The demarcation point is on the *property boundary*, i.e. it will be placed on the edge of the property so that no other wayleaves are required once permission is obtained from the MDU's land/building owner.
- No cables or closures need to be placed in the demarcation point at design time – they will be installed in the empty duct and terminated as per the splice schedule for the serving closure.



The MDU and wayleave processes are triggered by the presence of the MDU flag on the properties, and a wayleave is generated for the land parcel containing the property that is appropriate for an MDU. No assets are required on the land to trigger the wayleave.

Any wayleaves required to reach the MDU will be flagged as normal by the presence of the demarcation point, and will be cleared as normal, meaning the set of wayleaves required will be complete and inclusive of all assets.

Once a survey is completed and a final design is in place for the building the network design should be updated to indicate the final planned location of the network e.g. final approach path to the building.

7. Version History

Version	Date	Notes
1.0	2019-09-30	First issue
1.1	2019-10-04	Added planning guidance
1.2	2019-10-29	Additional notes on duct sealing and landowners
1.3	2019-11-26	Added some process details