

Residential preparation and installation: Single Dwelling Units (SDUs) and Multi Dwelling Units (MDUs)

FTTx Engineering

Document number	NBN-DES-STD-0011
Document category	Standard
Author	External Networks
Approver (owner)	National Engineering Manager, External Networks
Status	Approved
Issue date	12 DEC 2016
Revision number	11.0



Disclaimer

This document is provided for information purposes only. This document is subject to the information classification set out on this page. If no information classification has been included, this document must be treated as 'nbn-Confidential: Commercial' and must not be disclosed other than with the consent of nbn co. The recipient (including third parties) must make and rely on their own inquiries as to the currency, accuracy and completeness of the information contained herein and must not use this document other than with the consent of nbn co.

Copyright © 2016 nbn co limited. All rights reserved.

Document control

Revision history

Date	Revision	Details
21 OCT 16	11.0	<ul style="list-style-type: none">Rebranding and update of security classification.Change of document number and name from NBN-TO-GDE-0011 Residential Preparation and Installation Guide: SDUs and MDUs to NBN-DES-STD-0011 Residential preparation and installation: Single Dwelling Units (SDUs) and Multi Dwelling Units (MDUs).References to MTM: HFC, FTTB, copper to the MDF (FTTN), FTTN throughout.Sections 1.2, 1.5 and 1.6 added statements for Purpose, Audience, and Assumptions and constraints.Section 2.4 revision of definition of fibre NBP.Section 2.5 update of MTM installation lifecycle.Sections 3.1, 3.2, 3.3 and 3.4 update of installation components, including Figure 1 diagram.Section 3.5 update of MTM activities for preparing new buildings.Section 3.6 update of LIC installation.Section 3.7 update of MTM internal conduit installation requirements, including Figure 3 diagram. New Figure 4 and 5 diagrams.Section 3.8 update of external wall space requirements and preparations for the PCD or NTD, including Figure 6 diagram. New Figure 7 and 8 diagrams.Section 3.9 update of internal premises wiring for MTM.



Date	Revision	Details
		<ul style="list-style-type: none">• Section 4.3.3.1 new Figure 13 and 14 diagrams of FTTP NTD portrait and landscape layout examples.
		<ul style="list-style-type: none">• Section 5.1 updated table of 'who provides what' to include MTM.
		<ul style="list-style-type: none">• Section 6.2 updated internal cable feed MDUs to include MTM.
		<ul style="list-style-type: none">• Appendix B and C updated to include MTM item.



Contents

1 About this document	9
1.1 Background	9
1.2 Purpose	9
1.3 Health, Safety & Environment (HS&E)	9
1.4 Scope	10
1.4.1 In scope	10
1.4.2 Out of scope	10
1.5 Audience	10
1.6 Assumptions and constraints	11
1.7 Responsibilities	11
1.8 Contact information	13
1.9 Referenced documents	13
1.10 Changes in this revision	14
2 Before you start	15
2.1 Read this first	15
2.2 Safety	15
2.3 Australian Communications and Media Authority (ACMA) wiring rules	16
2.4 NBP	16
2.5 Installation lifecycle	16
3 Preparing for FTTx installation	19
3.1 Fibre installation components	19
3.2 FTTN copper installation components	19
3.3 HFC installation components	20
3.4 FTTB/copper to the MDF installation components	21
3.5 Preparing new buildings: overview	22
3.5.1 Building activities	22
3.5.2 nbn™ activities	22
3.6 LIC installation	23
3.7 Internal conduit installation	25
3.7.1 Internal conduit requirements	25



3.7.2	Conduits and structural integrity.....	26
3.8	Providing external wall space and preparation for the PCD or NTD.....	28
3.8.1	FTTP PCD installation requirements.....	28
3.8.2	FTTN NTD installation requirements.....	29
3.8.3	HFC PCD installation requirements.....	31
3.8.4	Variations on requirements.....	32
3.8.4.1	Limited space.....	32
3.8.4.2	Conduits and other utilities.....	32
3.9	Internal premises wiring.....	33
3.9.1	FTTP PSU (PS/S [default] or PS/OBB): AC power requirements.....	35
4	nbn™ equipment inside the premises.....	37
4.1	Basic equipment requirements.....	37
4.2	nbn™ equipment: installation requirements.....	38
4.3	Providing space in the premises for nbn™ equipment.....	40
4.3.1	FTTP mounting surface template.....	40
4.3.2	Organising nbn™ equipment.....	40
4.3.3	Example FTTP equipment layouts within mounting surfaces.....	40
4.3.3.1	Layout examples.....	41
4.3.3.2	Cable entry locations.....	42
4.3.4	Power outlet(s).....	42
4.3.5	Customer-purchased equipment.....	42
4.4	Mounting locations.....	43
4.4.1	Types of locations.....	43
4.4.2	Open wall areas.....	43
4.4.3	Open enclosures.....	44
4.4.3.1	Power outlet location.....	45
4.4.4	Home distributors.....	45
4.4.4.1	Minimum home distributor dimensions.....	46
4.4.4.2	Power outlet(s) and customer equipment.....	46
4.4.5	Enclosures within enclosures.....	46
5	Wiring inside the premises.....	47
5.1	Who provides what?.....	47



5.2	Services available at the nbn™ NTD	48
5.3	Customer cabling.....	48
5.3.1	Customer-side cabling work	48
5.3.2	Customer cabling is optional	48
5.3.3	Planning for customer cabling	49
5.3.3.1	End user intentions	49
5.3.3.2	Cabled end user access to nbn™ equipment	49
5.3.3.3	More information.....	49
5.3.4	Installing customer cabling	49
6	MDUs.....	51
6.1	Dwellings with direct access to street boundary	51
6.2	Internal cable feed MDUs.....	51
7	Pre-installation of FTTP nbn™ equipment and cabling	53
7.1	Arranging pre-installation	53
7.1.1	Prerequisites	53
7.1.2	Booking pre-installation appointment form online.....	53
7.1.3	Key changes	53
7.1.4	Pre-installation activities	54
7.2	Troubleshooting connection problems.....	54
8	Glossary.....	55
Appendix A	Australian and international standards.....	58
Appendix B	Standard circumstances defined.....	59
Appendix C	Ventilation of NTD enclosure and PSUs.....	63
Appendix D	Builder checklist: SDU/MDU preparation.....	66

Figures

Figure 1.	Conduit dimensions	21
Figure 2.	Marking tag example	23
Figure 3.	Conduit passing through timber framing	26
Figure 4.	LIC passing through footing and internal cavity wall.....	27
Figure 5.	LIC surface mounted and internal conduit	27



Figure 6. FTTP conduit alignment with PCD	29
Figure 7. FTTN conduit alignment with NTD	30
Figure 8. HFC conduit alignment with PCD.....	31
Figure 9. FTTP NTD enclosure with PS/S example.....	34
Figure 10. FTTP NTD enclosure with PS/OBB example.....	34
Figure 11. NTD height clearance.....	38
Figure 12. NTD mounting surface template	40
Figure 13. NTD portrait mounting surface template with GPO.....	41
Figure 14. NTD landscape mounting surface template with GPO.....	41
Figure 15. Cable entry location for NTD enclosure	42
Figure 16. Diagram of NTD device	48

Tables

Table 1. Responsibility description of each sector	11
Table 2. Contact information.....	13
Table 3. Safety principles.....	15
Table 4. Installation life-cycle	16
Table 5. Fibre installation components description	19
Table 6. Copper cable (FTTN) components description	19
Table 7. HFC components description.....	20
Table 8. FTTP/copper to the MDF components description	21
Table 9. LIC requirements.....	24
Table 10. Internal conduit requirements.....	25
Table 11. PCD installation requirements.....	28
Table 12. NTD installation requirements.....	30
Table 13. HFC PCD installation requirements.....	31
Table 14. Provision of internal premises wiring	33
Table 15. Internal service clearances	36
Table 16. NTD installation requirements.....	38
Table 17. Mounting surfaces conditions	40
Table 18. Types of locations to house the NTD	43



Table 19. Open wall area conditions	43
Table 20. Open enclosure conditions	44
Table 21. Home distributor conditions.....	45
Table 22. Home distributor parameters.....	46
Table 23. Provision responsibility from each sector.....	47
Table 24. Prerequisites before installing fibre equipment.....	53
Table 25. Australian and international standards table	58
Table 26. Standard circumstances checklist.....	59
Table 27. Ventilation requirements.....	64
Table 28. Additional ventilation requirements.....	65
Table 29. Builder checklist	66



1 About this document

1.1 Background

This document assists developers, building owners and builders in new developments to prepare premises correctly and to arrange connections for access to the National Broadband Network (**nbn**).

These guidelines have been provided for new developments, where the developer has an agreement with **nbn** to provide optical fibre broadband to the premises within the development.

It describes **nbn** minimum requirements and specifications for wiring and related infrastructure, to and within new premises. Additional internal wiring is at the discretion of the homeowner.

Developers, building owners and builders must adhere to this guide to ensure a smooth connection of **nbn**[™] services to the premises.

1.2 Purpose

This document deals with the provision of appropriate lead-ins, pathways and spaces in SDUs and MDUs for the delivery of **nbn**[™] Fibre To The Premises (FTTP), Fibre To The Building (FTTB), Hybrid Fibre Coaxial (HFC) and copper to the Main Distribution Frame (MDF) (via Fibre To The Node [FTTN]) infrastructure in new developments. This includes the conduit and spatial requirements within an SDU and MDU that are necessary for the deployment of **nbn**[™] Fibre To The 'x' (FTTx) infrastructure.

1.3 Health, Safety & Environment (HS&E)

nbn takes health, safety and environment very seriously and expects the same of our Delivery Partners (DPs), network planners, designers and constructors, who have a range of obligations under Workplace Health & Safety (WHS) and environmental legislation. You need to consider your specific duty of care; in particular, how you eliminate and minimise risks in the design that have an impact on later stages of the asset lifecycle (including construction, inspection and assurance) and how information about those risks, design rationale, and residual risks and controls are communicated to **nbn**.

nbn has considered the specific risks associated with these design standards for the lifecycle of the assets, and incorporated safety and environmental based design standards within this document where relevant. As a designer, you also have an obligation to:

- undertake whatever calculations, analysis, testing or examination are necessary to ensure your designs are without safety or environmental risks, so far as is reasonably practicable;
- communicate residual risks associated with the design and further controls/conditions required to manage those risks throughout the lifecycle of the design;
- demonstrate to **nbn** you have done this through the contract deliverables; and
- ensure adequate training and competency of workers involved in the design.



1.4 Scope

nbn[™] designs and constructs the network infrastructure up to each premise and provides wholesale data and voice services to Retail Service Providers (RSPs) and Internet Service Providers (ISPs).

nbn never provides internet or telephone services directly to occupants. Occupants of each premise have to contact their service provider of choice to activate telephone and/or data services.

For sites that require configurations that fall outside of the guidelines described here or for other problems that may arise, contact **nbn** directly (refer to Section 1.8 Contact information).

Important notes for owners and developers:



- **developers** must ensure that the building owner is aware of, and has a copy of, this document
- **building owners** must ensure these guidelines are provided to the builder and the builder is aware of the need to adhere to the specified requirements
- the **builder** and/or **building owner** is responsible for ensuring the building is prepared correctly and the supporting infrastructure is installed correctly

1.4.1 In scope

- residential SDUs
- small-scale MDUs, to which SDU methods can be applied
- new buildings constructed on vacant lots of land within a new housing estate
- connecting a building to the **nbn**[™] telecommunications network
- duplex or triplex dwellings

1.4.2 Out of scope

- estate pit and pipe installation information, processes, methods and practices (refer to the separate relevant documents at: <http://www.nbnco.com.au/newdevelopments>)
- larger scale MDUs, to which SDU methods cannot be applied (refer to the document *NBN-TE-CTO-284 Multi Dwelling Unit (MDU) building engineering and design standard - new developments* at: <http://www.nbnco.com.au/newdevelopments>)
- **nbn** customer (via RSPs and ISPs) connection equipment or information

1.5 Audience

The intended audience for this document is any of the following:

- new development site developer
- new development site designer
- new development site consultant
- building contractor




1.6 Assumptions and constraints



The developer and/or their representative should have a sound level of knowledge, understanding and experience in installing any telecommunications customer cabling or conduit for **nbn** to utilise in its FTTx network.

1.7 Responsibilities

Table 1. Responsibility description of each sector

Who	What
developer	<ul style="list-style-type: none"> Ensures that their builder and/or land buyer is aware of the requirements set out in this document and of the consequences of non-compliance. <p> The 'land buyer' can be a builder who plans to resell the land later as part of a house and land package, or an owner who engages a builder to construct the premises.</p> <ul style="list-style-type: none"> Makes a copy of this document available to builders and building owners, as required. Makes application to nbn for FTTx for any additional subdivisions within a development (similar to a super lot development). Any additional pit and pipe would have to be provisioned by the subdivision developer.
building owner	<ul style="list-style-type: none"> Gives this document to the builder to ensure the house is ready for the installation of FTTx network equipment as per nbn requirements. Discusses and reaches agreement with the builder about the desired services and the placement of the nbnTM FTTx equipment. Ensures the builder is aware of the following: <ul style="list-style-type: none"> space and pathway compliance requirements in accordance with the document <i>NBN-TE-CTO-284 Multi Dwelling Unit (MDU) building engineering and design standard - new developments</i> the correct equipment for the preparation of a connection to the nbn
builder (and building subcontractors)	<ul style="list-style-type: none"> Installs the internal customer wiring for data and other services (including power circuits) to the building owner's requirements. Installs the facilities to connect the premises to the FTTx network, including: <ul style="list-style-type: none"> Lead-In Conduit (LIC) through which to run cable from the street to the external Premises Connection Device (PCD) or Network Termination Device (NTD) internal conduit through which to run cable from the PCD/NTD to the nbnTM equipment location where applicable power for the General Purpose Outlet (GPO) to power to the nbnTM



Who	What
	<p>equipment and space reserved for an optional battery backup unit should the End User Premises (EUP) request one in future</p> <p> A draw-string should protrude through the wall at the location of the nbn[™] or customer equipment location, from the PCD/NTD position (both ends of the draw-string should be tied off)</p> <ul style="list-style-type: none">• After the premises is at lock-up stage, books a pre-installation appointment with nbn.
<p>nbn (or other FTTP solution provider)</p>	<p>Installs the following components:</p> <ul style="list-style-type: none">• a service drop cable from the street to the PCD• the PCD/NTD (dependent on the FTTx technology, this device is attached to an external wall and will have optical fibre, copper or HFC Radio Grade (RG) cable connected to it)• premises cable (also known as a connecting fibre or connecting copper, HFC RG) from the PCD/NTD to the internal location where the nbn[™] equipment will be installed• an NTD (the nbn[™] network termination point at the network boundary):<ul style="list-style-type: none">• for the fibre network (it connects internal wiring to the nbn inside the premises)• for the FTTC copper network (it connects the internal wiring to the nbn outside the dwelling)• an nbn[™] fibre enclosure (the housing for the NTD)• a Power Supply Unit (PSU) (with default standard power supply if no request for pre-installation of an optional battery backup unit has been lodged - this unit powers the NTD and provides battery backup as required in accordance with government policy) <p> For more information, refer to the <i>Optional Battery backup service information</i> on the nbn website at:</p> <p>http://www.nbnco.com.au/connect-home-or-business/already-connected/nbn-equipment/battery-back-up-service-information.html</p>



1.8 Contact information

Table 2 contains **nbn** new developments contact information. Refer also to the website <http://www.nbnco.com.au/newdevelopments>.

Table 2. Contact information

Method	Address/number
email	newdevelopments@nbnco.com.au
website	http://www.nbnco.com.au/newdevelopments
telephone	1800 OUR NBN (1800 687 626)

To request a booking for pre-installation of **nbn**[™] equipment, apply online at the following link:
<http://www.nbnco.com.au/develop-or-plan-with-the-nbn/new-developments/design-build-install/ntd-pre-installation-request.html>

1.9 Referenced documents



Please ensure you are referencing the latest applicable version of any of the referenced documents.

Document number	Document name	Owner
AS 4086.2:1997	Secondary batteries for use with stand-alone power systems Part 2: Installation and maintenance	Australian Standard
AS/CA S009:2013	Installation requirements for customer cabling (Wiring rules)	Communications Alliance
AS/NZS 1477:2006	PVC pipes and fittings for pressure applications	Australian and New Zealand Standard
AS/NZS 3000:2007	Wiring Rules	Australian and New Zealand Standard
AS/NZS 4029.2:2000	Stationary Batteries - Lead-acid Part 2: Valve-regulated type (IEC 60896-2:1995, MOD)	Australian and New Zealand Standard
NBN-TE-CTO-194	New developments - deployment of the nbn [™] pit and conduit network	FTTx Engineering
NBN-TE-CTO-284	Multi Dwelling Unit (MDU) building engineering and design standard - new developments	FTTx Engineering



1.10 Changes in this revision

Changes in this document revision 11.0 dated 21 OCT 2016 compared to the previous revision 10.0 dated 11 JUN 2014 are summarised below:

Section	Details
ALL	<ul style="list-style-type: none"> Rebranding and update of security classification. Change of document number and name from NBN-TO-GDE-0011 Residential Preparation and Installation Guide: SDUs and MDUs to NBN-DES-STD-0011 Residential preparation and installation: Single Dwelling Units (SDUs) and Multi Dwelling Units (MDUs). References to MTM: HFC, FTTB, copper to the MDF (FTTN), FTTN throughout.
Sections 1.2, 1.5 and 1.6	Added statements for Purpose, Audience, and Assumptions and constraints.
Section 2.4	Revision of definition of fibre NBP.
Section 2.5	Update of MTM installation lifecycle.
Sections 3.1, 3.2, 3.3 and 3.4	Update of installation components, including Figure 1 diagram.
Section 3.5	Update of MTM activities for preparing new buildings.
Section 3.6	Update of LIC installation.
Section 3.7	Update of MTM internal conduit installation requirements, including Figure 3 diagram. New Figure 4 and 5 diagrams.
Section 3.8	Update of external wall space requirements and preparations for the PCD or NTD, including Figure 6 diagram. New Figure 7 and 8 diagrams.
Section 3.9	Update of internal premises wiring for MTM.
Section 4.3.3.1	New Figure 13 and 14 diagrams of FTTP NTD portrait and landscape layout examples.
Section 5.1	Updated table of 'who provides what' to include MTM.
Section 6.2	Updated internal cable feed MDUs to include MTM.
Appendix B and C	Updated to include MTM item.



2 Before you start

2.1 Read this first

It is important to comply with the guidelines described in this document.

Failure to do so may result in delays in connecting the premises to the **nbn** or result in **nbn**'s inability to make a network connection to the new premises.

Developers, building owners and builders may face delays and additional costs (borne by the owner of the premises) until building preparations are brought into compliance with these guidelines.

2.2 Safety

nbn takes safety and risk management very seriously. **nbn** is subject to the Work Health and Safety Act 2011 (Commonwealth).

However, **nbn** recognises that the developers it engages may be subject to different health and safety legislation across Australia. This includes relevant regulations, standards and codes of practice.

Before you start, you must familiarise yourself with the safety principles in Table 1.

Table 3. Safety principles

Safety principles	
✓	nbn expects that developer organisations will implement, understand and comply with their own HS&E policies and procedures.
✓	Consistent with Commonwealth and state Occupational Health & Safety (OH&S) legislation, nbn expects that developers will consider the risks associated with property development that may impact on later stages of the asset lifecycle. This expectation includes the following: <ul style="list-style-type: none">• inspection/assurance• use• operation• maintenance
✓	Specific aspects that developers must consider include (but are not limited to) the following: <ul style="list-style-type: none">• risks associated with the location of SDU or MDU fibre, copper or HFC cabling and equipment• risks associated with the method of construction and installation
✓	Sufficient ventilation must be provided wherever nbn [™] equipment is intended to be enclosed.



Safety principles

Refer to Appendix C Ventilation of NTD enclosure and PSUs for more information.

2.3 Australian Communications and Media Authority (ACMA) wiring rules

All cabling work performed on the customer side of the Network Boundary Point (NBP) is subject to ACMA wiring requirements.

- Cabling work includes the connection, installation or maintenance (repair) of customer cabling.
- The ACMA rules also require the installer to be registered to install customer service cabling.



The ACMA wiring rules do not apply to cabling up to and including the NBP.

2.4 NBP

The fibre NBP is defined as the service output ports on the **nbn**[™] NTD; specifically the data (UNI-D) and phone (UNI-V) service sockets on the device.

The FTTN and FTTB copper NBP is defined as the external NTD or the internal MDF where the customer interconnects.

The HFC NBP is defined as the service output port on the **nbn**[™] modem.

As per *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)*, the NTD is labelled as an NTD.

2.5 Installation lifecycle

Table 4 describes the stages involved in the installation of telecommunications equipment in a new development. This document details the stages highlighted in grey.

Table 4. Installation life-cycle

Stage	Activity	Responsible party
before building commences	install estate pit and conduit	estate developer
	install estate fibre	FTTx nbn DP
	connect estate fibre to the nbn	FTTx nbn DP
	install estate copper	FTTx nbn DP
	connect estate copper to the nbn	FTTx nbn DP
	install estate HFC	FTTx nbn DP



Stage	Activity	Responsible party
	connect estate HFC to the nbn	FTTx nbn DP
	install the developer's starter pipe	estate developer
before building	confirm building design, accommodating fibre equipment and wiring	builder
	confirm building design, accommodating copper equipment and customer cabling	builder
	confirm building design, accommodating HFC equipment and customer cabling	builder
during base/slab stage	install LIC from starter pipe and install draw-string	builder
during framing stage	prepare a GPO outlet to the identified fibre NTD location	builder
	prepare a GPO outlet to the identified FTTN customer equipment location	builder
	prepare a GPO outlet to the identified HFC wall plate and modem location	builder
	install internal conduit and install draw-string	builder
	install pre-wired customer wiring	builder/owner
after lock-up stage	submit pre-install request	builder
after lock-up stage	install fibre NTD/NTD enclosure	nbn
	(when mains power to the premises has been connected and turned on) install PS/S into NTD enclosure (or install PS/OBB unit if EUP has lodged for one)	nbn
	install fibre PCD	nbn
	install service drop cable fibre to PCD	nbn
	connect fibre from the PCD to the internal NTD	nbn
	connect the power supply to the internal NTD	nbn
	connect customer wiring to the NTD	registered cabler



Stage	Activity	Responsible party
	FTTN install service drop copper cable to the NTD	nbn
	FTTN connect service drop copper cable to the customer cabling (where provided)	nbn/registered cabler
	install service drop HFC RG cable and isolator into the PCD	nbn
	connect service drop HFC RG cable from the PCD to the internal wall plate and equipment location	nbn
	copper to the MDF and FTTB: terminate jumpers on the 'A' (carrier) side of the MDF where the tagged jumpers have been provided by the developer or builder	nbn
after order from RSP received	activate communication services	owner/service provider
as required during or after building construction	install additional customer wiring (optional)	owner
	connect additional customer wiring (optional)	owner




3 Preparing for FTTx installation

3.1 Fibre installation components

Table 5 summarises the components of a fibre installation.

Table 5. Fibre installation components description

Component FTTP	Description
nbn™ service drop conduit	Located at the property boundary, running back to the service drop access pit. Marks the start of the builder's scope of work.
developer/builder LIC	Provides a pathway for fibre cabling to the building. Connects to the nbn™ service drop conduit.
PCD	A connection box for the fibre, located on the outside of the building.
internal conduit	Provides a pathway for fibre cabling to go to a point inside the building, where the nbn™ equipment will be located.
GPO	Electrical power point required to power the nbn™ equipment.
nbn™ equipment	<ul style="list-style-type: none"> • NTD • NTD enclosure • default standard power supply (PS/S) or optional BBPSU (PS/OBB) <p> The PS/OBB includes a battery backup unit and is sometimes referred to as a BBPSU.</p>
nbn™ equipment location	Space provided within and upon a premise for the installation of nbn™ equipment.
customer cabling	End user-owned communications cabling (if used).

3.2 FTTN copper installation components

Table 6 summarises the components of a copper cable (FTTN) installation.

Table 6. Copper cable (FTTN) components description

Component for FTTN	Description
service drop conduit	Located at the property boundary, running back to the nbn™ network pit. Marks the start of the builder's scope of work.
developer/builder LIC	Provides a pathway for the nbn™ cabling to the building. Connects to the service drop conduit located at the property boundary.



Component for FTTN	Description
nbn™ NTD, utility box	A connection box for the nbn™ lead-in copper cable, located on the outside of the building.
internal conduit	Provides a pathway for the customer cabling from the nbn™ NTD to a point inside the building where the customer's equipment will be located.
GPO	Electrical power point required to power the customer's equipment.
nbn™ equipment	NTD.
nbn™ equipment location	Space provided upon a premise for the installation of nbn™ equipment.
customer cabling	End user-owned communications cabling (if used).

3.3 HFC installation components

Table 7 summarises the components of a HFC cable installation.

Table 7. HFC components description

Component for HFC	Description
service drop conduit	Located at the property boundary, running back to the service drop access pit. Marks the start of the builder's scope of work.
developer/builder LIC	Provides a pathway for the HFC cabling to the building. Connects to the nbn™ service drop conduit located at the property boundary.
nbn™ PCD	A connection box for the HFC RG cabling to a point inside the building where the nbn™ equipment will be located.
internal conduit	Provides a pathway for the HFC RG cabling to a point inside the building where the customer's equipment will be located.
GPO	Electrical power point required to power the nbn™ and customer's equipment.
nbn™ equipment	<ul style="list-style-type: none"> • PCD • single HFC RG wall plate • HFC RG cable to the wall plate • HFC modem and RG fly lead (provided to the end user upon application of a service order)
nbn™ equipment location	Space provided within and upon a premise for the installation of nbn™ equipment.
customer cabling	End user-owned communications cabling (if used).

3.4 FTTB/copper to the MDF installation components

Table 8 summarises the components of a FTTB/copper to the MDF installation.

Table 8. FTTB/copper to the MDF components description

Component for FTTN	Description
service drop conduit	Located at the property boundary, running back to the service drop access pit. Marks the start of the builder's scope of work.
developer/builder LIC	Provides a pathway for the copper cable to the building communications room or cupboard. Connects to the nbn™ service drop conduit located at the property boundary.
internal pathways	Provides all accessible pathways for the copper backbone cabling to each premises (i.e. unit, apartment and/or tenancy).
GPO	Electrical power point required to power the customer equipment.
10A power outlet	Developer provided a 10A electrical outlet required to power the nbn™ FTTB Digital Subscriber Line Access Multiplexer (DSLAM).
nbn™ equipment	DSLAM
nbn™ equipment location	Space provided within an MDU (i.e. communications room or cupboard).
MDF	Developer provided MDF for the interconnection of the nbn™ copper cable to the backbone customer cable.
backbone copper cable	Developer provided copper cable from the MDF to each premises, unit, apartment and/or tenancy.
customer cabling	End user-owned communications cabling (if used).

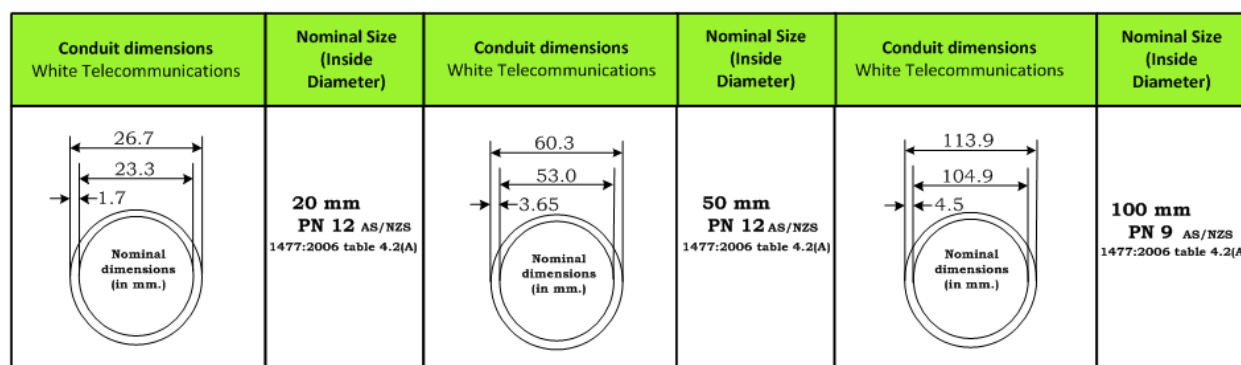


Figure 1. Conduit dimensions



3.5 Preparing new buildings: overview

3.5.1 Building activities

The builder must perform the following tasks to prepare a SDU building for the **nbn**TM fibre, copper or HFC network:

- extend the **nbn**TM service drop conduit with a LIC from the property boundary to the external PCD location, complete with internal draw-string
- provide sufficient space for the future fitting of the PCD or NTD with sufficient clearance from other utilities, such as electrical meter panels and gas meter assemblies (refer to Tables 11, 12 and 13)
- supply the pathway (a nominal P20 white communications conduit with draw-string) from the external PCD or NTD location to the **nbn**TM equipment location
- for fibre, co-locate the internal fibre exit location with the internal NTD enclosure (and PS/OBB if required) as part of the home equipment installation
- provide adequate space for the future fitting of **nbn**TM equipment inside the premises, and if home wiring is installed, collocate with any customer cabling
- provide for mains power requirements at the proposed **nbn**TM equipment location to support both the customer and **nbn**TM equipment

Important: Plan the positioning of the equipment and associated pathways as part of the overall building design.



When determining the location of the internal conduit and consequent location of the **nbn**TM equipment, builders should consider the intended use of the premises in terms of accessibility, safety and aesthetics. For example: make sure that equipment is easily accessible to people with restricted mobility, but out of normal reach of children and pets.

3.5.2 nbnTM activities

To connect the building to the FTTN, FTTB or HFC network, **nbn** will provide/install the following:

- SDU: the service drop cable to the PCD or NTD location via the LIC prepared by the builder
- SDU: the PCD or NTD onto the external wall in the space provided by the builder, clear of other utilities
- SDU (internally):
 - fibre cable from PCD to the NTD enclosure
 - HFC RG cable from the PCD to the **nbn**TM wall plate
 - for copper (FTTN), **nbn** provides the service drop cable only to the NTD located on the outside wall
- in a fibre area, an NTD and NTD enclosure is installed by **nbn** in the space and environment provided within the premises by the builder
- a power supply (refer to Section 3.9 Internal premises wiring for details on the choices available to developers):

- if the owner chooses the standard power supply PS/S, an NTD with PS/S supply along with NTD enclosure will be provided in the space and environment provided within the premises by the builder
- if owner chooses the power supply with optional battery backup, an NTD along with NTD enclosure supplied by an optional battery backup unit (PS/OBB) will be provided in the space and environment within the premises by the builder
- MDU FTTB: the fibre lead-in cable and DSLAM are installed in the communications room or cupboard within the space and environment provided by the developer or builder:
 - the copper cable from the DSLAM is terminated onto the 'A' (carrier) side of the MDF termination blocks
 - MDU copper to the MDF: the copper lead-in cable is installed to the communications room or cupboard, terminating onto the 'A' (carrier) side of the MDF termination blocks



For FTTP, the standard power supply (PS/S) will not be required if using a battery backup supply unit.

3.6 LIC installation

The LIC shall be installed from (and connected to) the **nbn**TM service drop conduit at the property boundary (if available) and run to the nominated location where the PCD or NTD will be located externally on the premises.

Ideally, the developer will have provided a marking tag in the street network pit servicing the lot, to help locate the developer's starter pipe.

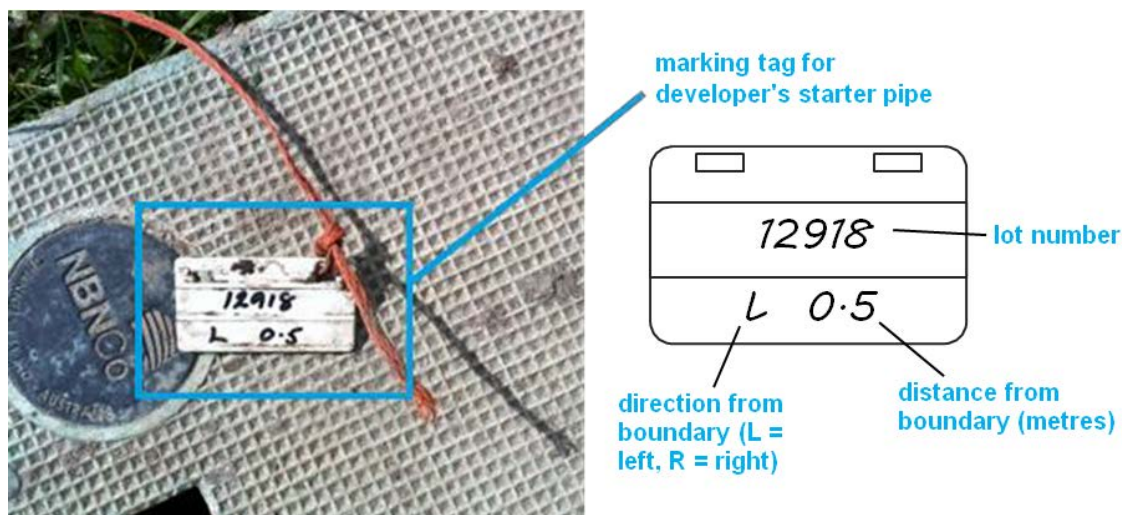


Figure 2. Marking tag example



For duplex or triplex developments, the LIC must have clear access from the property boundary directly to the PCD or NTD location for each dwelling. A LIC cannot traverse a neighbour's property.



The LIC must conform to the requirements in Table 9.

Table 9. LIC requirements

Type	<ul style="list-style-type: none"> SDU: nominal P20 (23 mm ID; 26.6 mm to 26.8 mm OD) white PVC-U telecommunications conduit, compliant with <i>AS/NZS 1477:2006 PVC pipes and fittings for pressure applications</i> MDU: nominal P50 (53 mm ID; 60.3 mm OD) white PVC-U telecommunications conduit, compliant with <i>AS/NZS 1477:2006 PVC pipes and fittings for pressure applications</i>
Installation	<ul style="list-style-type: none"> minimum depth of cover below finished ground level: 300 mm maximum depth of cover below finished ground level: 500 mm covering: all excavation work performed as part of installing the LIC shall be back-filled with suitable fill, compacted and reinstated to match the surrounding area increase minimum depth of cover to 450 mm for any service drop conduits planned to pass under a driveway
Bend angles	<ul style="list-style-type: none"> minimum radius: 300 mm underground and 100 mm above ground maximum individual bend angle: 90 degrees maximum total (cumulative) bend angles: 270 degrees (this is taken from the pit to the LIC end at the PCD/NTD location)
Draw-string	installed in the P20 LIC from the street network pit and exiting at the premises end
Draw rope	installed in the P50 or P100 LIC for MDU's from the street network pit to the communications room or cupboard
Seals	temporarily seal at premises end during construction activity to avoid debris entering and blocking the conduit
Connection	connected to the developer's service drop conduit from the pit on the footway, as shown in the LIC installation (in the footings option)

Important: Care should be taken to plan the best time to install the conduit, especially if using a shared trench with other utilities to service premises.



The risk of damage to the conduit by later installation of other services should be reasonably avoided. LIC is required for each dwelling in a duplex or triplex construction, between street property boundary and PCD location on each dwelling.





3.7 Internal conduit installation

3.7.1 Internal conduit requirements

Table 10 describes the internal conduit requirements.

Table 10. Internal conduit requirements

Type	nominal P20 (23mm ID; 26.6 to 26.8mm) OD white PVC-U telecommunications conduit, compliant with <i>AS/NZS 1477:2006 PVC pipes and fittings for pressure applications</i>
Installation	<ul style="list-style-type: none"> • FTTP PCD: 100 mm - 140 mm separation between the LIC and the internal conduit, aligned on the horizontal plane on the external wall • FTTN NTD: 27 mm separation measured from the centre of the LIC to the centre of the internal conduit, aligned on the horizontal plane on the external wall • HFC PCD: 40 mm separation between the LIC and the internal conduit, aligned on the horizontal plane on the external wall <p> Important: In all situations for FTTP, FTTN and HFC, the following shall apply:</p> <ul style="list-style-type: none"> • the location shall be planned to be outside exclusion zones for hazardous services, such as gas regulator and meter assemblies (refer to Section 3.8.1 FTTP PCD installation requirements) • an internal conduit from the PCD location to the customer equipment must remain part of the dwelling (internal conduits must never traverse a neighbour's property)
Bend angles	<ul style="list-style-type: none"> • minimum radius: 100 mm • maximum individual bend angle: 90 degrees • maximum total (cumulative) bend angles: 270 degrees between accessible draw points <p> Important: Contact nbn for advice on special building types if the number of required bends exceeds these guidelines.</p>
Draw-string	<p>installed along the length of the conduit:</p> <ul style="list-style-type: none"> • in cavity walls: at the end of the conduit, draw-string must be presented and tagged as 'NBN' for easy identification and location • for masonry walls: conduit may be chased into the masonry and the end presented to line up with the NTD enclosure access penetrations as per the

	spatial template <ul style="list-style-type: none"> • for surface conduit: present as a neat conduit end to line up with the edge of the mounting spatial template provided by the builder
Joins and bends	all glued with conduit solvent cement and primer

3.7.2 Conduits and structural integrity

Where the internal conduit passes through timber framing, care must be taken to maintain the integrity of the building structure.

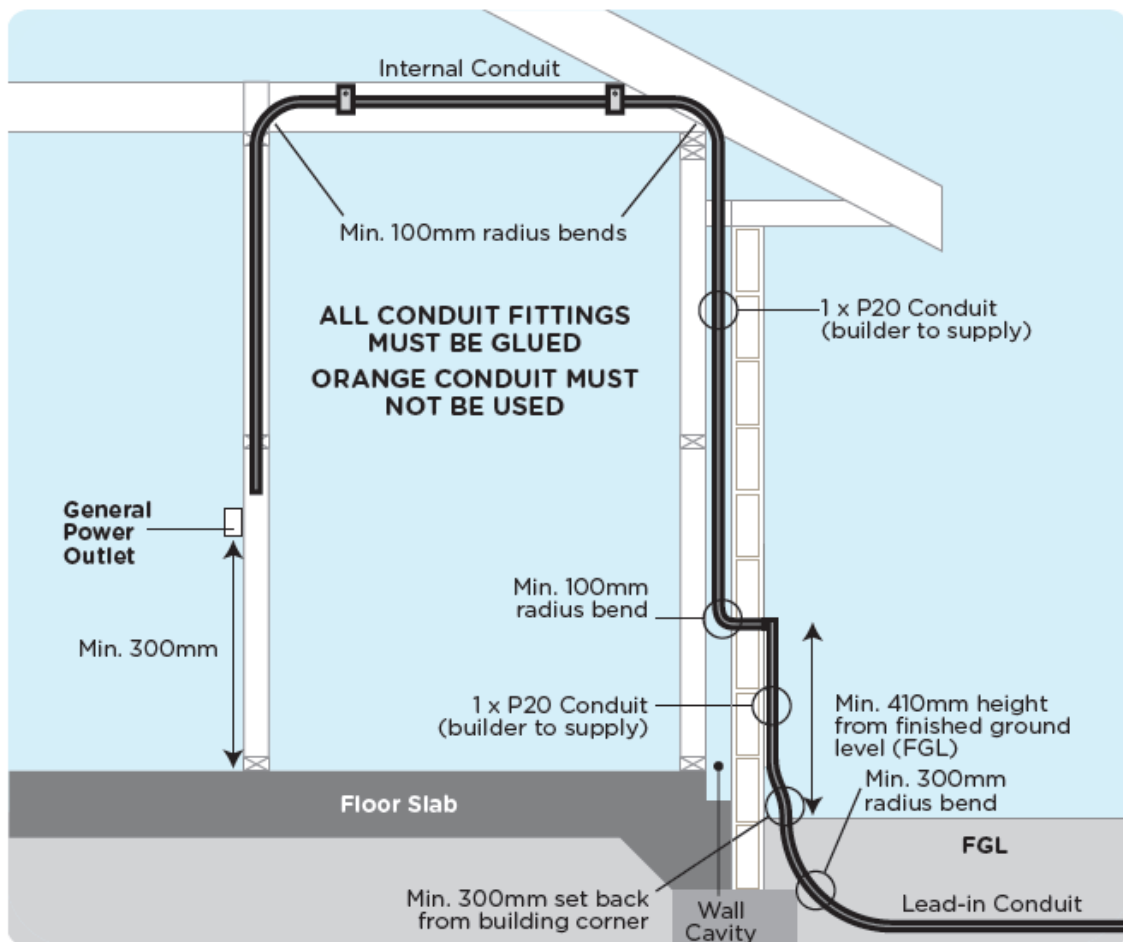


Figure 3. Conduit passing through timber framing

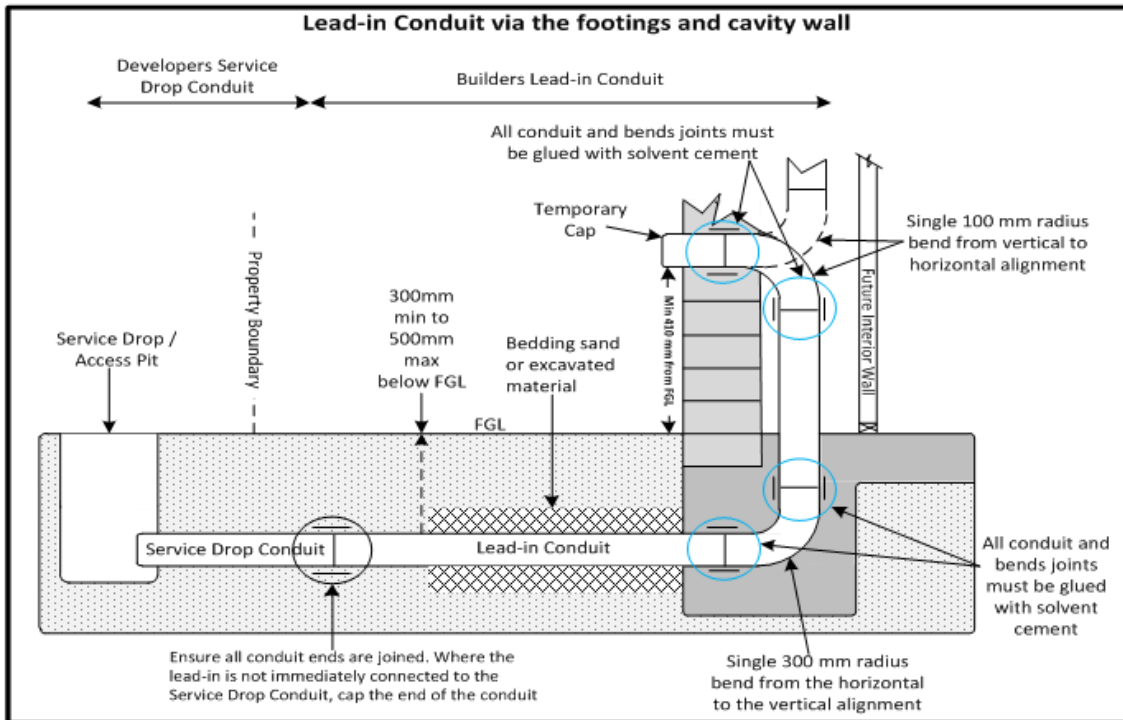


Figure 4. LIC passing through footing and internal cavity wall

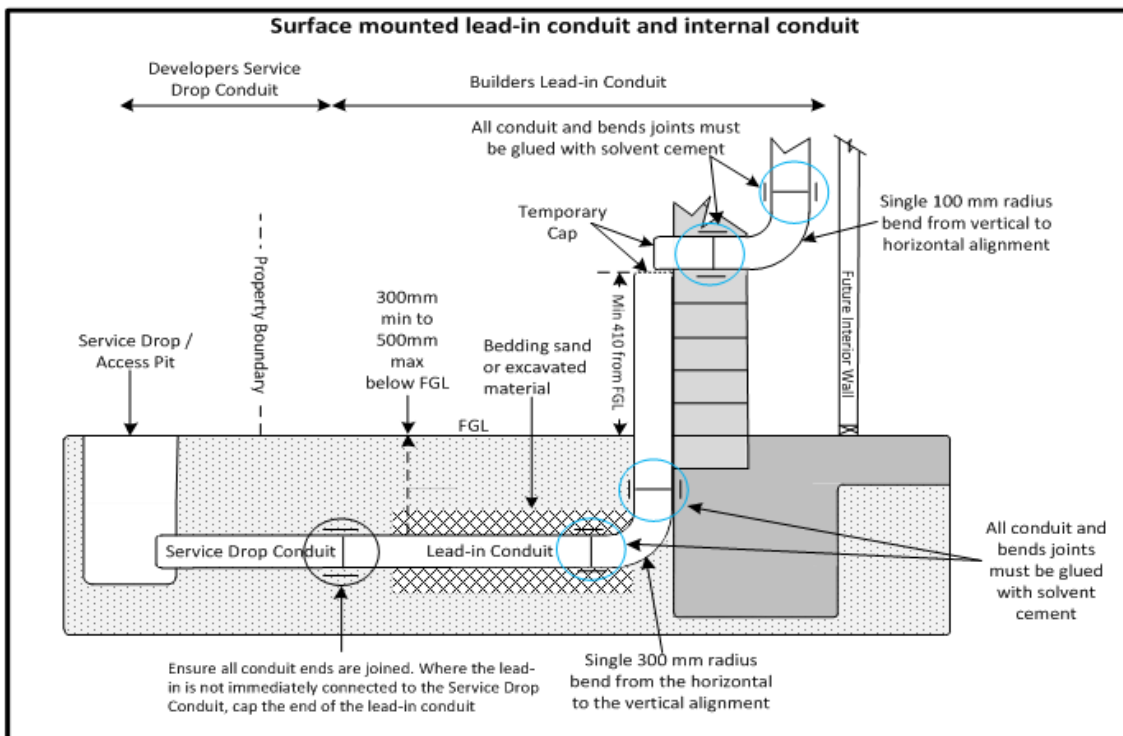


Figure 5. LIC surface mounted and internal conduit



3.8 Providing external wall space and preparation for the PCD or NTD


nbn requires a location with sufficient space and clearance on the outside of the premises to allow the future installation of a PCD or NTD.

When the fibre is later installed, the LIC may be open and the end of the internal conduit sealed.

3.8.1 FTTP PCD installation requirements

Table 11 describes the minimum clearances required for PCD installation.

Table 11. PCD installation requirements

External space requirement	<ul style="list-style-type: none"> • width: 300 mm • height: 300 mm • depth: 100 mm • additional 250 mm to left of PCD (to allow for open door)
Installation height	<p>measured from finished ground level to bottom of PCD:</p> <ul style="list-style-type: none"> • minimum: 410 mm and maximum: 1500 mm <p> Only exceed the minimum installation height when allowing for a service that requires more space at ground level (e.g. gas meter and regulator assemblies). Refer to Section 3.8.2 Variations on requirements for more information.</p>
Minimum clearances (measured from outer edges of PCD)	<ul style="list-style-type: none"> • 250 mm from fixed services, including pipes, taps and meters • 150 mm clearance from gas enclosure or combined utility enclosure • outside exclusion zones around gas regulator/boxes and enclosures, and gas discharge zones • 1500 mm from gas cylinders • 150 mm from the corner of the wall • 150 mm from an exterior structure, such as a window or balcony
Distance between cable entry ports (conduits)	<p>minimum: 100 mm and maximum: 140 mm</p>

Conduits align with the PCD from below

This provides a degree of protection from moisture entering the PCD when fitted. When planning the location for the PCD, the LIC and internal conduit ends must be located below where the PCD will be fitted.

FTTP:

- The LIC aligns with the PCD's left hand side cable entry.
- The internal conduit aligns with the PCD's right hand side cable entry.

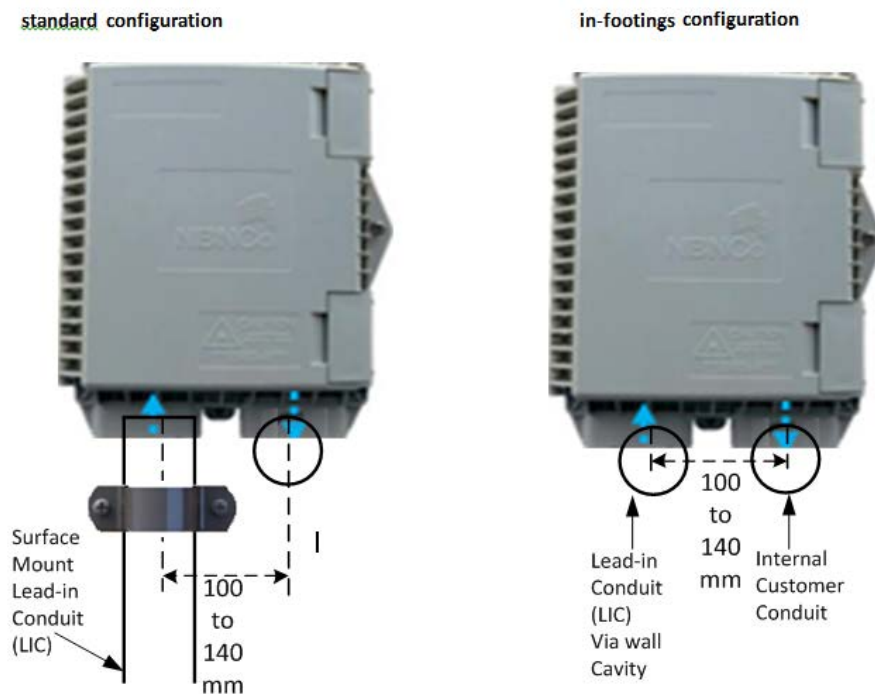


Figure 6. FTTP conduit alignment with PCD

3.8.2 FTTN NTD installation requirements

- The LIC aligns with the NTD's left hand side cable entry.
- The internal conduit aligns with the NTD's right hand side cable entry.

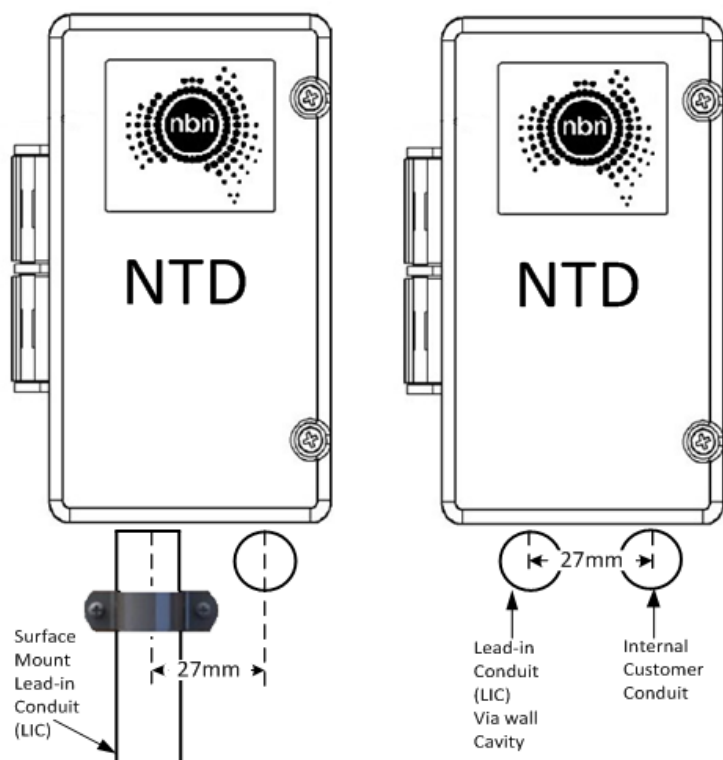


Figure 7. FTTN conduit alignment with NTD

Table 12. NTD installation requirements

External space requirement	<ul style="list-style-type: none"> width: 91 mm height: 134 mm depth: 25 mm additional 250 mm to left of NTD (to allow for open door)
Installation height	<p>measured from finished ground level to bottom of NTD:</p> <ul style="list-style-type: none"> minimum: 410 mm and maximum: 1500 mm <p>i</p> <p>Only exceed the minimum installation height when allowing for a service that requires more space at ground level (e.g. gas meter and regulator assemblies). Refer to Section 3.8.2 Variations on requirements for more information.</p>
Minimum clearances (measured from outer edges of NTD)	<ul style="list-style-type: none"> 250 mm from fixed services, including pipes, taps and meters 150mm clearance from gas enclosure or combined utility enclosure outside exclusion zones around gas regulator/boxes and enclosures, and gas discharge zones 1500 mm from gas cylinders 150 mm from the corner of the wall

	<ul style="list-style-type: none"> • 150 mm from an exterior structure, such as a window or balcony
Distance between cable entry ports (conduits)	minimum: 0 mm and maximum: 27 mm

3.8.3 HFC PCD installation requirements

- The LIC aligns with the PCD's left hand side cable entry.
- The internal conduit aligns with the PCD's right hand side cable entry.

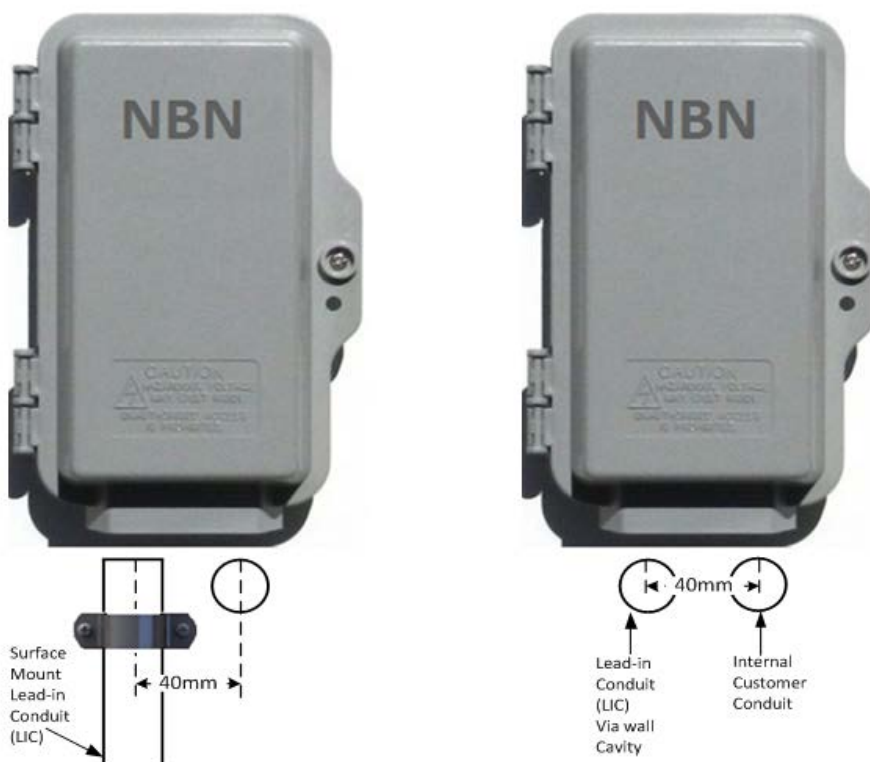


Figure 8. HFC conduit alignment with PCD

Table 13. HFC PCD installation requirements

External space requirement	<ul style="list-style-type: none"> • width: 136 mm • height: 215 mm • depth: 60 mm • additional 250 mm to left of NTD (to allow for open door)
Installation height	<p>measured from finished ground level to bottom of NTD:</p> <ul style="list-style-type: none"> • minimum: 410 mm and maximum: 1500 mm <p>i</p> <p>Only exceed the minimum installation height when allowing for a service that requires more space at ground level (e.g. gas meter and regulator assemblies).</p>



	Refer to Section 3.8.2 Variations on requirements for more information.
Minimum clearances (measured from outer edges of NTD)	<ul style="list-style-type: none"> • 250 mm from fixed services, including pipes, taps and meters • 150 mm clearance from gas enclosure or combined utility enclosure • outside exclusion zones around gas regulator/boxes and enclosures, and gas discharge zones • 1500 mm from gas cylinders • 150 mm from the corner of the wall • 150 mm from an exterior structure, such as a window or balcony
Distance between cable entry ports (conduits)	minimum: 0 mm and maximum: 40 mm



Important: nbn has the right to request re-work from the builder if these standards have not been met and the equipment cannot be installed to comply with these specifications.

3.8.4 Variations on requirements

Depending on the building type and location of other structures like fencing, the amount of wall space that utilities have to share can be very limited.

It is important to take into account the clearances required by each utility to avoid disputes that may arise over many services competing for limited space.

When planning for the placement of conduits, consider the relationship between the LIC and the internal conduit. The position of the internal conduit will be difficult to change later in the building cycle (e.g. after the completion of masonry works).

When planning for the alignment of the relationship between the PCD or NTD and the conduits, the placement of the internal conduit may actually determine the positioning of the LIC.

In many instances, locating the LIC directly under an electrical meter/switchboard may not be practical. It may be better to locate the LIC to either the left or right of the meter/switchboard.

3.8.4.1 Limited space

Where space is very limited, consider allowing for higher PCD or NTD placement (up to 1500 mm) during building design.

If the allowed space for all utilities is very narrow, prepare a plan so that clearance can be met.

3.8.4.2 Conduits and other utilities

Builders may need to position the internal conduit so that it can pass adjacent to another device (such as an electrical meter/switchboard) when making its way inside. Consider the location of other facilities (e.g. in-wall cisterns), to ensure adequate space for conduit pathways.



In some regions there may also be gas or combined utility enclosures. Experience has shown that other utilities (e.g. gas) are located closer to ground level, but typically require a lot of clearance.



Important: The required clearance for services can vary by region. Check with local utilities for specific requirements.

3.9 Internal premises wiring

Electrical Hazard

The NTD and NTD enclosure, along with its default PSU (PS/S or PS/OBB), must be installed in the same building as the main electrical meter box or distribution board. The **nbn**TM equipment is only certified for connection to customer cabling (structured wiring), which is entirely enclosed within the same building.



If any aerial or underground customer cabling is connected from the UNI-D or UNI-V ports of the NTD to a separate freestanding building, there is a risk to the user that a potential lightning hazard may be transferred from the UNI-D or UNI-V ports via the external cable to any connected equipment.

For specific safety guidelines about customer cabling beyond the network boundary, refer to the ACMA and mandatory wiring rules.

Table 14. Provision of internal premises wiring

The builder provides...	nbn provides/installs...
<ul style="list-style-type: none"> GPO optional patch panel space for a routing gateway or consumer electronic device any structured wiring if used; there are many variations depending on consumer choice and need (including wireless devices) for FTTN, a minimum CAT 5 copper cable from the NTD Building Entry Port (BEP) location to the first Telecommunications Outlet) TO 	<ul style="list-style-type: none"> FTTP: <ul style="list-style-type: none"> PS/S (default) PS/B (optional) NTD (in NTD enclosure) fibre FTTN: <ul style="list-style-type: none"> external NTD lead-in copper cable to the NTD HFC: <ul style="list-style-type: none"> first RG wall plate only RG cable to the first wall plate nbnTM modem (supplied upon receipt of a customer service order) FTTB and copper to the MDF: <ul style="list-style-type: none"> cable and equipment connecting to the 'A' side of the builder provided copper MDF

For detailed information on 'who provides what' refer to Table 23.

Figure 9 and Figure 10 illustrate the relationships between the elements.

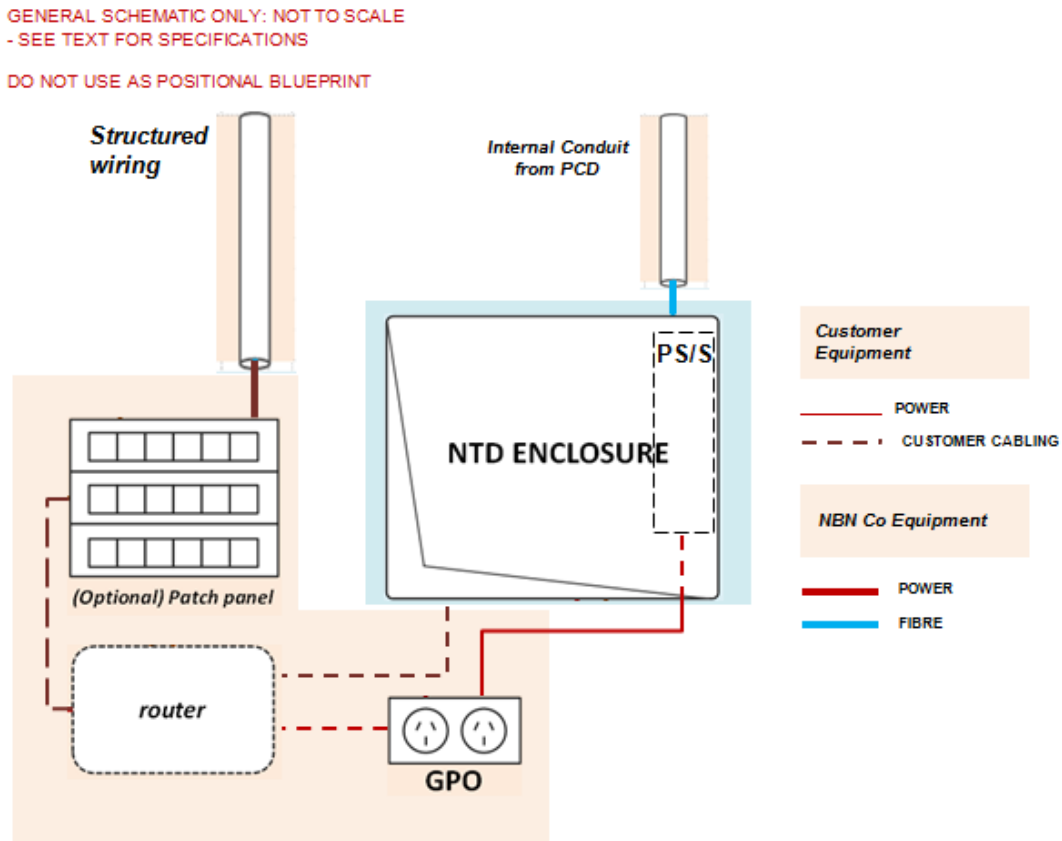


Figure 9. FTTP NTD enclosure with PS/S example

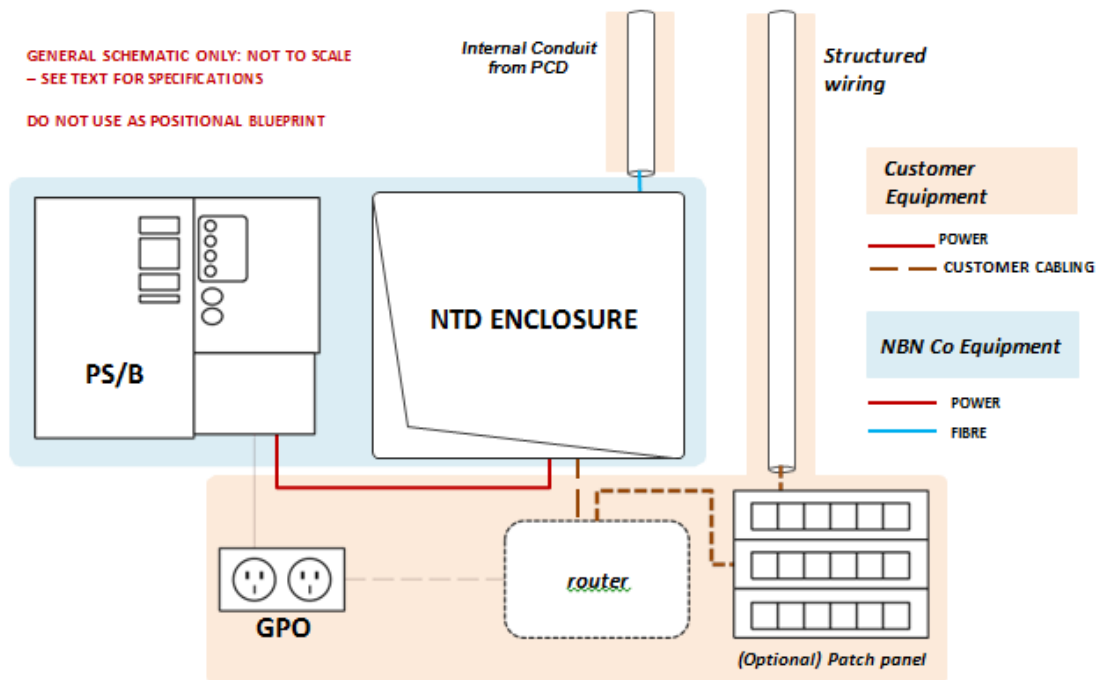


Figure 10. FTTP NTD enclosure with PS/OBB example



Some RSP equipment can offer more innovative ways for planning the distribution and connectivity in the premises.

As a builder, when you request a pre-installation date for **nbn™** equipment, you can nominate the pre-installation of a standard power supply or a power supply with battery backup. In most cases, a standard power supply is recommended for pre- installations unless you are aware the first occupant will require battery backup capability. If you select the standard power supply, future occupants can still have the power supply with battery backup fitted later (this can be arranged by their service provider at no cost and their service activation can still proceed). However, if a power supply with battery backup is fitted first, and the original occupant does not require the battery backup service, the equipment cannot be uninstalled and the occupant will have unnecessary equipment and a battery to remove and dispose of.



This initiative is part of a new government policy whereby occupants at service activation shall be provided with information by their service provider before they elect to take up a service with or without battery backup capability. Service providers shall be required to record and retain the decision of the occupant. As a result, **nbn** recommends in the first instance for pre-installations that a standard power supply be installed and battery backup only be considered where it is known the occupant will require the capability.

3.9.1 FTTP PSU (PS/S [default] or PS/OBB): AC power requirements

To allow the connection of the default power supply to the building's mains power, the builder must do the following:

- Install a single (minimum) mains power GPO.

This must be a dedicated socket for the exclusive use of **nbn™** PSUs. The power supply plug must connect directly to the socket. Devices such as a power board or double adaptor must not be used. If use of an Uninterruptible Power Supply (UPS) is proposed, please contact **nbn** for advice (refer to Section 1.8 Contact information).

Ensure the GPO is positioned a maximum of 200 mm away from an **nbn™** equipment template layout (refer to Section 4.3.1 FTTP mounting surface template for layout details).



Recommended: A double GPO is recommended, so that one (1) socket is available for customer devices (e.g. an internet router). Locating the new GPO as close as possible to the equipment location minimises safety issues with excess cord and improves the appearance of the installation.

- Ensure all mains power electrical cables associated with the **nbn™** equipment installation meet the requirements of *AS/NZS 3000:2007 Wiring Rules* (refer to Appendix A Australian and international standards).
- Maintain all cable separations according to *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)* (or the latest issue at the time of installation), as summarised in Table 15.



Table 15. Internal service clearances

Service	Minimum power cable separation distance
power	100 mm
gas, water or sewer	150 mm



4 nbn™ equipment inside the premises

During the design phase, building plans will require a location set aside to allow the future installation of nbn™ network equipment.

This section provides guidance for the three (3) types of acceptable locations for the installation of nbn™ equipment.

This location will be the point to which the internal conduit from the PCD/NTD will transit and the point at which any customer cabling will connect/interface.

4.1 Basic equipment requirements

Network equipment installed by nbn requires the following:

- a mains power outlet
- a location that:
 - protects the integrity of the equipment for long-term use
 - allows for a straightforward upgrade of the components over the life of the building
- enough space within the location to install the equipment so it can be readily:
 - accessed by the occupants of the premises
 - serviced by technicians



Important: When determining the location of the nbn™ equipment, builders should consider the intended use of the premises in terms of accessibility, safety and aesthetics. For example: make sure that equipment is easily accessible to people with restricted mobility, but out of normal reach of children and pets.

4.2 nbn™ equipment: installation requirements

The following table lists nbn’s requirements for the installation of its network equipment. Builders and contractors should refer to this information when determining an appropriate location for the internal conduit.

Table 16. NTD installation requirements

Category	Requirements
installation height and space provided	<p>Between 300 mm and 1700 mm from the finished floor level to the top of the space allocated for nbn™ equipment.</p> <p>This allows for either minimum portrait or landscape clear mounting surface dimensions (also called the mounting surface template, refer to Section 4.3.1 FTTP mounting surface template for further information).</p> <div data-bbox="608 813 1334 1245" data-label="Diagram"> </div> <p style="text-align: center;">Figure 11. NTD height clearance</p>
adjacent equipment	<p>Includes the PS/OBB. Minimise the distance as much as possible.</p> <ul style="list-style-type: none"> PS/OBB is less than 200 mm radial distance from a dedicated mains power GPO.



Category	Requirements
prohibited locations	<p>Equipment must not be installed in any of the following locations:</p> <ul style="list-style-type: none"> • Damp, humid, moist or wet areas (e.g. kitchen, bathroom, toilet, laundry, under an open window). • Where the ambient temperature routinely drops below 10°C (e.g. an uninsulated garage). • Where the ambient temperature routinely exceeds 40°C (e.g. a ceiling, wall or floor cavity; masonry wall facing north or west; near a water or space heater, or heater vent; exposed to direct sunlight). • A confined area with restricted air circulation (e.g. closed cupboard, wall cavity or area restricted by curtains, clothes or furniture). • Subject to high dust (e.g. work area or under an open window). • Subject to potential damage (e.g. workshop or work area). • Outside the normal living area or outdoors. • A separate freestanding building (e.g. garage, shed or office). • Below the Flood Hazard Level (FHL) in premises in designated flood hazard areas.
recommended locations	<p>The primary connection point, as determined by the home owner:</p> <ul style="list-style-type: none"> • study • walk-in robe; acceptable open enclosure; home distributor • lounge; living room • rumpus room • enclosed garage or a garage under the main roof (not a separate building), where consideration has been given to ensuring in-building coverage requirements are met • out of normal reach of children or pets and protected from accidental knocks, damage, disconnection, unplugging or being switched off
FTTP indicator lights	<ul style="list-style-type: none"> • lights must be easily accessible • lights must be easily viewable by removing a cover or opening a door
FTTP audible alarms	<p>must be readily audible when triggered, even if within an enclosure or home distributor</p>
ventilation	<p>location must be adequately ventilated (refer to Appendix C for further information)</p>

4.3 Providing space in the premises for nbn™ equipment

4.3.1 FTTP mounting surface template

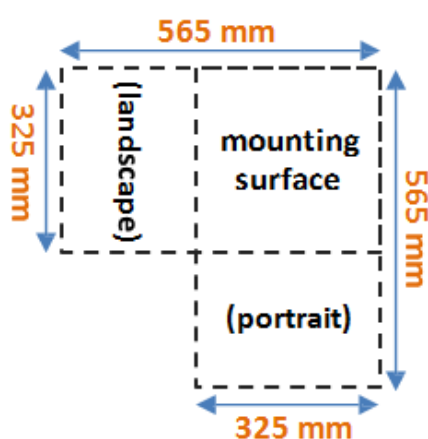
nbn requires builders to reserve space in each premise for the installation of nbn™ equipment.



Important: The mounting surface template area is for nbn™ equipment only. It allows room for the equipment, the associated power and data cables, and adequate ventilation.

The minimum area required is called the mounting surface template. This area has been designed as a reservation area that may allow for future generations of nbn™ equipment during the life of the building.

The mounting surface template must have the minimum width and height specified in Figure 12, depending on orientation.



orientation	min width	min height
portrait	325 mm	565 mm
landscape	565 mm	325 mm

Figure 12. NTD mounting surface template

Mounting surfaces must meet the criteria in Table 17.

Table 17. Mounting surfaces conditions

Mounting surfaces must be...	
✓	free of obstruction
✓	adequately ventilated
✓	usable for mounting the equipment

4.3.2 Organising nbn™ equipment

The nbn installer shall determine and organise the ultimate positioning and orientation of nbn™ equipment within the area defined by the mounting surface template.

4.3.3 Example FTTP equipment layouts within mounting surfaces

The following diagrams show layout examples that use the current nbn™ equipment components, within the mounting surface template.



nbn installers may choose to arrange the equipment in configurations different from those shown below.

4.3.3.1 Layout examples

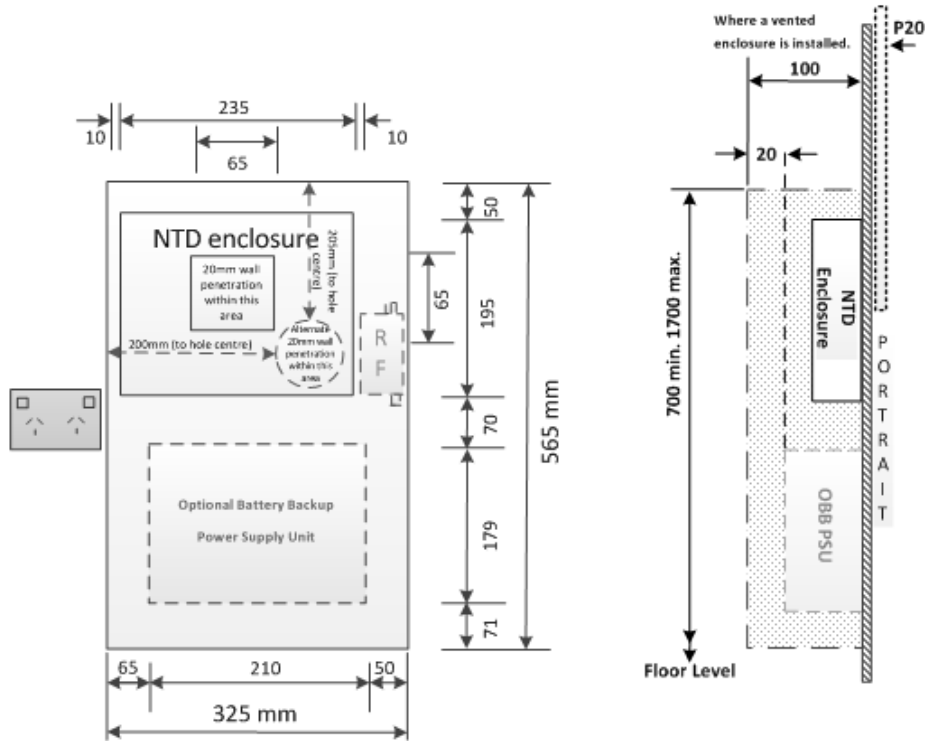


Figure 13. NTD portrait mounting surface template with GPO

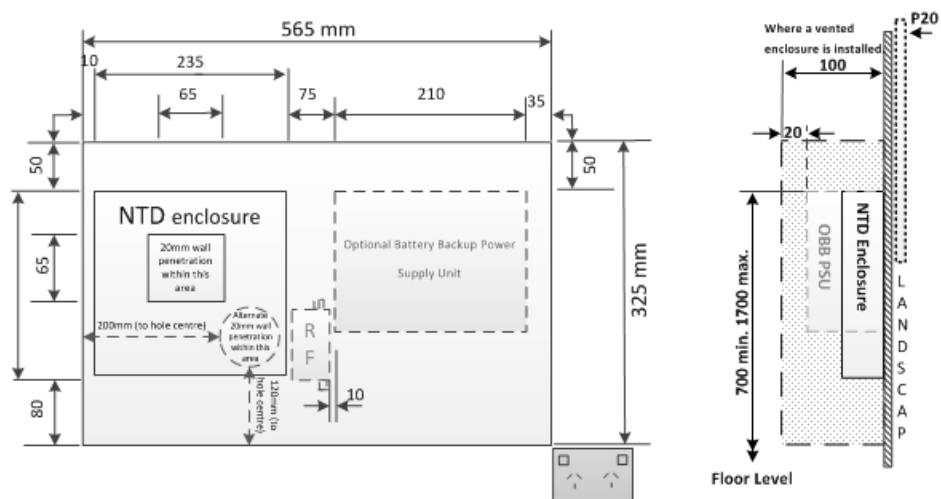


Figure 14. NTD landscape mounting surface template with GPO

i Ensure the NTD enclosure is installed to the left or right of the power outlet as shown in Figure 13 and Figure 14, and NOT above or below it.

4.3.3.2 Cable entry locations

Builders must provide an interior cable entry hole of at least 15 mm width to allow the fibre cable clear access from the conduit end to the NTD enclosure.

As a guide to locating the entry point for the cable, the following diagram illustrates the NTD enclosure's back-plate, showing the fibre cable access points.

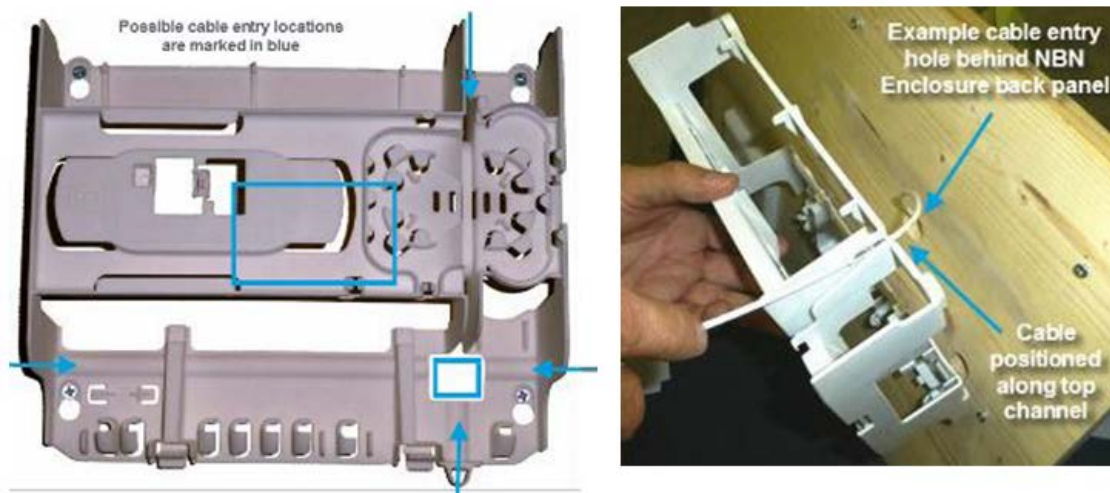


Figure 15. Cable entry location for NTD enclosure

4.3.4 Power outlet(s)

The GPO that powers the installation is not included within the dimensions of the mounting surface template, but is shown adjacent in each of the above examples (refer to Figure 13 and Figure 14).

Ensure that the GPO is positioned up to 200 mm from the **nbn**TM equipment template.

i **Recommended:** A double GPO is recommended, so that one (1) socket is available for customer devices (e.g. an internet router). Locating the new GPO as close as possible to the equipment location minimises safety issues with excess cord and improves the appearance of the installation.

4.3.5 Customer-purchased equipment

Where possible, builders should allow room to locate customer network equipment (such as a wireless router) and cabling adjacent to the proposed **nbn**TM equipment location.



4.4 Mounting locations

Both the **nbn** and the homes in which **nbn**TM equipment shall be installed, will last for many decades.

nbn anticipates that over this time, the technology within NTDs and PSUs will improve and be upgraded in accordance with both the needs of customers and technology life-cycles.

The future occupants of a premise may have different requirements to today's residents. By providing sufficient space and ventilation for equipment today, we ensure the effective operation of that equipment now, and simplify the upgrade process for the future.

4.4.1 Types of locations

Builders and building owners must make one (1) of the following types of locations available for the installation of **nbn**TM equipment.

Table 18. Types of locations to house the NTD

Location type	Description
open wall areas	An area on an open wall with either no obstructions or only partial obstructions. Open wall areas use the bulk space of the room for air circulation (e.g. walk-in robe, joinery or other designed spaces).
open enclosures	A partially-enclosed area that contains no internal obstructions. Open enclosures use the bulk space of the enclosure and the absence of obstructions for air circulation.
home distributors	A cabinet or cupboard dedicated to communications equipment. Home distributors need ventilation to be added to the design to improve the air circulation.

4.4.2 Open wall areas

An open wall area is an unenclosed, obstruction-free location with minimum dimensions equal to the mounting surface template described in Section 4.3.1 FTTP mounting surface template.

To be considered 'obstruction-free', the location must meet the conditions in Table 19.

Table 19. Open wall area conditions

Obstruction-free conditions	
✓	be clear of obstructions of any kind, both within the defined area and off the face of the area Examples: <ul style="list-style-type: none"> dividers, shelves, doors, covers or hanging rails
✓	unobstructed ventilation into the bulk of the room in which it is located
✓	unimpeded air circulation within the bulk of the room in which it is located



For further information about standard circumstances for indoor **nbn**TM equipment, refer to Appendix B.

4.4.3 Open enclosures

An open enclosure is a partially enclosed, obstruction-free location with minimum dimensions equal to the mounting surface template described in Section 4.3.1 FTTP mounting surface template.

On request, **nbn** may mount the **nbn**TM equipment into an open enclosure, as long as its design meets the requirements in Table 20.

Table 20. Open enclosure conditions

Open enclosure design requirements	
✓	clear of internal obstructions of any kind Examples: <ul style="list-style-type: none">• dividers, shelves
✓	bounded by one (1) or more solid or partially-solid obstructions above, below, to the left or to the right of the open enclosure area Examples: <ul style="list-style-type: none">• shelf, divider, wall, floor
✓	provides at least 500 mm of clear and unobstructed space from the equipment mounting face of the open enclosure to the nearest door or cover
✓	discourages end users from using the space for other purposes Examples: <ul style="list-style-type: none">• no hanging rails passing across or above the area, within 200 mm of the equipment• no useful shelves or solid surfaces (or provision for them, such as holes for adjustable shelving) below the mounting surface template area for a distance of at least 500 mm
✓	provides air circulation into a bulk space of a minimum volume of 1000 litres Examples: <ul style="list-style-type: none">• the bulk of a room• joinery cupboards without doors• wardrobes into which nbnTM equipment has been installed bare, onto a rear or side surface



If a door, cover or obstruction is present (such as a cupboard door), the enclosure is probably a home distributor (refer to Section 4.4.4 Home distributors).



4.4.3.1 Power outlet location

The GPO for use with the **nbn™** equipment installed in the open enclosure must be located in one (1) of the following situations:

- within the open enclosure itself (subject to available space, in addition to that occupied by the mounting surface template)
- accessible from within the open enclosure through a hole of at least 50 mm diameter, as close as practical to the plane of the mounting surface

For further information about standard circumstances for indoor **nbn™** equipment, refer to Appendix B.

4.4.4 Home distributors

A home distributor is an enclosed location with minimum internal dimensions equal to the mounting surface template described in Section 4.3.1 FTTP mounting surface template, which meets the requirements/definition in Table 21.

Table 21. Home distributor conditions

Home distributor design requirements	
✓	meets the minimum home distributor dimensions defined in Section 4.4.4.1 Minimum home distributor dimensions
✓	bounded by one (1) or more solid or partially-solid obstructions above, below, to the left or to the right of the open enclosure area (e.g. shelf, divider, wall, floor)
✓	is ventilated in accordance with Appendix C
✓	manages any of (and only) the following equipment: <ul style="list-style-type: none">• cabling<ul style="list-style-type: none">• in-premises telephone• data• RF• facilities associated with their cross-connection• customer networking devices<ul style="list-style-type: none">• residential gateways• routers• access points• Ethernet switches• analogue telephone adapters• Ethernet-over-powerline adapters• any other service or networking equipment that consumes power• power supply



Home distributor design requirements

- power supplies associated with the above equipment
- batteries associated with the above equipment



Important: not for general household use!

A home distributor must not be used for other purposes, such as general household storage. It should be designed and constructed so that alternative use would be impractical.

4.4.4.1 Minimum home distributor dimensions

The home distributor must meet or exceed the size requirements in Table 22.

Table 22. Home distributor parameters

Parameter	Home distributor dimensions
minimum inside volume	20 litres (20,000 cubic centimetres)
minimum surface area of mounting required for an indoor NTD composite layout	2,000 square centimetres, measured within the home distributor
minimum available depth of home distributor for mounting nbn TM equipment	10 centimetres, providing a minimum two (2) centimetre clearance between the nbn TM equipment and the home distributor's door/cover

4.4.4.2 Power outlet(s) and customer equipment

If GPOs and customer equipment are also to be located within the home distributor, ensure that its internal dimensions are sufficient to contain the unobstructed mounting surface template and the additional equipment, cabling and power outlet(s). Metallic home distributors that contain any mains power must be electrically safe.

For further information about standard circumstances for indoor **nbn**TM equipment, refer to Appendix B.

4.4.5 Enclosures within enclosures

When an enclosure (such as a home distributor) is installed within another enclosure (such as a wardrobe), apply the clearance and ventilation requirements individually to each enclosure, as though the other enclosure did not exist.

For example: if a small home distributor is installed in an area with a bulk space volume of less than 1000 litres, then the bulk space also requires the ventilation methods described in Appendix C.

For further information about standard circumstances for indoor **nbn**TM equipment, refer to Appendix B.



5 Wiring inside the premises

5.1 Who provides what?

Table 23 lists each party's equipment responsibilities.

Table 23. Provision responsibility from each sector

Technology	nbn	Builder (and building subcontractors)	Premises owner or occupier
FTTP	<ul style="list-style-type: none"> PSU NTD fibre cabling to nbnTM equipment 	<ul style="list-style-type: none"> structured wiring GPO (optional) patch panel 	<ul style="list-style-type: none"> routers unstructured wiring other equipment supplied by ISP/RSP
HFC	<ul style="list-style-type: none"> RG cable to the first wall plate first wall plate RG fly cable and modem (provided upon receipt of a customer service order) 	<ul style="list-style-type: none"> structured wiring GPO (optional) patch panel 	<ul style="list-style-type: none"> routers unstructured wiring other equipment supplied by ISP/RSP
FTTN	<ul style="list-style-type: none"> the network boundary is the external NTD 	<ul style="list-style-type: none"> a minimum CAT 5 copper cable from the NTD BEP location to the first TO structured wiring GPO (optional) patch panel 	<ul style="list-style-type: none"> routers unstructured wiring other equipment supplied by ISP/RSP
FTTB/copper to the MDF	<ul style="list-style-type: none"> the network boundary is the 'A' side of the MDF 	<ul style="list-style-type: none"> an MDF, copper termination modules and mounting frame (current industry approved type e.g. Krone) backbone customer cabling structured wiring GPO (optional) patch panel 	<ul style="list-style-type: none"> routers unstructured wiring other equipment supplied by ISP/RSP

5.2 Services available at the nbn™ NTD

The NTD is part of the nbn™ equipment installed by nbn.

The NTD provides User Network Interface (UNI) ports that enable access to voice and data services, which the premises occupant orders from ISPs or RSPs.

nbn provides wholesale broadband services to the premises. The nbn™ NTD has two (2) functions:

- allows access to data (internet) services: up to four (4) UNI-D ports are available for data services
- allows access to voice (telephone) services: two (2) UNI-V ports are available for fixed-line telephones

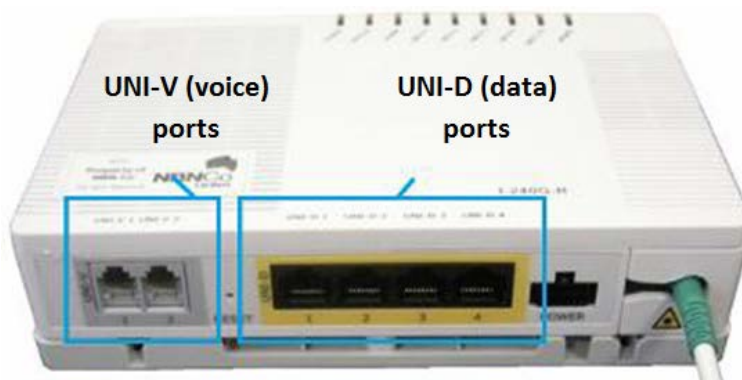


Figure 16. Diagram of NTD device

To activate any nbn™ service, the occupant must contact a RSP of their choice. The RSP will provide services (and possibly additional equipment) to allow the occupant to access the nbn.

5.3 Customer cabling

Customer cabling can be used to provide connectivity to electronic devices or other equipment that is not located in close proximity to the planned nbn™ equipment location.

Customer cabling within premises is not within the scope of the nbn.

5.3.1 Customer-side cabling work

All cabling work performed on the customer side of the NBP is subject to ACMA requirements (refer to Section 2.3 Australian Communications and Media Authority [ACMA] wiring rules for more information).

5.3.2 Customer cabling is optional

Customer cabling allows owners of premises to choose a location of nbn™ equipment away from where the services may be used, so as to improve data speeds within the premises, assist with aesthetics and/or cater for greater additional scope (such as a wired home network).



Important: While builders and cabling should let customers know about the benefits of pre-wiring at the time of home construction, it is important to note that customer cabling is optional and entirely at the discretion of the developer, builder or premises owner.



5.3.3 Planning for customer cabling

5.3.3.1 End user intentions

nbn cannot mandate the installation of customer cabling.

However, **nbn** suggests that developers, builders and premise owners think about:

- the proposed location for **nbn™** equipment
- where premises occupiers are likely to use internet services



Important: End users may intend to use a wireless or cable router plugged into a wall outlet in the premises. Where feasible, consultation with the owner of the premises about their home networking needs is recommended, as it is far more economical to install fixed wiring during the construction of a building.

5.3.3.2 Cabled end user access to **nbn™** equipment

Once the location of the **nbn™** equipment within the premises is determined, further planning may be necessary to assess whether additional customer cabling will be required to access the service from rooms or locations other than the one in which the **nbn™** equipment is to be installed.

Example: If the **nbn™** equipment is to be located in an attached garage, further cabling is often required to allow occupants of the associated house to easily access services.

5.3.3.3 More information

- Industry bodies provide advice about 'smart wired' homes.
- Refer to ACMA wiring rules for fixed or concealed customer cabling.
- RSPs can provide guidance and options for new and existing customers.
- Electronic retailers provide products for connectivity that does not require customer cabling (such as a Wi-Fi router).

5.3.4 Installing customer cabling

nbn recommends the installation of data cabling from the **nbn™** equipment location to wall sockets elsewhere in the premises.

In many instances, a routing gateway is needed to make full use of the internet services.



Suggestion: Provide a minimum of two (2) runs of customer cabling from the **nbn™** equipment location (or the associated RG) to nominated locations in the premises, so a telephone (using UNI-V) and an internet connection (using UNI-D) can be used at the same time in the home.



Data cabling:

- can be used for either telephone (UNI-V) or internet (UNI-D)
- uses four (4) pair data cables, with eight (8) positions, eight (8) contact (8P8C) modular sockets and connecting cables
- is 'star-wired' with a cable dedicated to each socket in the premises



Legacy methods for traditional telephone cabling using telecommunications cable, looped or daisy-chain wiring and telephone sockets were not originally designed for Ethernet data transmission.

Modern data cabling (specifically star-wired Category 5 or better) can, however, be used for both applications.

Where feasible, install customer cabling so the addition of customer connecting cords, routing gateways, Ethernet switches or other devices provides an aesthetic appearance.

Give thought to how additional end user devices (such as routing gateways) will be positioned or mounted in the premises. Avoid excess cord wherever possible.



6 MDUs

For the purpose of this document, **nbn** divides MDUs into the following categories:

- Duplexes, triplexes, rows of villas or terraces: These require a direct pathway to each premise from the street pit.
- MDUs without street frontage that need additional pit and pipe, or internal pathways to allow fibre and/or copper cabling to be provided to multiple levels, or through the building to allow access to each dwelling: These require internal pathways inside the site for each premise.
- Additional subdivisions or super lots: Where a development is created beyond the original Development Agreement (DA), any builder or developer who intends to further subdivide a development needs to make application for adjustment of **nbn**[™] fibre plans for that development. Some additional subdivisions may require further pit and pipe to be provided by the subdivision developer to get access to each dwelling if they do not have street frontage. All super lot or additional subdivision developers and builders need to contact **nbn** before proceeding. Duplex and triplex construction on a single lot may not have been provisioned with suitable starter pipes as part of the major development in which they exist. **nbn** cannot allow lead-ins to dwellings that cross a neighbour's property/title.

6.1 Dwellings with direct access to street boundary

External cable feed MDUs are similar to SDUs in that the connection to each premise is via an external underground conduit. For example: rows of villas or townhouses, duplex or triplex constructions.

- Where the conduit to each unit is directly from the pit and developer's starter pipe, then preparations will follow the SDU guidelines.
- Where a development requires pit and pipe to be provided onsite for pathways to the units, then the developer should refer to *NBN-TE-CTO-194 New developments - deployment of the nbn[™] pit and conduit network*.



For guidance on an MDU/hybrid MDU lead-in location at the development boundary, refer to **nbn** directly.

To make an application for the development, where pit and pipe is required within the development, the site developer must contact **nbn** for further guidance.

6.2 Internal cable feed MDUs

Refer to the document *NBN-TE-CTO-284 Multi Dwelling Unit (MDU) building engineering and design standard - new developments* for further information.

This document outlines **nbn**[™] conduit and spatial requirements for deployment of its fibre-to-the-home infrastructure. It also applies to HFC, FTTB and copper to the MDF technologies within an internal cable feed MDU.

For special building designs (such as hybrid MDU projects) contact **nbn** directly.



An MDU is any premises with multiple dwellings that does not have street frontage for each dwelling. MDUs need additional scope for making preparatory works for the **nbn**. Typical examples of these are high rise apartment buildings with two (2) or more floors.



7 Pre-installation of FTTP nbn™ equipment and cabling



Recommended: By arrangement with builders or developers, **nbn** completes equipment installation while the builder is still in possession of the property, that is, while the builder still has control of both access to, and safety at, the construction site.

This provides both builders and **nbn** with the opportunity to quickly rectify any problems that may arise from the preparation works prior to occupancy and avoid subsequent disruption to landscaping or finishes.

7.1 Arranging pre-installation

After the builder completes all preparatory work and before handover to the building owner, builders or developers should contact **nbn** to arrange for installation of the fibre equipment.

7.1.1 Prerequisites

Table 24. Prerequisites before installing fibre equipment

Prerequisites...	
✓	the builder has completed all preparatory installation work
✓	electrical power is available
✓	the building is at lock-up stage

7.1.2 Booking pre-installation appointment form online

To request a booking for pre-installation of **nbn**™ equipment, apply online at the following link:

<http://www.nbnco.com.au/develop-or-plan-with-the-nbn/new-developments/design-build-install/ntd-pre-installation-request.html>



Important: The pre-installation date must be at least 10 business days prior to hand-over.

7.1.3 Key changes

This version includes some important updates:

1. document name and number
2. references to Multi Technology Mix (MTM): HFC, FTTB, copper to the MDF (FTTN), FTTN throughout
3. added Section 1.2 Purpose, Section 1.5 Audience and Section 1.6 Assumptions and constraints
4. Section 2.4 revision of definition of fibre NBP



5. Section 2.5 MTM installation lifecycle
6. Section 3.1 to 3.4 installation components, including updated Figure 1 diagram (conduit dimensions)
7. Section 3.5 MTM activities for preparing new buildings
8. Section 3.6 LIC installation
9. Section 3.7 MTM internal conduit installation requirements, updated Figure 3 diagram and new Figure 4 and 5 diagrams (LIC to internal cavity and LIC surface mounted)
10. Section 3.8 external wall space requirements and preparations for the PCD or NTD, updated Figure 6 diagram and new Figure 7 and 8 diagrams (FTTP, FTTN and HFC conduit alignments)
11. Section 3.9 internal premises wiring for MTM
12. Section 4.3.3.1 new Figure 13 and 14 diagrams of FTTP NTD portrait and landscape layout examples (mounting surface template with GPO)
13. Section 5.1 who provides what (Table 23) to include MTM
14. Section 6.2 internal cable feed MDUs to include MTM
15. Appendix B and C to include MTM item

7.1.4 Pre-installation activities

nbn will arrange site access with the builder. On arrival, **nbn** undertakes the following activities:

- installation of the PCD, NTD enclosure, NTD and the default standard power supply of PS/S (PS/OBB if the EUP requests one)
- installation of the service drop cable fibre from the street pit to the NTD, through the service drop conduit
- verification that the system operates correctly, up to and including the NTD and default PS/S



nbn does not verify that the internal customer wiring is correctly installed.

7.2 Troubleshooting connection problems

Circumstances may arise during construction that could result in **nbn** being unable to readily connect the building to the **nbn**TM fibre network. If this situation should occur, then the building owner will have to contact their RSP or ISP to facilitate service activation after handover. The RSP/ISP will then contact **nbn** to determine the appropriate remediation and arrange installation and connection to the **nbn**TM fibre network.



The building owner may incur additional charges where remediation work is necessary.



8 Glossary

Term	Description
AC	Alternating Current
ACMA	Australian Communications and Media Authority
BEP	Building Entry Port
copper to the MDF	Copper from the node cabinet extends to a MDF located in the communications room or cupboard of a MDU. Services are delivered via backbone copper provided by the developer to each premises or tenancy.
customer	The final 'downstream' customer; being the individual or organisation who acquires services from one (1) of nbn 's RSPs. Also called the end user.
DP	Delivery Partner
DSLAM	Digital Subscriber Line Access Multiplexer
EUP	End User Premises
FGL	Finished Ground Level
FHL	Flood Hazard Level
FTTB	Fibre To The Building Optical fibre extends to the basement communications room or cupboard of an MDU, connecting to a DSLAM unit. A copper tail from the DSLAM terminates onto the developer provided MDF. Services would be delivered via backbone copper provided by the developer to each premises or tenancy.
FTTN	Fibre To The Node Optical fibre extends to a node cabinet located close to existing copper pillars and/or cabinets. Services are delivered over the existing copper network to each premise.
FTTP	Fibre To The Premises Optical fibre cable extended to the premises, with GPON fibre-sharing.
FTTP solution provider	Any company or supplier providing FTTP.
FTTx	Fibre To The 'x' (building, distribution point, node, premises)
GPO	General Purpose Outlet
GPON	Gigabit Passive Optical Network



Term	Description
HFC	Hybrid Fibre Coaxial HFC cable is extended from the HFC network to each premises.
HS&E	Health, Safety & Environment
ISP	Internet Service Provider
LIC	Lead-In Conduit
nbn	<ul style="list-style-type: none"> National Broadband Network Company established by the Australian Government to design, build and operate the wholesale-only National Broadband Network.
MDF	Main Distribution Frame Contains the 'A' side termination blocks for the camera copper cable and the 'B' side termination blocks for the customer's side.
MDU	Multi Dwelling Unit A structure that contains more than one (1) premise.
MTM	Multi Technology Mix
NBP	Network Boundary Point
new developments	A new or undeveloped piece of land that represents the growth of the premises market, formerly called greenfields.
NTD	Network Termination Device (also referred to as an nbn TM connection box) nbn TM network termination point at each premise for residential fibre services, typically featuring four (4) data and two (2) voice interfaces.
NTD enclosure	Optional wall-mounted, purpose-built housing for an NTD and cabling. Consists of a base and a removable cover. (Also referred to as an nbn TM connection box cover.)
OH&S	Occupational Health & Safety
PCD	Premises Connection Device (Also referred to as an nbn TM utility box.) A connection box for the fibre from the street, located on the outside of the building.
PS/OBB (optional)	Power Supply with Optional Battery Backup Provides power to a NTD.



Term	Description
PS/S (default)	Power Supply Standard Provides power to a NTD.
PSU	Power Supply Unit
PVC	Polyvinyl Chloride
RG	Radio Grade
RSP	Retail Service Provider
SDU	Single Dwelling Unit A structure that contains only one (1) premise.
TO	Telecommunications Outlet
UNI-D	User Network Interface - Data
UNI-V	User Network Interface - Voice
VRLA battery	Valve-Regulated Lead-Acid battery A lead-acid rechargeable battery of the type used in nbn ™ PS/OBBs.
WHS	Workplace Health & Safety



Appendix A Australian and international standards

The following table lists the documents relevant to Australian and international cabling standard compliance guidelines.

Table 25. Australian and international standards table

Number	Title
AS/CA S008:2010	Requirements for customer cabling products
AS/CA S009:2013	Installation requirements for customer cabling (Wiring rules)
AS/NZS 3000:2007	Wiring Rules
AS/NZS ISO/IEC 15018:2005	Information technology - Generic cabling for homes
AS/NZS IEC 61935.1:2012	Specification for the testing of balanced and coaxial information technology cabling Part 1: Installed balanced cabling as specified in ISO/IEC 11801 and related standards
HB252-2007	Communications Cabling Manual Module 3: Residential communications cabling handbook



Appendix B Standard circumstances defined



B.1 Standard circumstances: checklist



Important: The indoor NTD and its PS/S or HFC modem are only suitable for installation in standard circumstances.

All of the checks in Table 26 must be true for an installation to be categorised as standard circumstances.

Table 26. Standard circumstances checklist

Requirement	
<input type="checkbox"/>	Both the NTD and PS/S or HFC modem are installed in a building where people normally live, work or meet, but not in a place that is open to public access.
<input type="checkbox"/>	Both the NTD and PS/S or HFC modem meet the following requirements: <ul style="list-style-type: none">are installed inside the same building as each otherare not installed on the external surface of an external wall <p> This refers to the outside of a building and would include, for example, an undercover area within an enclosed patio or similar circumstances.</p> <p>The installation of an NTD and PS/S on the internal surface of an external wall refers to the inside of a building and this situation is not meant to be precluded by these points, however, may fall under other circumstances outlined later in this list.</p> <ul style="list-style-type: none">are not installed in an enclosure situated on, or embedded into, the external surface of an external wall of the building <p> This means that the Indoor NTD and PS/S should not be installed in a building or structure separate from where the services will be reticulated, or in a hut or street cabinet or another kind of enclosure such as a telephone booth where the environmental conditions may extend outside the specifications permitted for the NTD, PS/S or battery.</p>
<input type="checkbox"/>	The customer cabling remains wholly within the same building containing both the NTD and the PS/S or HFC modem. <p>This includes any cables that contain electrical conductors or conductive components, for the purpose of reticulating any UNI-V or UNI-D service, or reticulating PS/S power. This term is intended to mean the same as the term customer cabling in <i>AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)</i>.</p> <p>This requirement also means there must not be any electrically conductive telephone or data or PS/S power cables between the main building and a separate free-standing building.</p>



Requirement



Where a PS/OBB is deployed, it will be mounted permanently to a wall or permanent fixed enclosure.



Neither the NTD nor the PS/S (or PS/OBB) are installed in a situation where they might be reasonably expected to experience damp, moist or excessively humid conditions.



Neither the NTD nor the PS/S (or PS/OBB) or HFC modem are installed within a roof cavity.



Neither the NTD nor the PS/S (or PS/OBB) or HFC modem are installed below a floor outside the normal living, working or occupancy areas of the building.

This means that neither the NTD nor the PS/S (or PS/OBB) may be installed under a home between the floor and bare earth, or in a location that cannot be locked up.



Neither the NTD nor the PS/S (or PS/OBB) or HFC modem are installed in a cupboard/enclosure/home distributor or in a confined space where any of the following are true:

- it might reasonably be expected that linen, clothing or towels might be stored in direct contact with the NTD or PS/S (or PS/OBB) or HFC modem
- it might be reasonably presumed that items could be stored that restrict free airflow around the NTD or PS/OBB or HFC modem
- gases may be trapped due to limited or no ventilation, or because the design or situation of the enclosure/home distributor is such that there is a potential for ventilation to be inhibited



VRLA batteries of the kind used in the PS/OBB, may emit hydrogen and oxygen gas under some circumstances, such as battery overcharging.

VRLA batteries may be installed into office or end user enclosures providing the enclosure provides for the exchange of air with the ambient atmosphere, as described in Section 2.4 of *AS/NZS 4029.2:2000 Stationary Batteries - Lead-acid*. While not strictly applicable to nbn's application, Sections 2.6 and 2.7 of *AS 4086.2:1997 Secondary batteries for use with stand-alone power systems* provide relevant recommendations.



Neither the NTD nor the PS/S (or PS/OBB) are installed in either of the following situations:

- in a location where the ambient temperature in the immediate vicinity of the NTD or the PS/S (or PS/OBB) might routinely exceed +40° Celsius or fall below 0° Celsius
- on a surface where the surface temperature might routinely exceed +40° Celsius or fall below 0° Celsius

This means that neither the NTD nor the PS/S (or PS/OBB) may be installed directly onto a northern or western facing masonry wall where either of the following are true:

- the wall is likely to be subjected to heating through solar loading and the heat may be



Requirement

transferred to the surface on which the NTD and PS/S (or PS/OBB) is mounted

- near a space heater, water heater or heater vent



Indoor NTDs and PSUs may be installed on northern or western facing masonry cavity walls, where the cavity is fitted with R1.5 or higher-rated insulation batts.

In circumstances where a wall would be subjected to solar loading except for a tree currently providing shade, the installer must assess the location assuming that the tree is not present.



Neither the NTD nor the PS/OBB or HFC modem are installed in a location where either the power cabling or the customer cabling might be a tripping or strangulation hazard.



Cables and equipment must be installed in accordance with local OH&S regulations and requirements. It is beyond the scope of this document to specify values.



Neither the NTD nor the PS/OBB or HFC modem are installed in a location where either the power or customer cabling can be accidentally wrenched or damaged by tripping, passing by or other inadvertent disturbance.



Neither the NTD nor the PS/OBB or HFC modem are installed in either of the following locations:

- onto an accessible conductive/metallic surface encompassing a GPO
- inside a conductive/metallic enclosure with accessible metallic parts encompassing a GPO



Exception: All accessible conductive surfaces and parts are protectively earthed, in accordance with *AS/NZS 3000:2007 Wiring Rules* and *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)*.



Where PS/OBB AC is used, the power cord should not be routed through an opening in a metallic surface.



Exception: The metallic edges of that opening are appropriately protected by a grommet or similar device.



Neither the NTD nor the PS/S (or PS/OBB) are at risk of being damaged.



B.2 Standard purposes



Important: The indoor NTD is only suitable for providing services for standard purposes.

The following situations DO NOT qualify as standard purposes:

- Connection to untwisted cabling or other forms of non-standard cabling that do not meet the indoor NTD technical requirements, as specified in Appendix B.1.

Untwisted cabling is commonly deployed, for example, to a lift car, and with some fire alarm systems.

- Situations where customer cabling neither satisfies the requirements of *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)* or *AS/NZS 3000:2007 Wiring Rules* nor meets the technical requirements outlined in Appendix B.1

This addresses potential breaches of primary insulation, inadvertent detachment of live conductors coming into contact with exposed metallic parts, and other potential risks in situations where conductors carrying mains potential are routed into conductive/metallic enclosures.

Refer to Sections 9.1.2 and 20.7 of *AS/CA S009:2013 Installation requirements for customer cabling (Wiring rules)* for more information.

- Services delivered into a lift car.
- MDU or body corporate managed alarm services, and/or fire indicator panel alarm services.



Appendix C Ventilation of NTD enclosure and PSUs

nbn requires the effective thermal ventilation of open enclosures and home distributors. This appendix outlines the reasons for this requirement and provides guidelines to facilitate it.

C.1 Reasons

C.1.1 Electronic devices generate heat

All electronic appliances, including the **nbn**[™] NTD, HFC modem and PSUs, consume energy. Some of that energy is dissipated as heat.

When installed into a closed enclosure or space, the energy dissipated by electronic appliances accumulates and heats the air in the enclosure.

If the heated air cannot easily escape, it increases the operating temperature of the enclosed devices.

In any case, **nbn**[™] equipment should not be installed in an area where the ambient temperature exceeds the range described in Appendix B.1.

C.1.2 Operating temperature affects failure rates

There is a relationship between an electronic device's long-term average operating temperature and equipment failure rates.



General rule: Failure rates approximately double for every ten degree rise in long-term average temperature within an enclosure.

To reduce the chance and frequency of equipment failure, it is important to optimise an equipment enclosure's ability to dissipate heat. This in turn reduces inconvenience to the end user, productivity loss and the costs involved in managing failures and restoring services.

For these reasons, the design of an open enclosure or home distributor should be optimised to take advantage of convection cooling.

Convection currents established in the air within and around the enclosure carry heat away from the equipment, minimising temperature rise in the electronic equipment it houses.

Effective convection requires enclosures to be thermally ventilated.



C.2 Requirements

C.2.1 Ventilation area

nbn requires that enclosures for the nbn™ equipment only, satisfy the thermal ventilation requirements in Table 20.

Table 27. Ventilation requirements

Volume of open enclosure or home distributor	Required ventilation area (for <u>each</u> of the upper and the lower ventilation regions)
20 litres (minimum volume requirement)	60 square centimetres
between 20 litres and 60 litres	60 square centimetres, plus an additional 1.5 square centimetres per litre of volume over 20 litres
greater than 60 litres	120 square centimetres, plus an additional 0.1 square centimetres per litre of volume over 60 litres

Calculating ventilation area

For each ventilation region, use the following steps to calculate the required ventilation area (in square centimetres):

1. use the following formula to calculate the volume:

$$volume = \left(\frac{W \times H \times D}{1000} \right)$$

where:

- W, H and D are the internal width, height and depth of the enclosure (in centimetres)
 - volume is expressed in litres
2. based on the volume you calculated in step 1, determine the required ventilation area (in square centimetres):

- for volumes between 20 litres and 60 litres:

$$ventilation\ area = 60 + [(volume - 20) \times 1.5]$$

- for volumes greater than 60 litres:

$$ventilation\ area = 120 + [(volume - 60) \times 0.1]$$



Example

An enclosure with internal dimensions of width 38 cm, height 65 cm and depth 13 cm, has the following volume:

$$volume = \left(\frac{38 \times 65 \times 13}{1000} \right) = 32.13 \text{ litres}$$

As this volume is **between 20 litres and 60 litres**, we calculate the required ventilation area for each of the upper and lower ventilation areas as:

$$ventilation \ area = 60 + \left[\left(\frac{38 \times 65 \times 13}{1000} - 20 \right) \times 1.5 \right] = 78.2 \text{ cm}^2$$

C.2.2 Additional requirements

Table 28. Additional ventilation requirements

Rule	Notes
doors or covers must not obstruct ventilation	An open enclosure or home distributor design must not rely on a cover or doors being opened to meet the thermal ventilation requirements.
obstructed ventilation does not count towards thermal ventilation assessment	Examples of obstructed ventilation include (but are not limited to) the following: <ul style="list-style-type: none"> • an open enclosure or home distributor is installed into a cavity • an open enclosure or home distributor is surrounded by a purpose-designed architrave • an open enclosure or home distributor is fitted with fixed shelving • an open enclosure or home distributor has the capability of being fitted with removable shelving
ventilation openings must not be used for cable ingress/egress at any time	This ensures that cables can neither obstruct nor reduce the free flow of air into and out of the open enclosure or home distributor, and compromise its effective ventilation.



Appendix D Builder checklist: SDU/MDU preparation

Table 29. Builder checklist

Task		
<input type="checkbox"/>	1.	Locate developer’s starter pipe at the property boundary.
<input type="checkbox"/>	2.	Plan the preferred location for the future fitting of the PCD or NTD by nbn . Check for clearance requirements or exclusion zones from other utilities.
<input type="checkbox"/>	3.	Install the LIC with draw-string from the developer’s starter pipe to the nominated location for the PCD on the exterior of the premises.
<input type="checkbox"/>	4.	Plan the preferred location for the future fitting of nbn TM network equipment by nbn . For FTTP ensure the clear mounting surface space requirement for either landscape or portrait orientation is met. If the location is enclosed, provide adequate ventilation. Check guidelines for open enclosures or home distributors.
<input type="checkbox"/>	5.	Install the internal conduit with draw-string from the PCD or NTD location to the nominated nbn TM equipment or customer equipment location.
<input type="checkbox"/>	6.	Provide a dedicated GPO at the nbn TM equipment location to power the installation.
<input type="checkbox"/>	7.	Plan for any customer cabling (if required). If data cabling is installed, co-locate the cabling connections at the proposed nbn TM equipment location. Ensure that additional space is provided to accommodate the wiring.
<input type="checkbox"/>	8.	Take into account any space required for customer premises equipment if used (such as routing gateways or other electronic devices). If space is required, either provide cable management or a method that ensures an aesthetic installation.
<input type="checkbox"/>	9.	When preparation work is complete and the premises is at a secure lock-up stage with power available, book a pre-installation of the nbn TM equipment by nbn (FTTP only): <ol style="list-style-type: none"> a. email nbn at newdevelopments@nbnco.com.au b. provide your consent and invitation for an nbn contractor to install the equipment and fibre cabling on your site c. submit a PDF request form d. nominate any special preference to have a PS/OBB installed instead of the normal NTD enclosure with PS/S



Task



10. When the above steps are complete, advise the new premises owner or occupant that the premise is **nbn** ready. Once the development is in service, the premises owner can contact a RSP to order a broadband service or package that uses the fibre network.