

How to build a **COPPER** network

DEVELOPERS' HANDBOOK

STEPS TO BUILD A COPPER NETWORK

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INTRODUCTION

By working closely with you in the earliest stage of your new development, our newsites team can create a modern communications infrastructure that will enable your customers to communicate in exactly the way they need to.

This Copper network How to Guide will ensure you have the relevant information to build the Openreach network that will provide communication services for your future occupants in residential properties/houses and apartments. Your nominated new site representative (NSR) will guide you through the installation requirements and the periodic quality inspections during the initial site meeting.

For commercial properties or fibre developments please refer to the appropriate How to Guide.

Avoiding damage to the Openreach U/G network

Openreach has an extensive underground network that can be located inside and/or on the perimeter of a site. This network is vulnerable to excavation related damage unless appropriate precautions are taken. The precautions for avoiding damage to an underground utility plant are contained within the Health & Safety Guide No. 47: "Avoiding Danger from Underground Services". This document stresses the need for the availability of utility plans on site and the use of safe digging practices.

Damage to an Openreach network by a third party can be expensive for that party to repair. By working with you, Openreach wants to ensure you avoid the repair and associated cost which can consist of one or more of the following:

- Direct Cost – the cost of repair
- Operational Cost – delays associated with repair
- Social Cost – the off-site effects i.e. loss of service to emergency services/centres or the vulnerable in society.

To obtain a more precise location of Openreach apparatus (either within your site or on the adjoining ground) and avoid costly damage, contact:

Click Before You Dig

Email: cbyd@openreach.co.uk

Tel: 0800 023 2023

Utilisation of the Openreach "Click Before You Dig" service has a proven record of minimising the potential for damage and cost.

Please note:

This is a FREE service.

1 COPPER NEW SITES QUALITY CONTROL CHECKLIST

A quality checklist must be completed for every phase.

Any subsequent changes to the site plan must be communicated and agreed with your New Sites rep as soon as possible.

Any re-work may result in an associated delay and Time Related Charges may apply.

The Site	
Developer	
Site Name	
Site Address	
Post Code	
Site Manager Name	
Telephone	
Email	
Openreach NSI Ref	

Openreach Contact	
New Sites Office	
NSR Name	
Telephone	
Developers Handbook Version 1	
Off Site Connection Location	
First Occupation Date	

COPPER NEW SITES QUALITY CONTROL CHECKLIST

Item Audited	Developer Shown Quality Standards		Checked			Comments
	YES	NO	YES	NO	N/A	
NTE5s will be provided and guidance issued on their desired location (Section 2)						
Duct Installation (Section 3 & 4 – As shown on the diagram)						
Correct type of duct will be provided						
Ducts will be laid at a minimum depth, or exceptions agreed and documented						
Duct separation distance will be maintained, or exception agreement obtained and documented						
Ducts will be properly trimmed and keyed when set in walls						
Ducts will be positioned correctly on external walls and in line with the cable entry point						
Correct rope/cables/tubing will be installed as per instructions						
Temporary duct seals will be fitted correctly to standard						
Cable/BFT left in planned location						
External cable/BFT protected + sealed in plot						
Duct seal plug 1A fitted						
Box Building / Frames & Covers (Section 5, 6 & 7 – As shown on the diagram)						
Joint boxes will be constructed as planned, positioned correctly and conform to drawings or alternatives agreed and documented						
Box will be installed at the correct depth. Any deviations to plan recorded and signed off by NSR						
Base will be cast correctly						
Bolts will be fitted and positioned correctly during construction of boxes						

COPPER NEW SITES QUALITY CONTROL CHECKLIST

Item Audited	Developer Shown Quality Standards		Checked			Comments
	YES	NO	YES	NO	N/A	
Ducts will be properly trimmed and keyed when set in walls						
Frames and covers will be bedded and correctly installed						
Cement and brick types will be used as specified or exceptions agreed and documented						
Modular boxes will be installed and prepared as per instructions						
Unmade surfaces joint box frame will be surrounded with 100mm wide strip of grade C30 concrete						
Boxes will be free of debris or other inappropriate material						
Reinforced base cast correctly for JBC (N)						
External cable/BFT protected + sealed in joint box						
MDUs (apartment blocks) (Section 9 – As shown on the diagram)						
Adequate space and access will be available and maintained for Copper network (lift, alarm, telemetry lines etc)						
All designated track ways/trays/ supports will be in good working order with separations maintained						
In Home Connections (Section 2- As shown on the diagram)						
Copper NTE will be installed & terminated correctly						
Extension wiring must be telephone/ data grade and shall have plain annealed solid copper conductors of a diameter between 0.5mm and 0.63mm. The conductors shall be in twisted pair format. The conductor resistance shall be of a maximum of 96 ohms/km. The cable sheath shall be PVC						

COPPER NEW SITES QUALITY CONTROL CHECKLIST

Plot Numbers Inspected											

Comments

Developers Representative

Print Name:

Signature:

Date:

New Site Representative

Print Name:

Signature:

Date:

2 HOME WIRING

Nowadays, home purchasers expect good access to broadband and the wiring you install will determine their experience. Smart TVs, remote alarms, heating and lighting controls along with digital recording devices, games and computers all require connectivity. Although wireless access has its place, some technologies work better through a wired connection to the home's broadband router. Your home wiring strategy for the 'connected home' should determine your wiring requirements. The following information is a guide for connecting the Openreach Network to your home wiring and not a comprehensive list of configurations. Refer to Governmental guidance PAS:2016 for further information.

Installing additional telephone sockets as part of the overall building programme avoids the problem of exposed wiring and will enhance the appearance of your development.

Basic Materials

Openreach will supply the master socket (Network Terminating Equipment (NTE)), which will remain the property of Openreach. The developer will supply a single gang flush mounted back box at the entry position of the service access hole adjacent to the external duct location.

To install telephone extension points you will need, back box for extension sockets, flush-mounted extension socket points, internal cable and an insulation displacement connector tool (IDC).

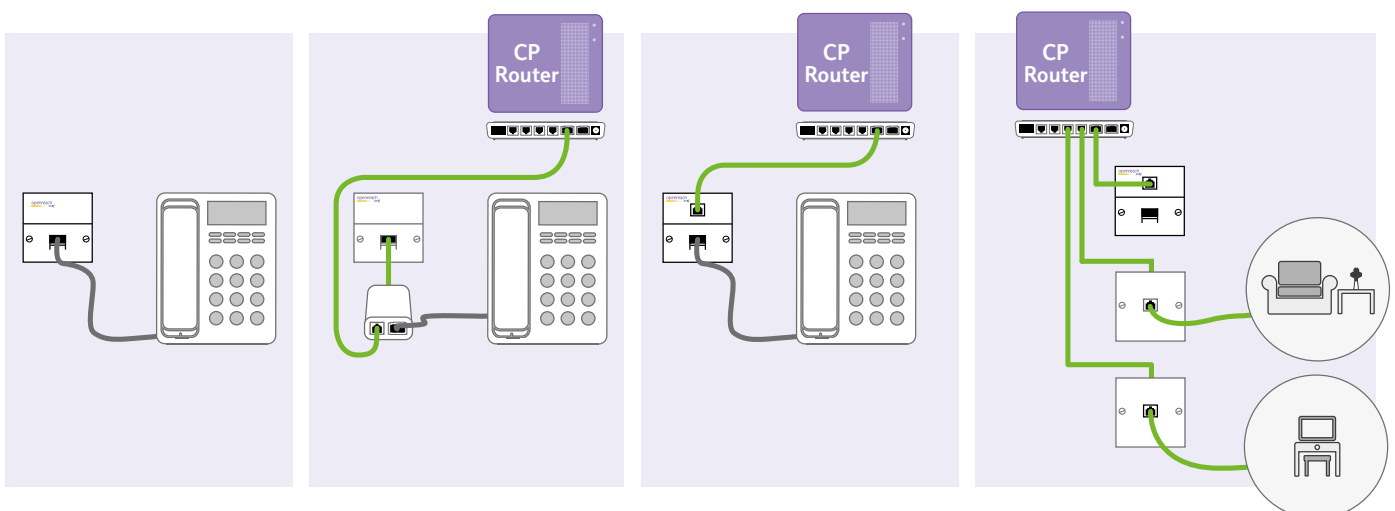
Installation

- Extension cabling must run from the NTE face plate with connections made using an IDC tool
- Extension sockets should be located close to power sockets for easy equipment connection. A minimum of 50mm between telephone cables and power cables should be left throughout. Where this is not practical, telephone and power cables must be separated by an acceptable divider (i.e. of rigid, non-conducting material)
- Extension wiring must be telephone/data grade and shall have plain annealed solid copper conductors of a diameter between 0.5mm and 0.63mm. The conductors shall be in twisted pair format. The conductor resistance shall be of a maximum of 96 ohms/km. The cable sheath shall be PVC.
- As a rule of thumb internal communication cables should not exceed the bend radius of a 2p coin.

Detailed information on cable installation and separation is given in the British Standard Code of Practice 6701, Part 1 (particularly clause 6) and the relevant sections of the latest IEE regulations for electrical installation (Regulation 525 is of particular importance).

The wiring pattern of the extension socket is critical i.e. non-star wired and in accord with the figure on page 9.

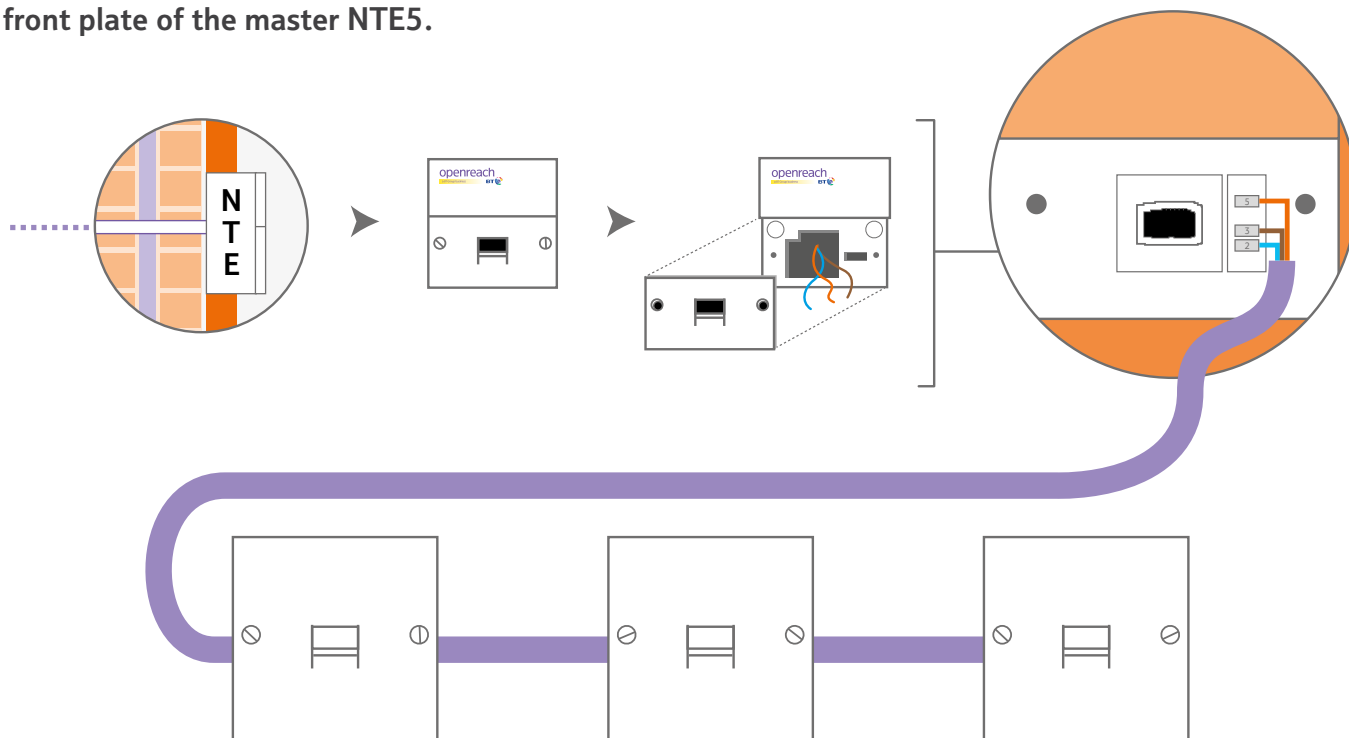
Please note: while the provision of internal wiring beyond the Openreach master socket will normally be the developers/customers responsibility, you can contract an Openreach engineer to do this work for you. If interested, please contact your local Customer Network Solution Team. www.openreach.co.uk/org/home/solutions/engineeringsolutions/customernetworksolutions/cns.do. Terms and conditions for the provision of internal wiring and charges will apply.



HOME WIRING

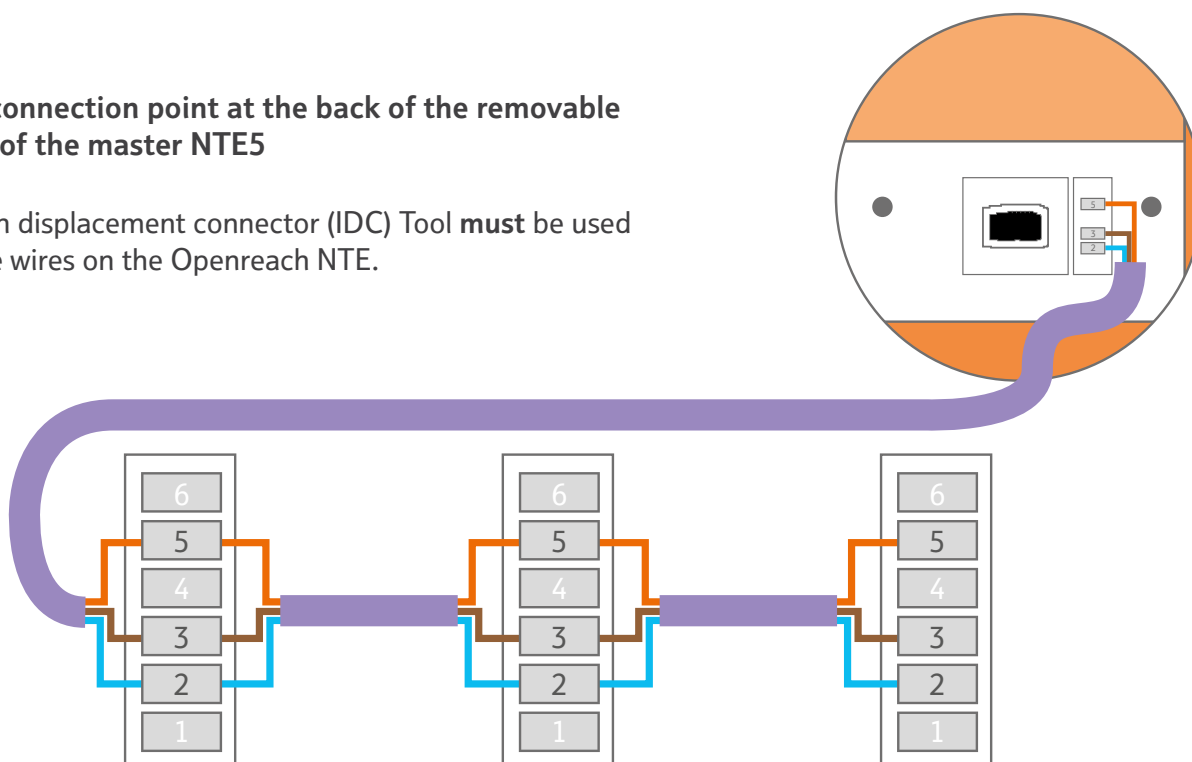
Extension wiring from the Openreach master socket (NTE)

Customer connection point at the back of the removable front plate of the master NTE5.



Customer connection point at the back of the removable front plate of the master NTE5

An insulation displacement connector (IDC) Tool **must** be used to terminate wires on the Openreach NTE.





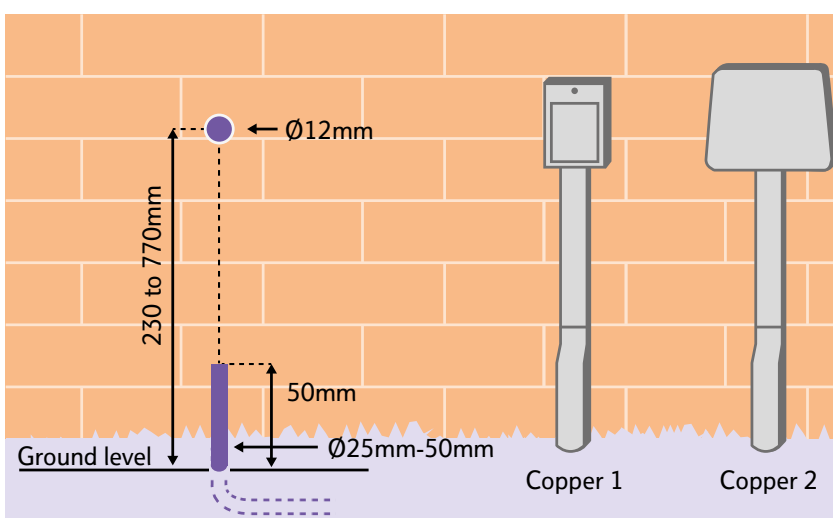
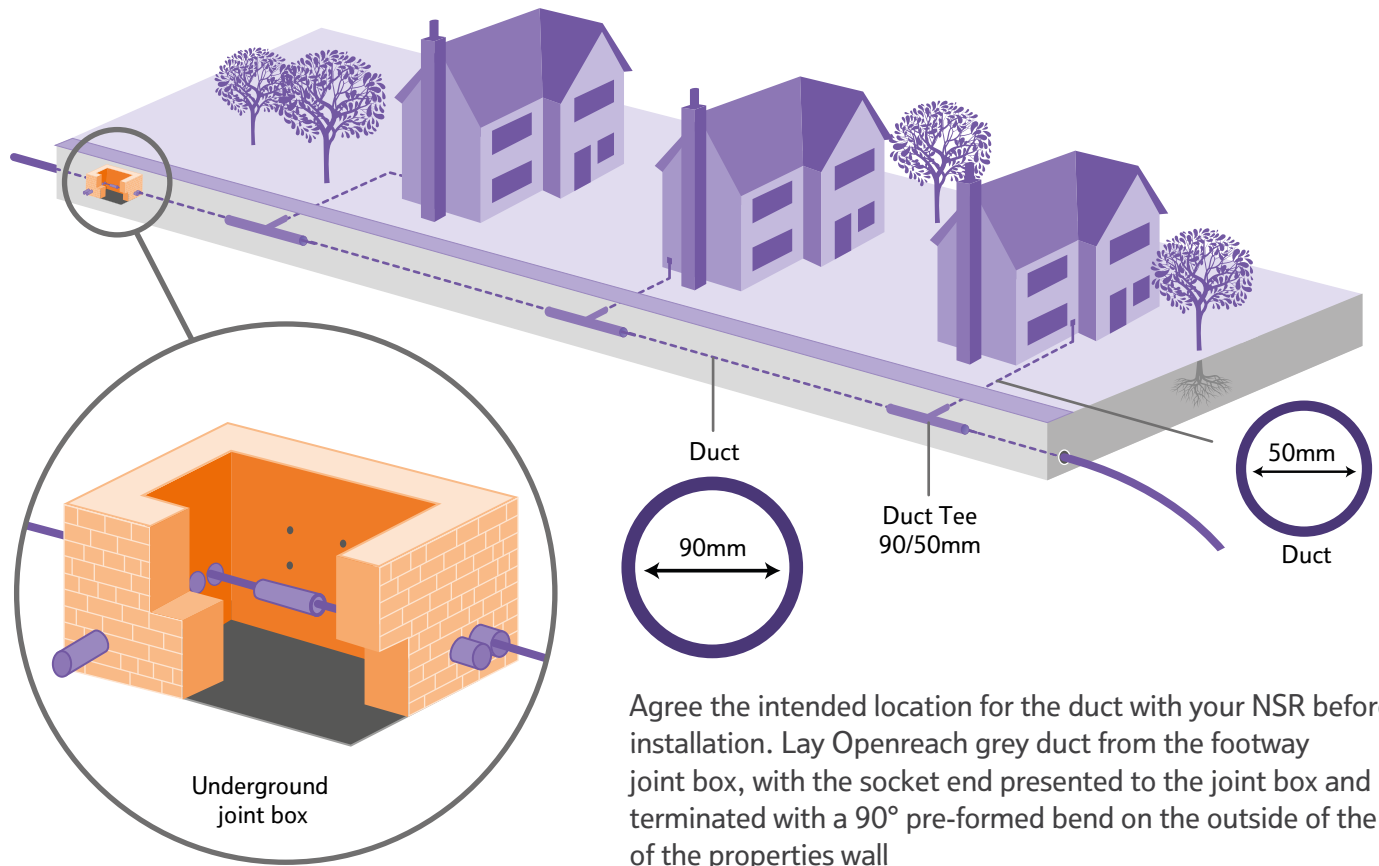
- Defective or damaged home wiring creating a fault on the line
- Extension sockets not connected to Openreach NTE
- Bending radii not exceeded causing reduced levels of service.

Impact on delivery

- Poor user experience for home purchaser with possibility of Openreach charges if called upon to rectify.

3 DUCT PRESENTATION – HOUSES

Installation for houses



Please note that:

All internal wires and sockets beyond the Openreach network terminating equipment (master socket) are the responsibility of the developer/future home owner. Any faults or defects resulting in an Openreach visit will incur a charge.

External capping 25 and connector bend 4 should be fitted, as required. Cover 101a is normally fitted at the top of the capping but this may be changed to a BT66 by Openreach during commissioning.

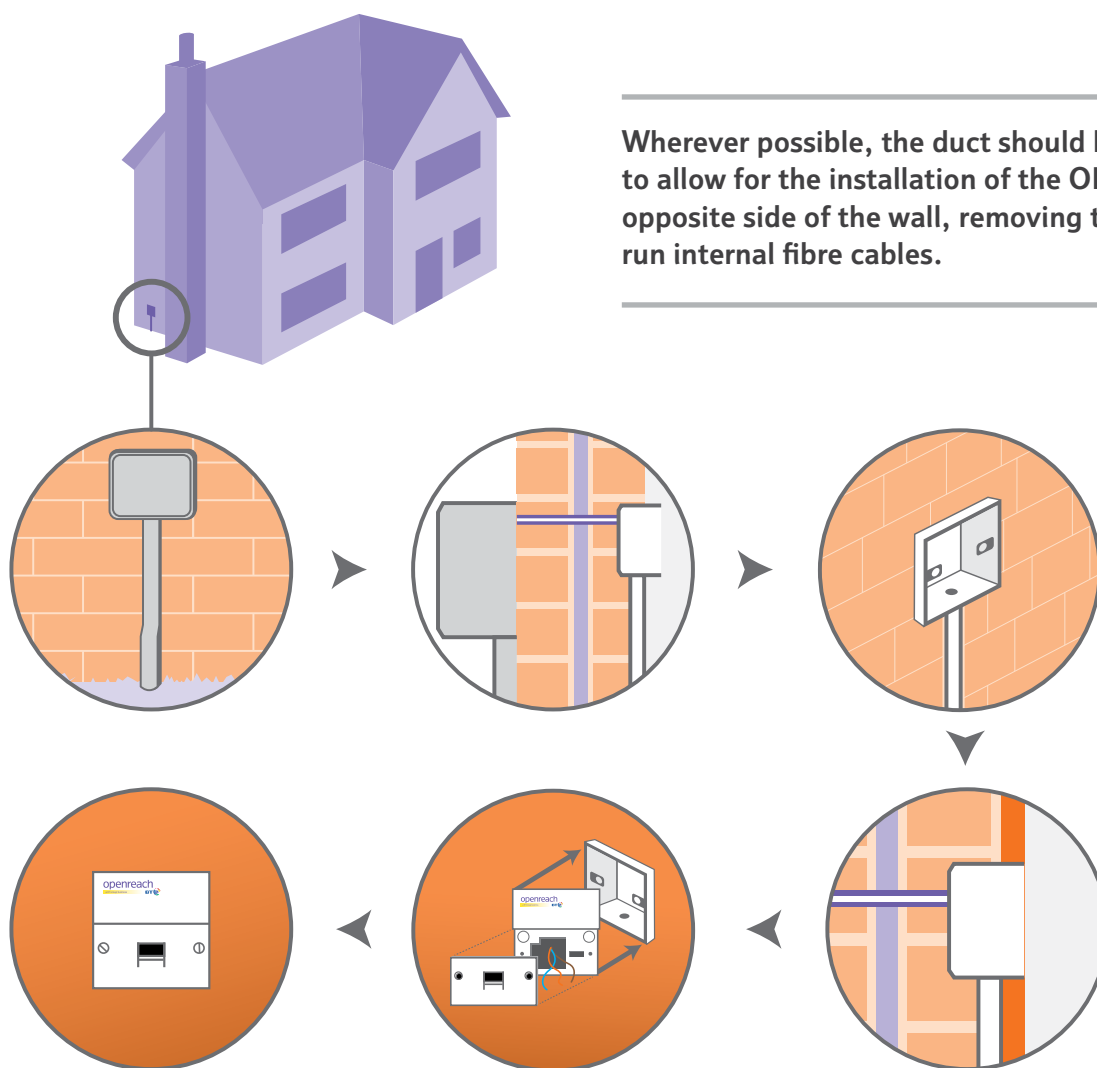
Copper 1 – Cover 101a

Copper 2 – BT66

Aesthetics will be impaired if the service access hole is not drilled in line with the duct and in keeping with the above dimensions.

Where the Network Terminating Equipment (NTE) is not directly behind the entry hole, and it will not be possible to provide a continuous external lead in to the NTE, a BT66B will be fitted by Openreach in lieu of cover 101A.

DUCT PRESENTATION – HOUSES



Wherever possible, the duct should be positioned to allow for the installation of the ONT on the opposite side of the wall, removing the need to run internal fibre cables.

- Limit duct runs to a depth of 350mm/450mm beneath the proposed external ground level
- The Openreach duct should be no greater than **15mm** from the finished wall surface
- The duct should protrude no more **75mm** from the finished ground level
- A rope, cable or tube **MUST** be installed as directed by your NSR
- The duct must be left in a protected state preventing the ingress of debris.

Wiring through cavity walls must be installed within 20mm conduit (to protect the cable and ensure easy maintenance).

Typical Issues with duct presentation

1. Service hole not aligned to duct
2. Duct not cut to the appropriate height from the finished ground level
3. Duct installed too shallow
4. Duct protruding too far from the finished wall surface.

Impact on delivery of issues

- Delay in completion – Openreach may refuse to cable if we can't ensure adequate protection
- The capping and covers would look unsightly
- Failure to provide conduit can prevent a cable from being installed.

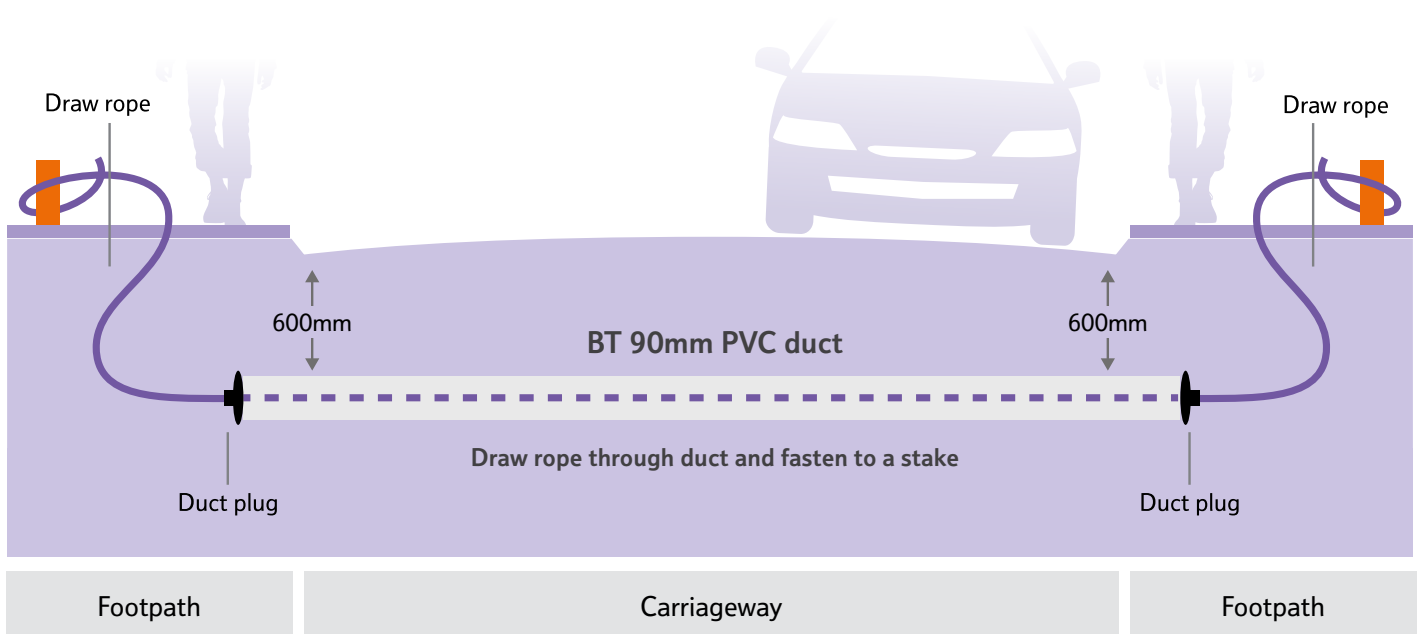
4 DUCT LAYING

Carriageway Road Crossings

Where our duct crosses a carriageway, adjoining kerbs must be temporarily marked to note positions.

Openreach **duct should be laid on an outer edge of the service trench** to enable box building. A draw rope should be inserted through the duct and secured to the marker posts at both ends of the crossing. The appropriate plug – **4B socket end and 4C Spigot**.

Duct laid beneath a carriageway crossing must be **600mm depth** from the cover of the final surface levels and, for engineering reasons (NJUG7), separated from other services **laid in parallel by 600mm** (to permit us to install underground joint boxes without the need for bends). **150mm** of separation is permissible, if the duct is laid at right angles.



Cable marker No. 2 is required at the site entrance/ boundary, to ensure link up identification for our contractors.

The latest information on the positioning of utilities, mains and plant can be obtained from the National Joint Utilities Group www.njug.org.uk

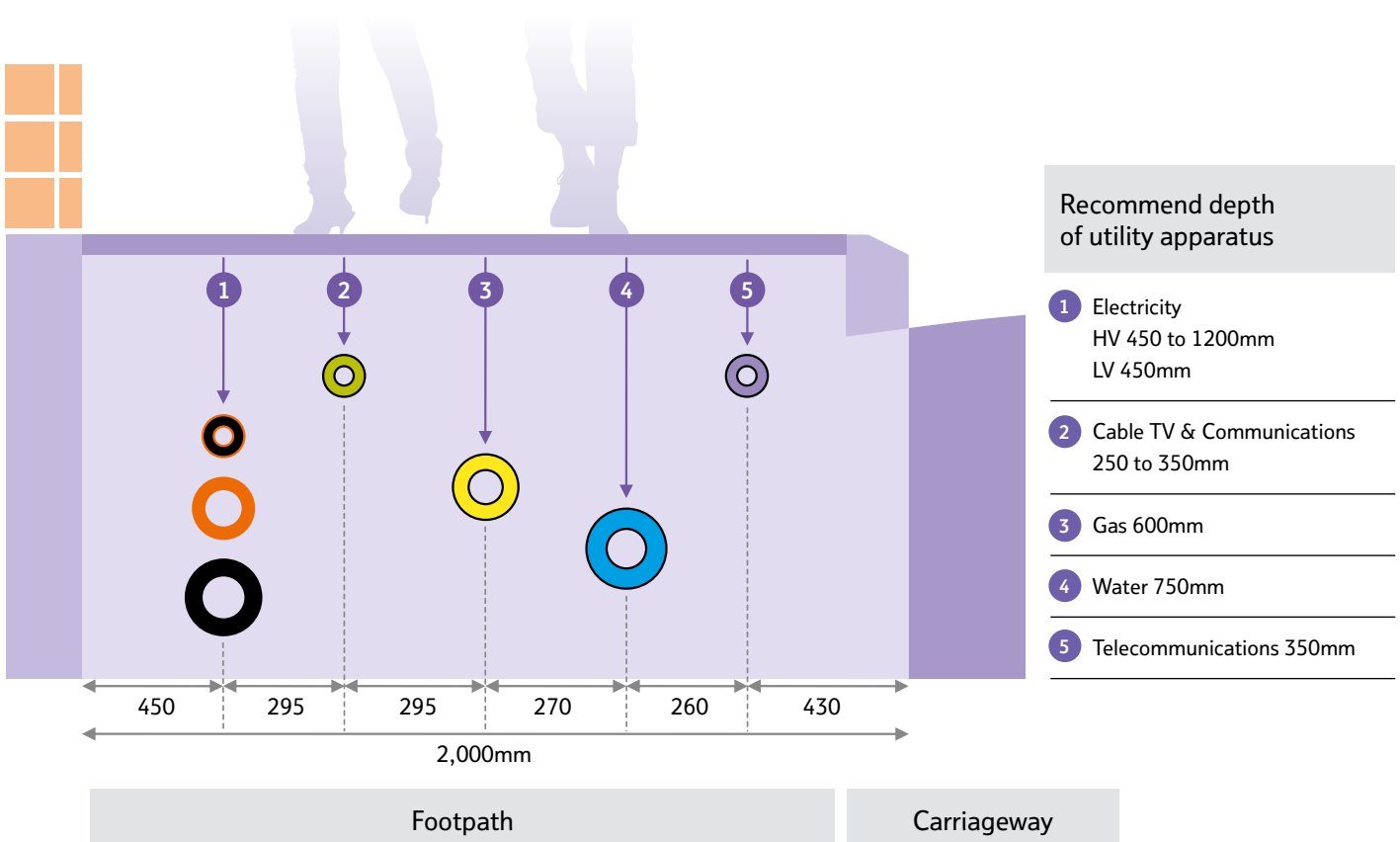
Ducting to the building

Duct to the premises/building must be laid at a minimum depth of 350mm; 450mm under a soft surface, and be as straight as possible.

DUCT LAYING

Ducting general principles

- All runs should be laid as straight as possible. If needed, you can carefully bend the ducts or use pre-formed bends supplied by Openreach
- There should be no more than one pre-formed 90° bend in any single run of duct
- Pre-formed 90° bends should not be installed in any duct linking two joint boxes
- Footpath or service strip ducting must be laid at 350mm depth of cover and 450mm depth of cover within premises
- All space alongside the duct must be backfilled with granular fill to a minimum thickness of 75mm
- For ALL single dwelling units (SDUs) duct must be terminated on the external surface of the property
- The duct termination point should be in a location that will afford unrestricted access for any future maintenance activity
- All ducts must be provided with a draw rope after installation, unless it's agreed locally to substitute the draw rope for a lead-in/copper cable
- Please notify your new sites representative (NSR) when the duct has been laid and is ready for inspection.



Typical issues with carriageway road crossings

1. Insufficient depth
2. Proximity to other services

Impact of issues

Developer will have to renew duct and this may delay any first occupation date (FOD)

5 JOINT BOXES FOOTWAYS & CARRIAGEWAY

Footway (JBF104/106)

Joint box designs and specifications may vary, depending on the duct layout and whether multi-way ducts or major road crossings need to be incorporated into the network design.

Full technical drawings and specifications are available from your new sites rep/designer.

Materials

- **Bricks:** British standard EN771-1 Engineering
- **Cement:** British Standard EN197-1:2000 ordinary mix. 3 parts sand to 1 part cement

Specifications

- **Base:** 150mm concrete, clean and level
- **Brickwork:** Keyed in at the corners and pointed
- **Frame and Cover:** Set on a mortar bed and fitted squarely to the box structure. You can purchase lifting keys (key No. 5, item code TW1731) for the covers from TW Tools,
- **Duct Entries:** Must not enter through corners and be no less than 75mm from the sidewall. Should enter wall at a minimum depth of 350mm from the top of the frame, cut flush and clear the base by a minimum of 100mm
- **Bolts:** Must be fitted in each box to allow ironwork to be installed
- **Step(s):** One step is required in all boxes deeper than 700mm. Two steps are required if the depth of the box is more than 1050mm
- **JBF104(C):** 915mm(L) x 445mm(W) x 750mm(D)
- **JBF 104(D):** 915mm(L) x 445mm(W) x 900mm(D), the minimum depth for boxes either side of road crossings.

At no time must minimum box depth be compromised. Consult with your Openreach New sites representative if the 750mm minimum depth cannot be achieved.

- All backfill material to be class 6N type
- Workmanship, materials and method of construction are to comply with all current relevant contract documents, British standards and codes of practice for the construction industry
- Concrete to be grade C32/40 with a water cement ratio 0.4 minimum. Cement content 380kg/m². Aggregate maximum size 20mm All in accordance with BS8500
- All ducts shown are based on maximum recommended values for duct type 54D
- End ducts to be inline
- Ducts to be positioned not less than 75mm from a side wall
- Mesh to be grade B500B or B500C conforming to BS4483
- Short lengths of duct 54D to be used on non-ducted routes. Appropriate duct to be used on ducted routes
- Where instructed to do so Drill 1 set of 3 holes using a 12mm masonry drill bit to a depth of 80mm for future fitting of MOBRA bracket.

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JOINT BOXES FOOTWAYS & CARRIAGEWAY

Carriageway JBC4

Box design and specifications may vary. This will be determined by the duct lay-out and whether multi-way ducts or major road crossings need to be incorporated into the design.

Materials

- **Bricks:** Grade B to BSEN771 & BSEN772
- **Cement:** BS12 Portland Cement
- **Concrete:** Grade 32/40 reinforced concrete with A393 grade mesh at 70mm cover – BS EN206
- **Mortar:** designated within BS5628; Part1 requirement for mortar table 1; Type (i) BS5628.

Base

- **Bricks:** Grade B to BSEN771 & BSEN772
- **Cement:** BS12 Portland Cement
- **Concrete:** Grade 32/40 reinforced concrete with A393 grade mesh at 70mm cover – BS EN206
- **Mortar:** designated within BS5628; Part1 requirement for mortar table 1; Type (i) BS5628.

Brickwork

- All brickwork to be keyed in at corners and pointed
- Brickwork to be English bond constructed with a 10mm joint thickness of cement mortar.

Frame and cover

- Carriageway No.4 Frame and cover to be set on a mortar bed and fitted squarely to box structure to Highway Agency document standards HA104.

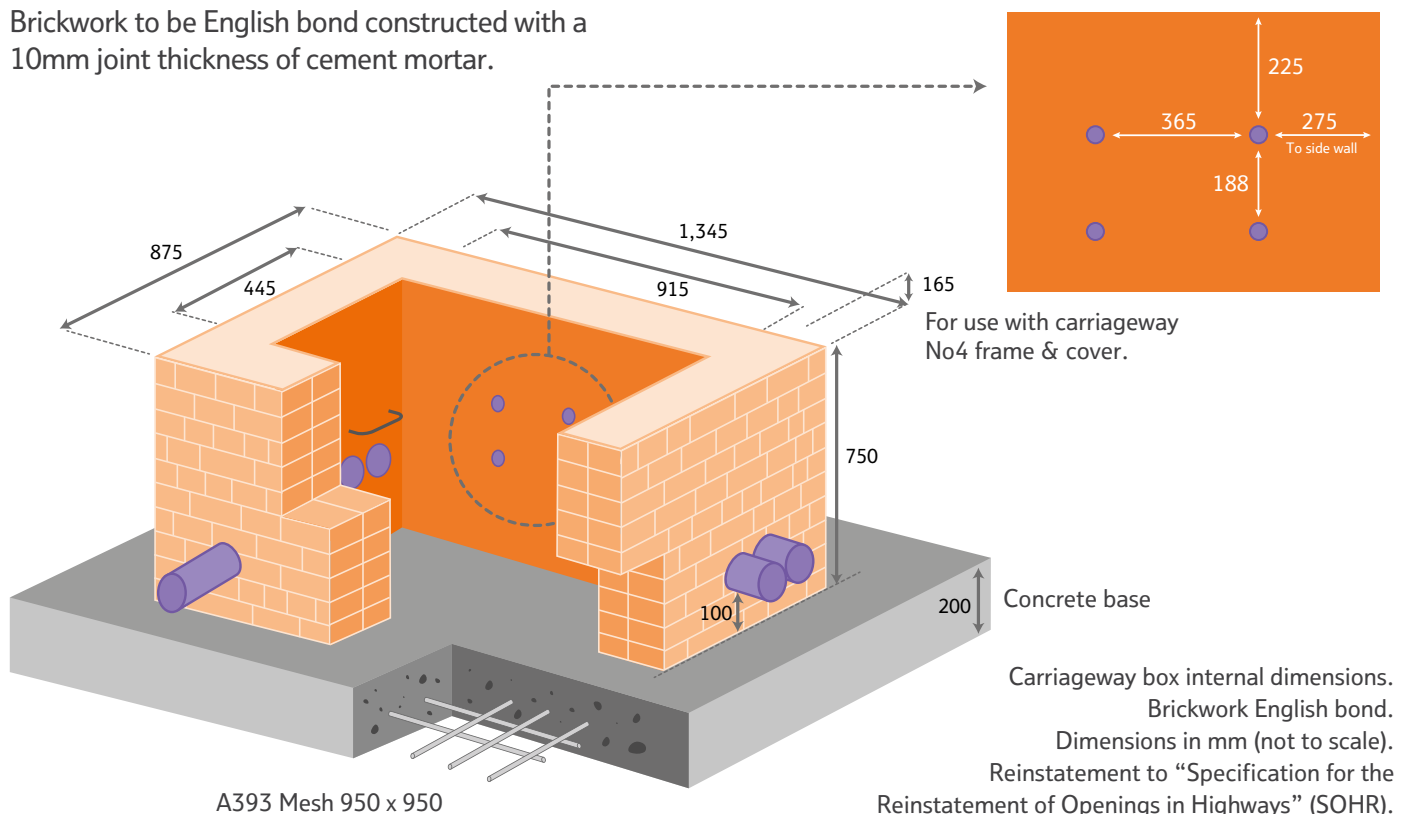
Lifting keys

- Lifter manhole cover 4B should be used to lift the cover and can be purchased from: TW Engineering Tel: 0115 932 3223 or other approved suppliers.

Duct entries

- Duct to be cut flush to the internal box wall
- Duct must not enter through corners and be no less than 75mm from the side wall
- Duct to enter wall no less than 600mm from the top of the frame
- Duct to be no less than 100mm from the box base.

Step to be installed



6 PRE-FORMED CHAMBER – QUADBOX

We've approved a pre-formed chamber system – Quadbox™ to speed up the installation process. This means that there's no need for specialist box building teams and concrete backfill.

Joint box modular footways 102, 104 and 106 are the Openreach approved versions (BT specification LN178).

Box furniture items slot into moulded pockets within the chamber, eliminating the need to cast-

in fixings or drill on site. Duct entries are also easy to achieve, using a standard hole saw mounted on a cordless drill.

The Quadbox™ is not a free stores item from Openreach, but can be purchased directly from our approved supplier, Cubis Industries: www.cubisindustries.com

Your NSR will approve your request to use this product.

The lightweight high-strength system is supplied as 150mm deep twin wall HDPE rings to provide maximum flexibility and strength which are simply stacked on a prepared base and backfilled with suitable as-dug or type 1 material. You must provide a clean and level 150mm concrete base for them.

If purchasing a pre-formed chamber you must also purchase the associated furniture.



Furniture

Cable brackets, bearers, pins and steps (where required) are supplied in a bagged kit and easily slot into purpose designed pockets in the chamber.

The brackets and steps drop into preformed slots.



PRE-FORMED CHAMBER – QUADBOX



Available Size Range	
Product Code	Clear Opening
MJF102	725 X 255mm
MJF104	915 X 445mm
MJF106	1310 X 610mm

**Duct entries**

Duct entries can be cut as and where required using a hole saw mounted on a cordless drill.

The chambers incorporate guides which identify drilling points to ensure correct duct spacing.

Typical issues with Quadbox are:


1. Box too shallow
2. Base/plinth not installed correctly or missing
3. Frame not level with surface
4. Over compaction/side wall damage allowing the box to misshapen
5. Unapproved boxes being used
6. Core drill not used for cutting duct entries
7. Duct not cut flush to box wall.

Potential impact on delivery is:

- Delay completing work by Openreach
- Additional cost
- Re-work by developer
- Unable to install fibre.

7 FRAMES & COVERS

Cubis Industries are the only supplier of these BT approved products

Only approved frames and covers must be fitted on your site. They are identifiable via the following markings; “EN124 B125” the British Standards kitemark , the Manufacturer's Mark (SID), the year of manufacture and the BT identifier.

The 'standard frames and covers' supplied by BT are 'lockable'. They consist of a galvanised steel fabricated frame, fitted with unfilled galvanised steel fabricated cover trays and cross-beams. There is also an optional 'recessed frame & cover'.

Security

Lockable footway frames and covers are available. The covers are secured by one or two integrated locks and fit into a reinforced frame that is bolted to the joint box during installation.

The installation of the box is the same specification, except that we supply you with the lockable frame and cover.



- They can be fitted to brick or concrete
- Securing tabs on the frame need to be bent down and bolted to the structure of the joint box during construction
- The cover has a Turnbuckle lock activated by the Key Security 1A. All other activities associated with opening the joint box remain unchanged
- Ensure the lock is secure.

Lockable frames and covers are also available for the “Quadbox” pre-formed chamber system.

Where ordered by the installer, security covers will be supplied pre-fitted in the Quadbox which must be fitted as the top ring.

Note – Where there is evidence or significant risk of vehicles using the soft verge e.g. as an undertaking area opposite a T-Junction, a passing point on a narrow road or a parking area, it will be necessary to install a 'carriageway chamber, frame & cover'.

FRAMES AND COVERS

Recessed frames & covers

These may be purchased by the installer as an option to the “standard frame & cover”.

Each cover tray is equipped with two key-hole fittings (in the centre of the short side) one of which carries a BT identity mark and the manufacturers' three letter identification 'SID'. The other key-hole fitting displays EN124 and B125 together with the BSI Kite mark certifying the covers to BS EN124: 1994.

Recessed frames and covers will accommodate infill blocks to a maximum depth of **65mm**.

If you are planning to install frames and covers that are not supplied by Openreach e.g. for block paving, or you have any doubts about what frames and covers to use, advice should be sought from your nominated new sites representative.



Installation

All frames and covers should be levelled to the final running surface.

Where a box is located on a **grass, soft or unmade surfaces**, the frame shall be surrounded with a 100 mm wide strip of minimum grade C25/30 concrete, to the full depth of the frame, finished level with the top edge of the frame and the outside edge and be straight and parallel to the frame.

www.openreach.co.uk/orpg/home/contactus/connectingyourdevelopment/installationdiagrams/installationdiagram.do

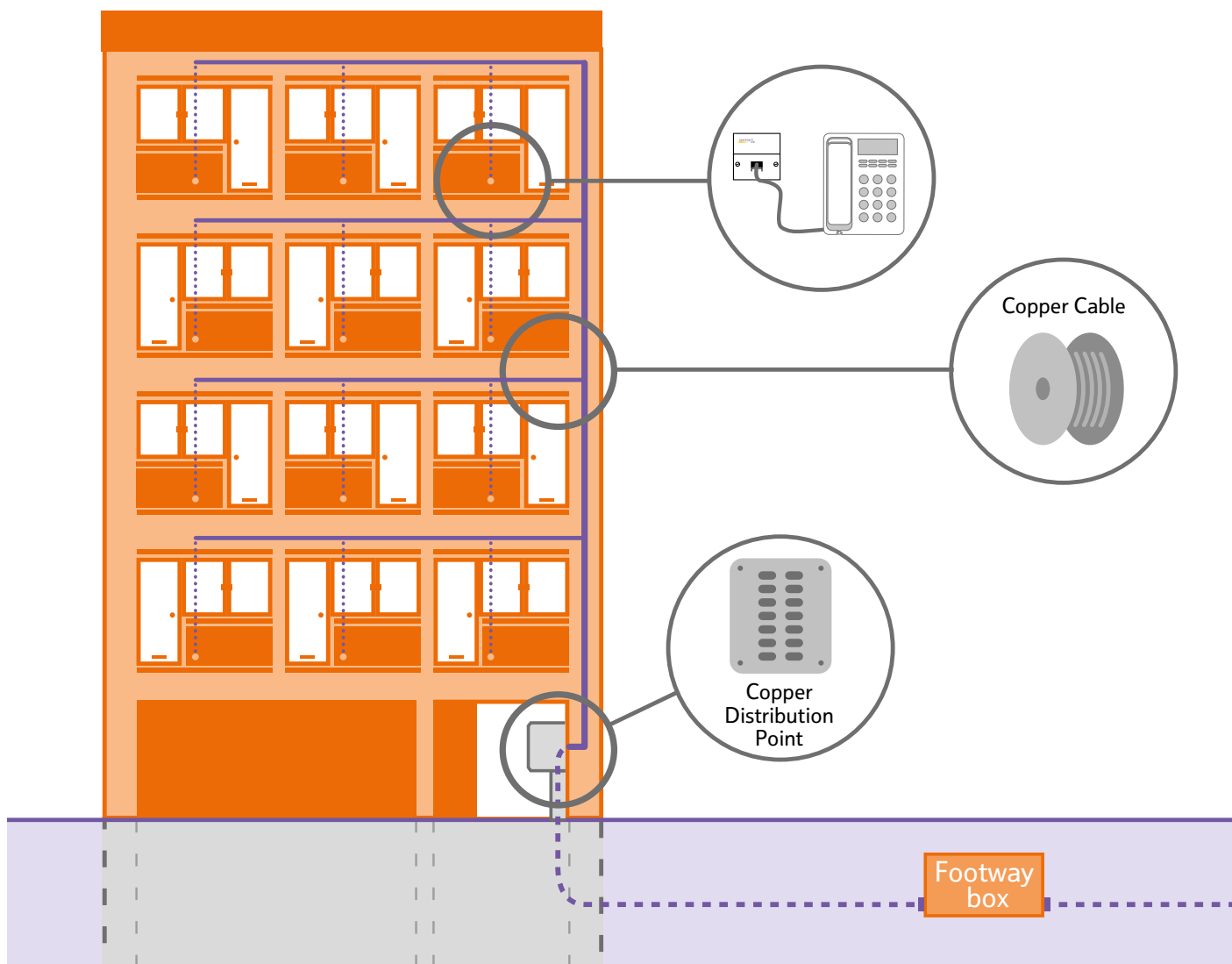
Unapproved frames & covers

Unapproved frames and covers must not be fitted.

BT will take any necessary action against any developer who fits unapproved frames and covers within the BT network, including any potential claim for damages and costs, with possible delayed SOD payments).

If you are unsure how to specify approved covers, please contact your new sites representative.

8 MULTI DWELLING UNITS FROM INTAKE ROOM TO CUSTOMER



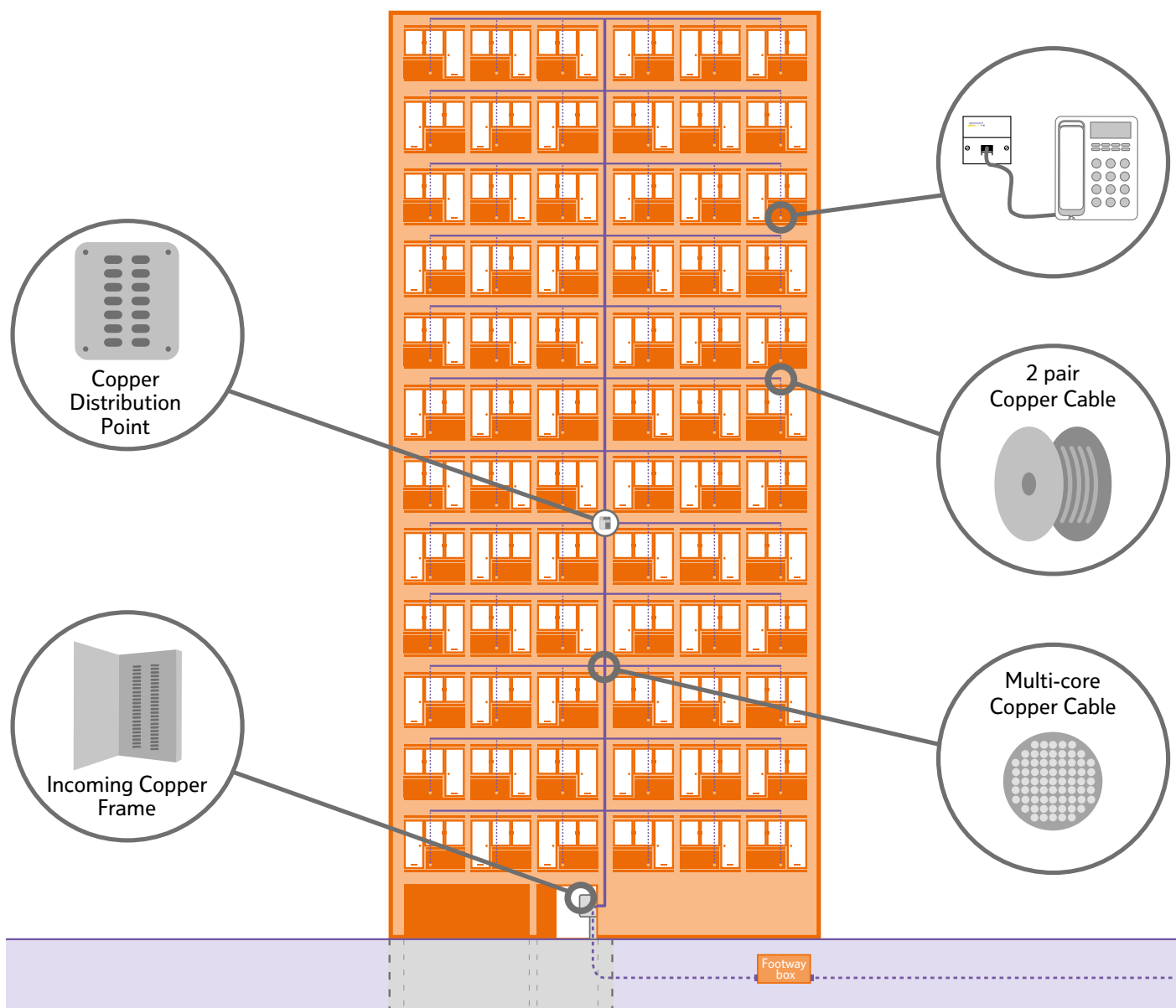
Our newsite designers will create a copper layout based on your M&E drawings of the MDU.

The design will calculate the stores required to build the network. Your NSR is on hand to guide you through the ordering process to ensure the equipment is available when you need it.

The incoming copper will terminate in the communications intake room or riser cupboard. This needs to be a secure and safe location with access for installation and any future maintenance visits.

Our copper Distribution Point (DP) needs to be installed at a minimum height of 200mm and a maximum of 1500mm. Your NSR will agree the location with you.

MULTI DWELLING UNITS FROM INTAKE ROOM TO CUSTOMER

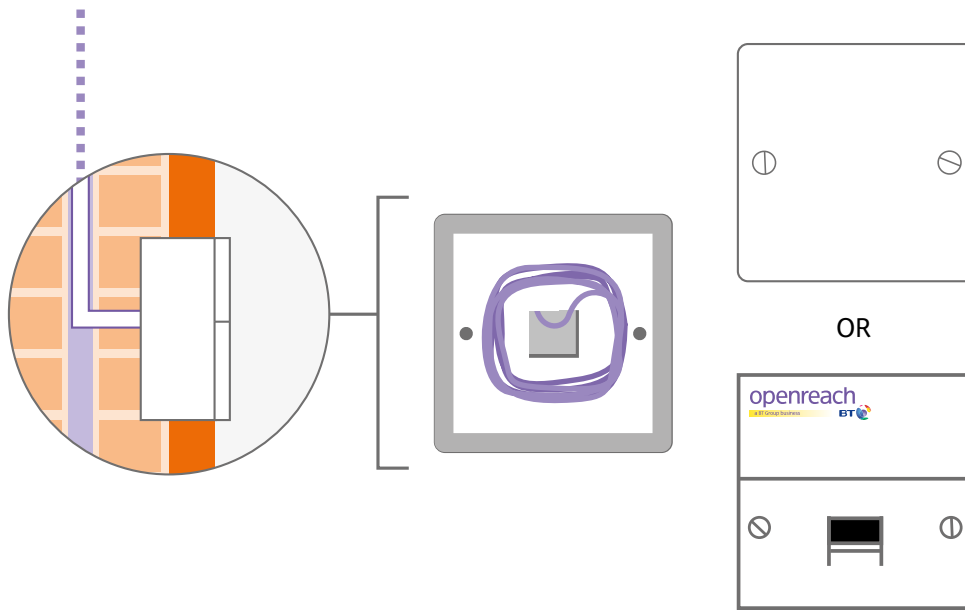


For larger MDUs there may be a requirement to install Multiple DPs. These DPs will be connected with copper cables housed within the riser space.

Each apartment will require a designated 4 wire copper cable run in a continuous fault free condition from the designated master socket location within the apartment to the designated DP within the riser.

The cable should be clearly marked with the apartment number and left safely coiled within the riser. 300mm of spare cable is required within the apartments master socket back box and at least 1500mm of spare cable is required at the designated DP location cated within the riser.

MULTI DWELLING UNITS FROM INTAKE ROOM TO CUSTOMER



- Install a single gang flush mounted back box at the desired master socket location
- Install the 4 wire cable from this point to the designated riser DP location
- Ensure there is 300mm of 4 wire cable should be left at the NTE position and at the DP position to allow for termination
- Install blanking plate to protect cable or the Openreach master socket as directed by your NSR
- An insulation displacement tool **MUST** be used to make all terminations onto the Openreach master socket.

Your NSR will advise of all cable marking/labelling and will check for this when calling off the work.

IEE Wiring Regulations should be adhered to external type cables can run to a maximum of 2000mm from the internal building entry point. From this point onwards all cables must either be of retarded, reduced or limited fire hazard properties. Alternative is to house in metallic trunking.

Care should be taken to avoid stretching cables through installation. If cables are found to be deficient/defective they will require replacement.

Correct sized shouldered cleats are to be used for fixing copper cable to walls.

A minimum separation distance between power (supply or distribution) cables and copper communications cables must be maintained.

Separation distance is subject to the voltages and power levels involved. Consult your NSR if you are unsure of the minimum separation distances.

Under NO circumstances should cable be secured or supported to the suspended ceiling hangers or under floor support legs.

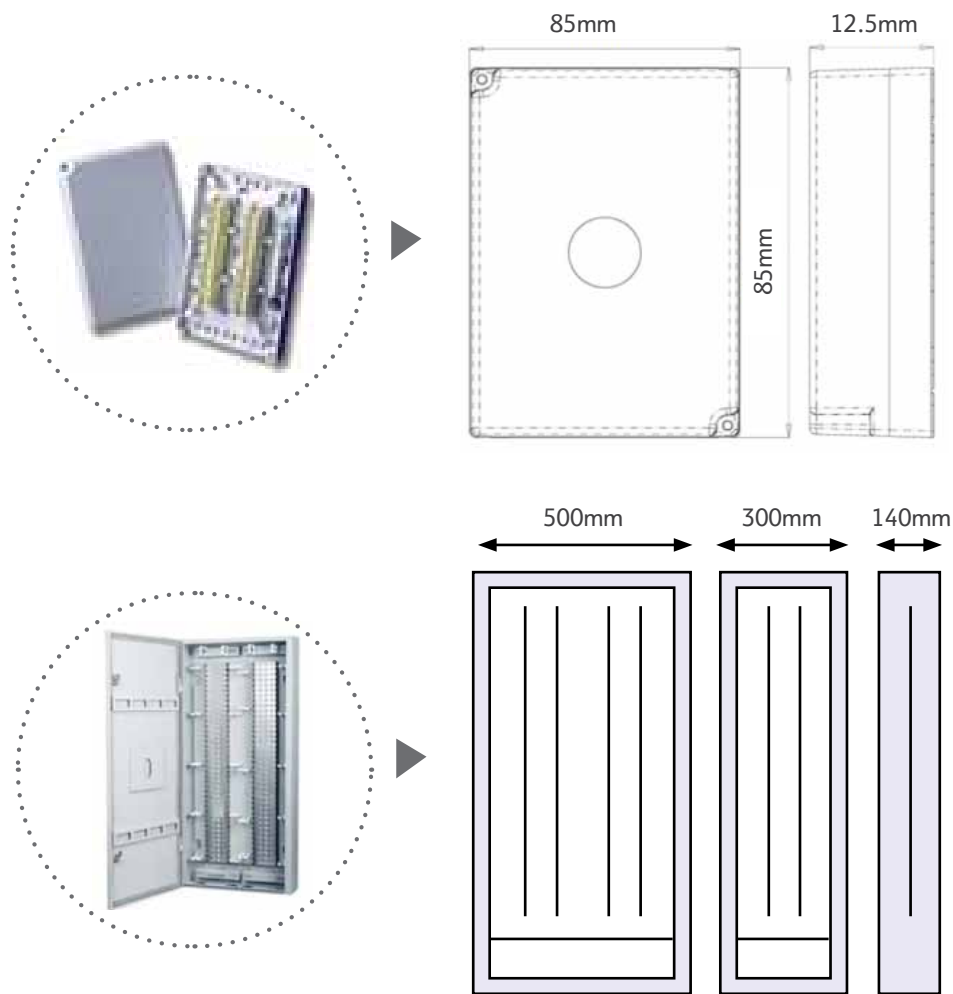
It is the Developers responsibility to provide fire stopping on completion of the cable/tubing installation.

Openreach Networks must not interfere with or be interfered by other services within the riser or any other shared space. E.g.

- Un-insulated hot water pipes
- Unscreened mains cables
- Fluorescent lighting
- Heavy duty switch gear.

Cables should not be kinked or adversely bent/twisted

MULTI DWELLING UNITS FROM INTAKE ROOM TO CUSTOMER



Bending Radius for Copper Cables	
5 pair 8.5mm (x 12 = Bend Radii)	102mm
10 pair 12mm (x 12 = Bend Radii)	144mm
20 pair 15mm (x 12 = Bend Radii)	180mm
50 pair 19.5mm (x 12 = Bend Radii)	234mm
100 pair 25mm (x 12 = Bend Radii)	300mm

All externally run cables must be of a type designed for external use, comply with the bending radius and appropriate cable separations to current IEE Regulations and the appropriate British Standards. Consult your NSR if you or your contracted partner is unsure of the installation requirements.



If your site is identified as being in an area of higher than normal risk from lightning we may ask you to provide additional protection. For example we may ask you to provide an earth wire to the Openreach main distribution point, or run copper tape in the ground for the jointing chambers.

Notes



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www.openreach.co.uk

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