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CODE OF PRACTICE

FOR THE PROVISION OF

ACCESS FACILITIES IN BUILDINGS

FOR THE SUPPLY OF

TELECOMMUNICATIONS AND BROADCASTING SERVICES

COMMUNICATIONS AUTHORITY

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Contents

FOREWORD

Telecommunications services such as telephone, facsimile, data and wideband multimedia services are indispensable in the modern society. In no case can a building developer afford to ignore these requirements during the planning of a building. In addition, broadcasting services using cables, such as pay television and terrestrial free television, are considered essential entertainment services to the occupants.

There are Fixed Telecommunication Network Services Licensees, Fixed Carrier Licensees or Unified Carrier Licensees (hereafter referred to as the "Network Operators") who will make use of the building access facilities, including the In-building Coaxial Cable Distribution System (IBCCDS), to provide telecommunications and broadcasting services to the occupants of the buildings.

This Code of Practice, hereafter referred to as the "COP", is issued by the Communications Authority (CA) in consultation with the Network Operators and the building industry. It encourages building design and construction professionals to design new buildings with adequate building access facilities so that the Network Operators can install their networks and provide services in the most efficient manner without causing undue inconvenience to both the developer and the occupants of the building. This COP does not set arbitrary rules, but lists the normal requirements of the facilities in a building which are to be provided by the developer to facilitate the provision of telecommunications and broadcasting services to the occupants. Developers are strongly advised to follow this COP when they design and construct new buildings.

It is a common practice in the field that relevant facilities for the essential services such as electricity power supply and water supply are to be provided by the developers. Similarly, the access facilities for the provision of telecommunications and broadcasting services should also be provided by the developers in their properties. It would adversely affect the value of a property if such facilities are not available in a building. In addition, if adequate access facilities were not provided, the occupants of the properties would not be able to have unimpeded access to the public telecommunications and broadcasting services and this would degrade the value and attractiveness of the properties to potential purchasers and occupants. Also it is expensive, inconvenient and architecturally undesirable to provide access facilities after building construction has been finished. Even the greatest care is exercised, it is almost impossible in such case to carry out large scale wiring operations without causing damage to the building structure and appearance, disfigurement of decorations or excessive disturbance to the occupants.

It is therefore highly recommended that related professionals who are involved in building construction should contact the Network Operators early in the planning stage to discuss matters concerning the provision of access facilities to meet the telecommunications and broadcasting requirements. If the access facilities are properly designed, provision of telecommunications and broadcasting services to the building can be ensured. In addition, subsequent cabling can be done with minimum inconvenience to the occupants of the building, and without causing deterioration to the structure or the appearance of the building.

For existing buildings, the developers and/or building management are also strongly encouraged to follow the principles of this COP as far as practicable when new or additional cabling facilities are to be constructed.

The COP is subject to amendments in part or in whole from time to time by CA.

1. ACCESS FACILITIES FOR DIFFERENT TYPES OF BUILDINGS

1.1 The access facilities should preferably be used for telecommunications and broadcasting services exclusively and include —

(a) Lead-in facilities, including cable entry and cable entry chamber;

(b) Telecommunications and Broadcasting Equipment Room (hereafter referred to as "TBE Room");

(c) Vertical riser;

(d) Horizontal distribution facilities;

(e) Accommodation for pay TV receiving system;

(f) TV/FM outlets;

(g) Telephone sockets; and

(h) Cables.

Items (a) to (e) above hereafter are referred to as cabling facilities which are to be provided by the building developers. For item (a), the building developers should plug or seal the ducts immediately with easily removable materials after the ducts are installed so as to prevent the ingress of water and gas during the construction stage and before hand-over to the Network Operators for cabling work. The Network Operators are responsible for sealing the lead-in ducts in order to prevent the ingress of water and gases into the building after the completion of cabling work. Item (f), together with other system components of a communal aerial broadcast distribution (CABD), if installed, should be provided by the developer. Special TV/FM outlets will be installed by the pay TV operators when pay TV service is to be provided. Items (g) and (h) could be provided by the Network Operators or the building developers.

1.2 The following types of buildings are covered in this COP —

(a) Office and Commercial Buildings;

(b) Residential Buildings;

(c) Hotels;

(d) Dwelling Houses;

(e) Industrial Buildings (e.g. warehouses, factories, manufacturing buildings); and

(f) Campus-Type Buildings (e.g. hospitals, universities).

1.3 General requirements on the cabling facilities for telecommunications and broadcasting services are given in Section 2. Special requirements on cabling facilities for each of the above building types are specified in Section 3 to 8 whereas requirements on telephone sockets, TV/FM outlets and cables are specified in Section 9 and 10. Guidelines on typical size requirements of cabling facilities recommended by the Network Operators for some building types are given in Table 1.

2. GENERAL REQUIREMENTS

It is common practice for building developers to consolidate the requirements of various public utilities, such as electricity, water and gas, when they plan for new building projects. As there are a number of Network Operators who will provide telecommunications and broadcasting services to new buildings, building developers should therefore contact the Network Operators as listed in the Annex during the planning stage of new buildings in order to consolidate the requirements of telecommunications and broadcasting access facilities. Building developers are also encouraged to appoint and permit more than one Network

Operators to install blockwiring cables in new buildings.

2.1 Facilities for Concealing Cabling Facilities and Apparatus

In common with water, gas pipes, lighting conduits and electrical fixtures, cabling facilities and equipment will eventually become a permanent part of the building. Their installations should be done in a manner which is satisfactory to the owners and occupants of the buildings. All facilities for concealing the cabling facilities and equipment should be provided by the owners of the buildings.

2.2 General Requirements of Cabling Network Systems

Separate conduits, ducts, channelling and trunking systems should be separately provided for the electricity power supply cables, telecommunications cables and IBCCDS cables. The same should also be separately provided to optical fibre cables, if any, as far as possible. Separate wall plates for copper and optical-fibre telecommunications cables are recommended. For metal duct system including the conduits, ducts, pipes, trunking etc., they should be fully bonded and earthed, and it must be ensured that the various services are kept separate at all points, that is in ducts, junction boxes and outlets. The developers may refer to the latest edition of the following widely recognised standards for the design, planning and construction practices of cabling network systems —

(a) TIA/EIA 568-B: Commercial Building Telecommunications Cabling Standard;

(b) TIA/EIA 569-A: Commercial Building Standard for Telecommunications Pathways and Spaces;

(c) ISO/IEC 11801: Generic Cabling for Customer Premises; or

(d) BS EN50173: Information Technology, Generic Cabling Systems, General Requirements and Office Areas.

2.3 Segregation between Electricity Supply and Telecommunications/IBCCDS Cables

If the cables are to be provided by the developer and where it is necessary for an electricity supply cable or service to run in parallel with or cross a telecommunications or IBCCDS cable, the following minimum segregation between electricity supply cables and the telecommunications/IBCCDS cables should be provided —

(a) For low voltage cables (not exceeding 600V between phase and earth), a minimum clearance of 50 mm should be given.

(b) For high voltage cables (exceeding 600V between phase and earth), a minimum clearance of 300 mm should be given.

2.4 Segregation between Telecommunications Cables and IBCCDS Cables

If the cables are to be provided by the developer, telecommunications cables should be avoided to run in parallel with or cross an IBCCDS cable. These two types of cables should be installed in separated trunkings.

2.5 Requirements of Ducts, Risers and Trunkings

The cable ducts, vertical risers, and trunkings for carrying cables should be made of

flame-retardant and corrosion/weather resistant materials. Sharp objects should be avoided inside or outside the trunking. It should provide removable covers throughout the entire length for installation and maintenance of cables. Trunking covers should normally be friction fit or should be secured by simple devices, but not screws. Trunking should not be installed in open areas where it is subject to bad weather and should be firmly fixed on walls, columns or beams. Easy bends are required at turning points to ensure that the cable bends comply with the minimum bending radius requirements. Trunkings should be earthed if made of metal. If any part of these facilities is located more than 4 metres from the floor level, adequate access facilities must be provided to facilitate cable installation and maintenance.

2.5.1 Requirements of Telecommunications Closet

Telecommunications closet will be required if it is not possible to accommodate the equipment and distribution cases/connection boxes in the riser. The requirements of telecommunications closet will vary with the design of the in-building telecommunications systems. Developers should refer to the latest edition of the widely recognised standards for the design, planning and construction practices of cabling network systems specified in paragraph 2.2. Developers should also discuss with the Network Operators on the actual requirement of the telecommunications closet, if applicable. The telecommunications closet may be an enclosure of small floor area or a section of wall surface where the Network Operators could mount their equipment onto the wall. There should be sufficient working clearance for the workers and suitable concealing arrangement to avoid unauthorised access. There should also be linkages between the telecommunications closet and the riser. Suitable power supply should be available in the telecommunications closet.

2.6 General Requirements of Horizontal Distribution Facilities

Sufficient access space and opening should be provided for access of horizontal distribution facilities. Separate distribution boxes should be provided for telecommunications and broadcasting services. Covers for the distribution boxes should be provided to protect the cables. The size of the distribution boxes will depend on the requirements of each floor and developers are advised to co-ordinate with the Network Operators to determine the actual need.

If any part of the horizontal distribution facilities is located more than 4 metres from the floor level, adequate access facilities should be provided to facilitate cable installation and maintenance.

2.7 Earth Connection for Telecommunication/Broadcasting Services

An earthing system should be provided for the telecommunications/broadcasting systems. It should have a resistance to earth of not greater than 3 ohms and should be terminated on an earth bus bar inside the TBE Room with an earth conductor of cross-sectional area not less than 70 mm^2 via the shortest routing. The earthing system should be extended vertically via the riser duct to the ceiling of the top floor.

2.8 General Requirements of TBE Room

Each building should have at least one TBE room which should meet the following requirements —

(a) a dedicated room with security lock should be assigned as TBE Room;

(b) the TBE Room should be located above ground level to avoid the risk of flooding and not neighbouring to the transformer room or the generator room. The door should be made of durable material if the TBE room is facing open area in order to prevent corrosion and damage. A door kerb of not less than 100mm of height should be constructed at the entrance. It is preferable to allow room for future expansion if possible;

(c) the TBE Room should be easily accessible. The entrance to the room and the access way leading to the room should preferably be at least 1.2 metres wide and 2.4 metres high;

(d) the room should be linked up with the vertical block-wiring system as well as the lead-in ducts;

(e) the size of the TBE Room will depend on the type and size of the building. A recommendation of typical room sizes for different types and sizes of buildings is given in Table 1;

(f) water pipes, sewage pipes, water drainage, water sprinklers, high voltage power supply cables, power transformers should not be installed inside the TBE Room. No air ducts, except for the ducts which provide service to the TBE Room, should be installed or routed through the TBE Room;

(g) there should be no opening in the room except for the door, the ventilation ducts and cabling ducts. All windows, if any, must be shut and sealed along the frames to keep out water and dust and blind should be provided to avoid direct sunlight;

(h) no kitchens, toilets, water pumps, main water drainage pipes should be installed directly above the TBE Room;

(i) sufficient lighting should be provided for the room;

(j) electric power supply should be available in the room. The power supply should be connected to the essential power generator if provided. At least one 13A power socket should be provided for common use;

(k) ventilation should be provided and exhaust fan or louver type door should be used to facilitate sufficient ventilation;

(l) air-conditioning is preferred. If not provided, facilities such as space and power supply should be made available for the installation of air-conditioners;

(m) solid walls should be provided for heavy equipment mounting. The walls and ceiling should be of normal finishing or be painted with a light-coloured vinyl emulsion or gloss paint; and

(n) concrete floors with durable PVC tiles or painted with polyurethane/epoxy paints with smooth finishing should be provided.

2.9 Fire Safety

Developer should observe all relevant ordinances and regulations regarding the fire safety requirements in the design of building wiring networks. In particular, the following ordinance and regulations are relevant —

(a) Building (Construction) Regulations;

(b) Factories & Industrial Undertakings (Fire Precautions in Notifiable Workplaces) Regulations; and

(c) Fire Services Ordinance.

For the TBE Room, as appropriate, the developer should provide the following —

(a) gas type portable hand-operated fire extinguishers; and

(b) emergency lighting be connected to the backup power supply.

2.10 Accommodation Required for Pay TV Receiving System at Rooftop

Space near to the rooftop of the building should be provided to accommodate pay TV receiving systems. The space is preferably within any equipment room with security lock on the top floor of the building which is close to the roof. A wall space of 1.5m × 1.5m for mounting the headend equipment of the receiving system with an access space of 1 meter is required. Two 32mm diameter concealed conduits for cabling from the roof top to the headend equipment should be provided. Space on the rooftop for mounting the receiving aerials is also required. Power supply should be made available for the receiving system. The receiving system may be co-located with the CABD system if installed.

2.11 Payphones

To cater for the installation of payphones at suitable locations in a development, developer should co-ordinate with the Network Operators at the building planning stage so that the requirements of cabling facilities for the payphones can be determined.

2.12 Identifications

Clear identification in both Chinese and English is required to denote the facilities which are installed exclusively for the provision of telecommunications or broadcasting services.

(a) Trunking, Pipe, Cable Tray, etc.
The purpose of individual trunking, pipe, cable tray, etc. should be clearly marked on their covers.

(b) TBE Room
The door of the room should be marked "TELECOMMUNICATIONS ROOM".

(c) Cables
If the cables are to be provided by the developers, clear identifications should be provided for each pair of cables at every termination/connection point in the TBE Room, the distribution boxes and other locations as necessary.

2.13 Design of Underground Duct Network

Each building development should have an entry point for the Network Operators to install their cables into the building site. These cables will be routed through the underground/lead-in ducts, manholes/joint-boxes and terminated at the TBE Room. The requirements of underground/lead-in ducts depend on the TBE Room configuration of the development. There are two TBE Room configurations, namely, the distributed TBE Room configuration and the centralised TBE Room configuration.

The distributed TBE Room configuration allows Network Operators to terminate their cables at individual TBE Room of each building. They have to install their equipment and associated facilities in individual TBE Room for serving the concerned building. The requirement of the TBE Room as stated in Table 1 is applicable to distributed TBE Room configuration. The distributed TBE Room configuration usually requires more underground ducts and lead-in facilities than that of the centralised TBE Room configuration.

For centralised TBE Room configuration, a Main TBE Room with size larger than that specified size in Table 1 is required to be provided in one of the building blocks. The Main TBE Room will accommodate most of the network equipment of all Network Operators which are required to serve the whole building development. The cables of the Network Operators will then be branched out from the Main TBE Room to the TBE Rooms of other buildings inside the development. Since most of the equipment would be installed in the Main TBE Room, the size of individual TBE Room of each building would be less than that of the Main TBE Room. The centralised TBE Room configuration usually requires less underground ducts than that of distributed TBE Room configuration.

Developers should consult the Network Operators of the detailed network design and the requirements of the access facilities in the early stage on the most suitable underground network design and the TBE Room configurations. It is advisable that the developers provide and install all the underground ducts for connecting the TBE Rooms of different building blocks to minimise future road opening inside the development. It is also advisable that spare ducts to be made available for future expansion. Alternatively developers may also install cable trench or cable trough linking all the buildings in the development for the ease of laying telecommunications and broadcasting cables. Spare space inside the cable trench or cable trough should be made available for future expansion. The developers must ensure that proper safety measures have been made for the protection of the telecommunications and broadcasting cables installed in cable trench or cable trough. The lead-in ducts to the cable trench or cable trough shall be properly plugged or sealed to prevent the ingress of hazardous or explosive gases and water.

There could be two alternative configurations of the underground duct network in respect of the lead-in facilities as described below and the detailed requirements are described in sections 2.13.1 to 2.13.2:

(a) multi-building blocks development with a central entry point at a concrete wall above or below ground level for all Network Operators; or

(b) multi-building blocks development with a central manhole at the entrance of the estate.

2.13.1 Underground Duct Network for Multi-block Development with a Central Entry Point

It is common that shopping arcade forms a part of the new multi-block development. Car parks and residential blocks would be built below and above the shopping arcade respectively. In general the central entry point is a concrete wall above or below the ground level inside the shopping centre or car park area of the development. Cables would be installed into such area and carried by cable trunkings to the Main TBE Room and then distributed to the residential blocks. In this case, it is advisable that spare space of the underground wall area of the central entry point to be reserved for future boring of holes for lead-in ducts. The reserved underground wall should meet the following requirements:

(a) the reserved wall area should be so designed to facilitate the Network Operators to install lead-in duct bores in future if required;

(b) the reserved wall area should provide at least 360x1500mm (Height X Width) space below ground level for boring of holes which should be enough to accommodate sixteen 107mm diameter duct bores;

(c) a working space of 2000 mm (Height) X 1500mm (Width) X 1500 mm (Depth) inside the building and behind the wall for access to the duct bores should be provided;

(d) there should be no lead-in chamber or other underground structure in front of

the reserved wall area and no cable trunking immediately behind the wall for the clear access by the Network Operators; and

(e) if there are physical constraints that the requirements of (a) to (d) above cannot be met, not less than six spare lead-in duct bores should be provided for future expansion or for the use by Network Operators. The additional duct bores could be sealed with easily removable material.

2.13.2 Underground Duct Network for Multi-block Development with a Central Manhole

Developer may request Network Operators to centralise the distribution of their underground cables at one central manhole which is usually installed at the entrance of the development. For better control the access of the central manhole, it is advisable that the central manhole be built by the developer. The Network Operators would then centralise their cables at the central manhole and the cables would then be branched out from the central manhole to the Main TBE Room or to individual TBE Rooms of each building.

The central manhole should be installed with at least eight spare underground ducts for future use. Four of them would be used for laying cables into the central manhole and the other four would be used to branch out cables.

If Main TBE Room configuration is employed in the development, the four spare outgoing underground ducts of the central manhole should be extended to connect to the Main TBE Room. If Main TBE Room configuration is not employed, a master manhole for each individual building should be constructed for future use. The master manhole should meet the following requirements:

(a) the master manhole should be inside the lot boundary;

(b) it is advisable that the owners/occupiers of the building to take up the ownership and maintenance responsibility of the master manhole; and

(c) the master manhole should be connected via lead-in ducts to the building. At the other sides of the master manhole, it should be installed with underground ducts for the connection by the Network Operators. Four spare underground ducts should be installed to cater for future requirement.

3. OFFICE AND COMMERCIAL BUILDINGS

Office and commercial buildings have medium to heavy telecommunications requirements and characteristically have high occupant turn-over and frequent office layout rearrangement. Developers are strongly advised to co-ordinate with the Network Operators so that sufficient and flexible cabling facilities can be designed to meet the individual need. As a general guideline, the access facilities to be provided by the developers should comply with the requirements in Section 2 as well as the followings.

3.1 Lead-in Facilities

3.1.1 General

For providing telecommunications and broadcasting services, cables from the street underground system will be required to be laid into the building below pavement level. The point of entry should be co-ordinated with the Network Operators. Developer may refer to Table 1 regarding the typical capacity requirements. However, in order to meet the actual need, developer should co-ordinate with the Network Operators who will supply

details of the type and size of lead-in duct to be built across the boundary of building and the suitable lead-in location. The lead-in duct between the building and the lot boundary, connecting to the lead-in chamber (outside the building boundary), should be provided by the developer and cable joint should be avoided as far as possible in the lead-in chamber.

3.1.2 Lead-in Ducts

Lead-in ducts for running between the lead-in chamber and the TBE Room or the distribution frame should be provided by the developer. General recommendations for the lead-in ducts are given below —

(a) PVC/GS (galvanised steel)/fibre glass/FRE (fibre reinforced epoxy) ducts or pipes of about 100mm diameter and with draw wires and easy bends for cabling should be used;

(b) the number of ducts required depends on the size of the building. A guideline regarding the typical number of ducts required for different sizes of buildings is shown in Table 1. However, developer should co-ordinate with the Network Operators to obtain the actual figure;

(c) the ducts should be corrosion-resistant and durable;

(d) bends in underground duct are undesirable. However, when required, the bend in a duct run should be limited to not more than one 90° bend, which should be at the end of the lead-in duct inside the TBE Room, and the bending radius of the duct must be greater than 450 mm. If the duct run shall have more than one 90° bend, a jointing chamber should be provided. The size and the location of the jointing chamber are to be co-ordinated with the Network Operators. To facilitate work, the cover of the jointing chamber should be removable with common type of tools;

(e) where applicable, rigid metallic conduit sleeves should be placed through the foundation wall. Wall sleeves with annular rings or other type of seals should be provided to prevent water leaks through the foundation wall. After the handed-over of lead-in ducts to the Network Operators, the Network Operators should seal all the lead-in ducts, whether cables are laid in the ducts or not, in order to prevent the ingress of water and gases into the building. The sealing of lead-in ducts should also be applied to subsequent cabling or maintenance work; and

(f) the lead-in ducts should be terminated inside the TBE Room. The minimum depth of the ducts in carriageway is 900 mm and in footpath is 450 mm. The ends inside the TBE Room are 300 mm above finished floor and the other ends are in centre of footpath with a depth within 450 mm to 600 mm. End of duct to lead-in cable chamber should be laid beyond building line by 600 mm minimum.

If the lead-in ducts are not terminated inside the TBE Room, it will be necessary to make provision for cables to be run to the TBE Room and thence to the risers. For this purpose, diversified cable trunkings should be provided by the developer to facilitate cabling and prevent unnecessary damage to the structure of the building. As basements are often congested with ventilation systems, pipes for various services, etc., sufficient clearance should be provided between the cable trunkings and those services to allow easy access to the cable trunkings for cable installation and maintenance.

Developer should consider providing diversified lead-in ducts for a building to enhance the reliability of the telecommunications and broadcasting services. Developer should co-ordinate with the Network Operators for the provision and design of diversified lead-in ducts.

3.2 TBE Room

In addition to the general requirements for TBE Room given in Section 2, the following requirements and guidelines should also be observed —

(a) the room should preferably be within 200 metres from the farthest outlet.

(b) the floor loading should meet the following requirements —

(i) minimum bearing loading — 5.8 kPa (please see note below)

(ii) minimum puncture loading — 1400 kPa

Note: The minimum bearing loading required will depend on the types of telecommunications system to be installed to serve a building and up to 10 kPa may be required for large building. Developers are strongly advised to liaise with the Network Operators to obtain the floor loading requirements during the building planning stage.

(c) the room should have a minimum ceiling height clearance of 3 metres for equipment installation and the walls of it should extend to the structural ceiling. Walls and ceiling should be covered by a durable, easily cleaned white finish;

(d) adequate 13A AC power supply outlets should be provided. Developer should co-ordinate with the Network Operators for the exact number of power outlets required. AC switch with essential power backup should be provided if essential power generator is available in the building;

(e) separate telecommunications earth electrode with resistance not greater than 3 ohms should be terminated to an earth bus bar inside the room;

(f) smoke detection device should be installed inside the TBE Room and be connected to the central control of the building management office; and

(g) audible and visual fire alarm which should be activated when there is a fire in the building to alert the people working in the TBE Room.

For fire safety and to improve the reliability of telecommunications and broadcasting services, it is highly recommended that approved gas type fire fighting system should be installed in the TBE Room.

Developers may refer to Table 1 regarding the typical size requirement of the room. However, the requirements for different buildings vary and developers are strongly advised to liaise with the Network Operators so that firm requirements of the TBE Room can be finalised.

3.3 Vertical Riser

3.3.1 Riser Ducts

Vertical riser ducts are required for carrying the cables for telecommunications and broadcasting services from the TBE Room to each floor of a building. The vertical riser ducts will link up the horizontal distribution boxes for running cables in horizontal direction to serve each flat of a storey. Developer should provide vertical riser ducts from the basement to the ceiling of the top floor of the building. To obtain the maximum benefit from the distribution system, each riser duct should be placed centrally with respect to the distribution in which it is to serve. To facilitate the installation and maintenance of horizontal cables, the distance between the riser duct and the outlet point should be kept as short as possible, preferably less than 30 metres.

The quantity and size of the riser ducts required depends on the type and size of the buildings. A general guideline of the typical requirements is given in Table 1 for reference. Developers are strongly advised to liaise with the Network Operators in the early stage of the building planning so that accurate requirements of riser ducts can be obtained.

For the lead out of the cables in a riser to each floor, a rectangular hole at the side of the riser duct in the order of about 75% of the cross-sectional area of the duct should be provided.

To ensure the proper fixing of cables, risers must be fitted with appropriate cable fixing devices along the whole length of vertical cable run from the TBE Room to the top of the building (e.g. steel cable racks, perforated cable trays, wooden backboards etc., the type to be used depends on the type and amount of cables to be installed) and should be installed only on the permanent structure of the building, to avoid difficulties with future re-arrangements of partition walls.

To provide flexibility of cable running and to improve the reliability of telecommunications services, provision of more than one riser duct is highly recommended.

If the building has both CABD and pay TV systems, both systems should share the same riser ducts and equipment accommodation area.

3.3.2 Access to Risers

Access to each riser will be necessary on each floor and should always be available from a corridor or other common area to avoid undue disturbance to office occupants. The access can be provided best by a hinged door of not less than 1.8m in height in order to give a man reasonable access to the cables, distribution cases and also the underfloor ducts feeding from the riser. Hinged doors are preferable to screw-on panels, especially where several services are using the same riser. If screw-on panels are to be used, the panels should be light-weighted that can be easily removed and handled by a single worker. To make the underfloor duct more accessible at the point of entry into the riser, the screed should be omitted within the riser.

3.3.3 Accommodation for Equipment, Distribution Cases/Connection Boxes

Equipment, distribution case**s**/connection boxes could be located inside the risers. However, should it be not possible to provide a riser big enough to accommodate both the cables and the distribution case, an adjacent recess to conceal the latter should be provided. Telecommunications closet as specified in paragraph 2.5.1 should also be provided to accommodate telecommunications equipment, cable terminations, patch panels and associated cross-connection wiring/patching if so required.

Adequate space for accessing the cables should be available. In general, the following requirements should be met —

(a) at least one distribution case should be provided on each floor. Developer should co-ordinate with the Network Operators for the actual size of the distribution case required;
(b) there should be a rigid wall that is capable of supporting the attached equipment/ distribution case;
(c) the distribution case and associated cables/wires should be well covered to avoid possible damage; and
(d) the distribution case should be located away from the water pipes, sprinkler system outlets and fire hydrants.

3.4 Horizontal Distribution Facilities

Ducts/conduits for horizontal wiring are recommended to be concealed during construction of floors. All the concealed ducts/conduits should be kept straight. Ducts/conduits with more than one bend should be provided with adaptable box at each turning for wiring work.

3.4.1 Size of Ducts to be Provided

For buildings with small floor size, one 25mm diameter concealed conduit from the riser to the outlet end of each unit should be provided. For large floor size buildings, horizontal trunking system should be provided for cable running.

The size of ducts/conduits for horizontal distribution depends on the type and nature of the building. Developer is recommended to co-ordinate with the Network Operators at the building planning stage to work out the most economical sizes of ducts to be defined.

3.4.2 Types of Horizontal Distribution Facilities

If the office layout is designed and constructed by the developer, facilities for horizontal distribution should be provided. There are many different methods for horizontal distribution and this paragraph highlights the most frequently used horizontal distribution facilities. One or more of these types of facilities should be provided by building developers for installation of cables for the provision of telecommunications or broadcasting services to the occupants.

- Underfloor Duct System
- Floor Trough
- Cabling Facilities above Suspended Ceiling
- Facilities for Surface Wiring

(a) Underfloor Duct Systems

It is important to layout the duct system such that the cross-sectional area of the duct from any riser to the first junction box is adequate for cables to pass through without congestion. The following types of layout of duct system are frequently use —

- Grid Layout
- Branching Layout
- Perimeter Layout

(i) Grid Layout

Flexibility for customer premises equipment in open-plan offices can be provided adequately only by a comprehensive grid of underfloor ducts with floor outlets. A suitable spacing is 1.5 m to 2 m, but other spacing can be chosen depending on the flexibility required. Since maximum flexibility is essential, the grid of the underfloor ducts is required to be as comprehensive as possible.

(ii) Branching Layout

The layout uses a central feeder duct with branches to each window bay. The branches can either terminate just short of the wall or extend to wall outlets. This layout provides reasonable flexibility where the grid layout is considered too expensive.

(iii) Perimeter Layout

The duct is located about 450 mm from the outer wall with boxes opposite alternate pillars (approximately 6 m spacing), each serving two window bays with a wall outlet each. The wall outlets are connected to the junction box by 25 mm diameter conduits.

Another perimeter layout uses floor outlets only. The boxes are spaced at intervals not exceeding 10 m with floor outlets positioned suitably along the duct.

A further method of providing a perimeter layout is by the use of skirting duct. This method is most suitable when the wall line is uninterrupted by structural pillars, but the problem of negotiating doorways has to be solved; one solution is to link up the skirting duct on each side of the doorway by a length of underfloor duct of adequate cross-sectional area.

All perimeter layouts have the disadvantage of not serving the floor area remote from the wall. There is also likely to be duct congestion unless cross-connecting ducts are provided between suitable points to allow alternative cable routing.

(b) Floor Trough

When a wood-block floor is installed on top of a thin screed, there is little room to accommodate an underfloor duct. In such cases, a floor trough complete with cover provides a satisfactory distribution system. As with other types of removable cover, the cover should be cut to provide convenient access points so as to avoid any deterioration in appearance by the frequent removal of the whole length of cover. The base should be finished smooth to prevent undue abrasion to the cable sheaths.

(c) Cabling Facilities above Suspended Ceiling

Utilisation of the space above the suspended ceilings for the horizontal distribution of cables from the riser to the customer premises equipment is not always as convenient as the underfloor duct scheme. For example, whilst it is possible to serve an isolated desk from a floor outlet when an underfloor duct is used, this facility is not freely available if the duct is between the ceiling and the structural floor.

Cable installation and maintenance is more difficult in this environment compared with other distribution systems and it is important that the dimensions of wiring channels should be larger than those specified for underfloor systems and that adequate access for equipment and wiring inspection and maintenance should be provided at key points by removable ceiling panels of the size 600mm × 600mm. The ceiling panels along the path of the cabling facilities should be of light weight and easily removable to permit cable installation and maintenance.

Top access to cable trunking should normally be provided where there is sufficient clearance between the trunking and ceiling. If side access is to be used, cable

retainers must be provided at regular intervals inside the trunking to ensure that cables held in position when covers are removed. Trunking covers should normally be friction fit or should be secured by simple devices, but not screws, to permit easy access. Space for accessing the facilities must be provided in common areas.

(d) Facilities for Surface Wiring

In some buildings where appearance is not critical, for example, in temporary buildings, it may be decided that the cost of facilities for concealment is not warranted. However, to assist in cabling and so reduce annoyance to occupants, cable holes through walls, and cable runs on walls should be provided by the developer. The cabling scheme in such a building will make use of sub-local distribution cases. Multipair cables will be carried nearer to the telephone socket to reduce the amount of wiring necessary for each change of equipment position. The rising cables can still be concealed, multipair cables will be taken horizontally, in corridors or in large open-plan offices, to positions suitable for placing distribution cases of the required capacity. From these distribution cases, small cables can be taken to each equipment.

Surface cable runs (e.g. trunking with removable cover, timber batten, etc.) which connect with the risers should, therefore, be provided on walls in the corridors, at high level.

To give access to the rooms from the cable run in each corridor, a short length of 25 mm diameter conduit should be built into the wall just above the door frames. This will enable the smaller cables to the equipment to be extended into the rooms. The cables can then be run to the telephone socket positions via the door frames and skirting board.

3.4.3 Horizontal Distribution Facilities for Broadcasting Services

Separate concealed conduits of 32 mm diameter for horizontal wiring associated with adaptable boxes should be provided for IBCCDS cables. Adaptable boxes of the size of 200mm × 200mm × 75mm should be provided for housing the broadcasting taps. The facilities may be used for CABD and pay TV systems, if provided.

4. RESIDENTIAL BUILDINGS

Residential buildings contain stand-alone single building, multi-blocks on a podium and housing estates with many blocks. In addition to the following requirements, the general requirements of access facilities stated in Section 2 should be followed.

4.1 Lead-in Facilities

Lead-in ducts for the cables from the street and cable trunking in building are similar to those in office and commercial buildings. Requirements of lead-in facilities in Section 3.1 should also be applied. The typical requirements of lead-in ducts for different sizes of residential buildings are given in Table 1.

For large scale multi-blocks housing estates, an underground duct network or trunking system may be required to link up all the buildings within the development as well as the lead-in duct. Alternatively, separate lead-in ducts along the boundary of the estate for connecting individual building may be provided. Developer should co-ordinate with the Network Operators for the actual requirements of lead-in ducts, local underground duct network and trunking system.

4.2 TBE Room

The general requirements of TBE Room are given in Section 2. For multi-blocks residential premises and large housing estates, the requirements of TBE Room in Section 3.2 should also be applied. Developers may refer to Table 1 regarding the typical size requirement of the room. The actual requirements will depend on the scale of the development and developers should co-ordinate with the Network Operators to determine the actual requirements of the TBE Room.

4.3 Vertical Riser

The general requirements of vertical riser are the same as those for office and commercial buildings given in Section 3. The typical sizes of vertical risers required for different sizes of residential buildings are given in Table 1. The position of the risers will be determined by the layout of the building and possibly by the position of other service risers but in any case the riser ducts should only run through the common parts of the building. The size of the equipment**,** distribution case/connection box, which could be concealed in the riser, will be determined by the number of flats to be served from the particular position, and this in turn will influence the size of the riser or other means of concealment. Telecommunications closet as specified in paragraph 2.5.1 should also be provided to accommodate telecommunications or broadcasting equipment, cable terminations, patch panels and associated cross-connection wiring/patching if so required.

Generally, any single riser will serve only a few flats on each floor, and, in some cases, only a single flat on each floor. Thus, a block of flats usually has smaller vertical risers than an offices and commercial building of comparable size specified in Section 3.

4.4 Horizontal Distribution Facilities

4.4.1 Distribution between Risers and Flats

Separate conduits should be provided for telecommunications and broadcasting services.

The cables can be fed into individual flat —

(a) through a conduit of 25 mm diameter directly connected to the riser; or
(b) through one or more conduits of 32 mm diameter (the number of conduits depends of the number of flats to be served) from the riser to a junction box and then through a conduit of 25 mm diameter from the junction box to each flat.

4.4.2 Distribution within a Flat

Separate conduit should be provided for telecommunications and broadcasting services within a flat and it should meet the following requirements —

(a) a 25 mm diameter conduit should be used to connect the first outlet (where the conduit from the riser is connected) to the second outlet, and then to the third and so on to form a series configuration by using concealed conduit box conforming to BS 4662 or equivalent;

(b) the conduits connecting one outlet with another should be as straight as possible; and

(c) it is preferable to have one concealed conduit box per room.

5. HOTELS

Private Automatic Branch Exchanges (PABX) are usually installed in hotels for providing various kinds of telephone services. The most common building wiring network for this kind of buildings is to provide interconnection facilities between PABX and the external networks of the Network Operators. The responsibilities of the Network Operators are to provide the lines to the interconnect point and direct exchange line services. Access facilities for broadcasting services are similar to those of residential buildings and the general requirements in Section 2 should be followed.

5.1 Cabling Facilities

The requirements of cabling facilities, including lead-in facilities, TBE Room, vertical risers and horizontal distribution facilities, are similar to those of office and commercial buildings. Developers may refer to Table 1 regarding the typical size requirement of the cabling facilities.

6. DWELLING HOUSES

Dwelling house refers to building of not more than 3 storeys and is occupied by one or a few families. The requirements of telecommunications and broadcasting services in dwelling houses are usually small. Developers should co-ordinate with the Network Operators for the building planning so that the required facilities can be determined.

6.1 Lead-in Facilities

Underground lead-in is preferred for new buildings as it will preserve the appearance of the building and its surroundings even though overhead lead-in is acceptable. If underground lead-in duct is provided, it should meet the general requirements as stated in Section 3.1.2. If overhead lead-in cable is provided, it should be provided from the eaves near the external wires, pass through the top of the outside wall and continue inside the house to the telephone socket or TV/FM outlet positions or distribution point. Precautions should always be taken to prevent water from entering the conduit.

For a single house with one owner, two lead-in ducts of minimum 50 mm diameter should be provided and it should be terminated inside the house at suitable location such as the store room under staircase, or the meter room. Sufficient wall space should be available for the distribution point (DP).

For serving several independent units within a single house, a lead-in duct of 100 mm diameter should be provided and a wall space of 500 mm (H) × 400 mm (W) × 200 mm (D) should be available near the lead-in area for the installation of a distribution box. The lead-in duct should be terminated at the common area and the DP should be located in the common area in order not to cause disturbance to the tenants.

In large development project comprising tens or hundreds of villa type houses, a local underground duct network with at least 100 mm diameter ducts should be installed. The underground duct network should be connected to the lead-in duct. Two 50 mm diameter ducts should be provided for connecting the local underground duct network to each of the house and the route should be as straight as possible. Alternatively, separate lead-in ducts with not less than 100mm diameter may be installed along the boundary of the development and two 50mm ducts should be provided for connecting each house. The design of the local underground duct network and the number of lead-in ducts required depend on the scale and overall design of a development. Therefore developers are highly recommended to co-ordinate with the Network Operators for the actual need.

6.2 Internal Wiring Distribution

Suitable conduits should be provided for horizontal distribution. Two minimum 25 mm diameter conduits should be provided from the distribution box to the outlet positions. The conduits should be fully concealed if possible and the route should be as straight as possible, and preferably terminated at skirting level and should have draw wires.

Alternative method of using channelled and removable skirting for running and concealing wires is also acceptable. Adjacent rooms on the same floor may then be connected by short lengths of conduit through the walls at skirting level. Skirting on different floors may also be linked by vertical channels in the wall.

7. INDUSTRIAL BUILDINGS

This category refers to the single block of multi-storey building. Buildings which fall into this category include but not limited to warehouses, factories, manufacturing buildings. It does not include the industrial/office building as it should be treated as office building when cabling facilities are concerned. The general requirements of access facilities in Section 2 should be followed. The requirements of duct sealing in section 3.1.2 should also apply.

7.1 Lead-in Facilities

The requirements depend on the size of the development. Developer should co-ordinate with the Network Operators during the building planning stage.

7.2 TBE Room

In general the TBE Room should comply with the requirements given in Section 2. Developer should co-ordinate with the Network Operators to determine the actual room size and other requirements.

7.3 Vertical Riser

The general requirements of office and commercial buildings should be observed. Due to the large floor area, more risers will be required for shorter cable run to the service points. Telecommunications closet specified in paragraph 2.5.1 should also be provided to accommodate telecommunications or broadcasting equipment, cable terminations, patch panels and associated cross-connection wiring/patching if so required.

7.4 Horizontal Distribution Facilities

Horizontal trunking of 100mm × 100mm (minimum) linking up the risers is required for easy distribution of cables to telephone socket outlets and to provide diversity service.

8. CAMPUS-TYPE BUILDINGS

Buildings which fall into this category include but not limited to Hospitals, Universities, Police and Fire Training Establishments, Prisons and Detention Centres, and Airports. Frequently these types of constructions consist of groups of buildings on one site. A TBE Room may serve some of the buildings. Additional cabling facilities for telecommunications / broadcasting systems are required to serve some larger buildings. Thus, in addition to the distribution of cables inside buildings, the method of cabling between the buildings and the accommodation of equipment within each building must be considered. Developer should co-ordinate with the Network Operators at the building planning stage so that suitable and appropriate cabling facilities can be determined. In addition to the requirements in this Section, the access facilities to be provided should also meet the requirements in Section 2.

8.1 Lead-in Facilities

Lead-in ducts for the cables from the street to each building and cable trunking in building, if applied, are similar to those in office and commercial buildings. Diversified lead-in ducts

are strongly recommended for improving the reliability of services. The requirements of duct sealing in section 3.1.2 should also apply.

8.2 Cabling Between Buildings

If buildings within the campus are required to be linked up, a separate underground duct and distribution network should be provided within the campus. The developer should co-ordinate with the Network Operators at an early stage regarding the requirements for underground ducts.

8.3 TBE Room

In general, the TBE Room should comply with Section 2 as well as the requirements of TBE Room in Section 3.2. Sizes will depend on local requirements and developer should co-ordinate with the Network Operators to determine the actual need.

8.4 Cabling Within Buildings

Different types of buildings within the same campus will have different need and demand for telecommunications and broadcasting services. Developer should co-ordinate with the Network Operators so that suitable and appropriate cabling facilities can be determined for each building.

8.4.1 Vertical Riser

For each building, space near the lead-in is required for installing a distribution box. Vertical riser should be provided for connecting the distribution box to each floor. The size and quantity of risers required will be determined by the anticipated requirements of the individual building. The distance between the distribution box and the telephone socket outlet should be kept as short as possible, and the farthest telephone socket outlet from the distribution box should preferably be within 200 metres. Telecommunications closet specified in paragraph 2.5.1 should also be provided to accommodate telecommunications or broadcasting equipment, cable terminations, patch panels and associated cross-connection wiring/patching if so required.

8.4.2 Horizontal Distribution Facilities

The design of the horizontal distribution facilities for each building depend on the nature and telecommunications and broadcasting services requirements. Developer should co-ordinate with the Network Operators so that suitable and appropriate horizontal distribution facilities can be determined.

9. TELEPHONE SOCKET AND TV/FM OUTLET

9.1 Telephone Sockets

Telephone sockets are used to terminate the telecommunications service cables at the user ends. Normally the socket is wall mounted at skirt level with a concealed conduit linking back to the horizontal distribution ducts and then to the riser ducts. The telephone socket provides direct interface between the public network and the customer premises equipment. The telephone sockets can be provided by the Network Operators or the developers. If they are provided by the developers, they shall conform to HKTA Specification 2011 "Network Connection Specification for Connection of Customer Premises Equipment (CPE) to Direct Exchange Lines (DEL) of the Public Switched Telephone Network (PSTN) in Hong Kong" which is issued by CA and can be downloaded from OFCA homepage at http://www.ofca.gov.hk/.

The Network Operators are allowed to replace the socket provided by the developer or install additional sockets to meet the service demand of the customer. If telephone sockets are not provided by the developers, a plastic cover should be installed by the developers to protect the cables.

9.2 TV/FM Outlet

TV/FM outlets are used to provide the broadcasting signals to the users. It should be installed at the skirt level at appropriate location of the service area. The TV/FM outlet plates are normally provided by the developers. Specially designed TV outlets will be supplied and installed by the pay TV operators when the service is requested.

10. CABLE SPECIFICATIONS AND TESTING

Cables for providing telecommunications services can be provided by the Network Operators or the developers. If the cables are to be provided by the developers, they should comply with the technical specifications given in this Section.

For broadcasting service, if CABD is installed by the developers, all associated cables and connectors should also be provided.

The type of cables required for telecommunications and broadcasting services, in general, includes copper cables, optical fibre cables and coaxial cables.

10.1 Copper Cables

The copper cables should be of unshielded twisted pair (UTP) cables which conform to TIA/EIA 568-B specifications. The cables to be installed for telecommunications services should be Category 3 or above. For horizontal wiring from the horizontal distribution box to the outlet in residential buildings, Category 5 UTP cables with 4-pair wires should be provided and pair number one should be terminated onto the telephone socket. In order to meet the long term demand and the use of future telecommunications services, higher grade cables for vertical wiring may be required.

Star configuration is recommended for the wiring arrangement from the main distribution frame up to the first telephone socket in the respective customer premises. For additional telephone sockets within the same customer premises, it may be extended from the first telephone socket in series configuration. Besides confirming the line mapping, the following tests should be carried out upon completion of the wiring network —

(a) Near End Crosstalk — Crosstalk interference created by cable pairs
(b) Attenuation — Transmission loss

10.2 Optical Cables

It is recommended that multi-mode optical fibre cables should conform to ITU-T Recommendation G.651.1 while single-mode optical fibre cables should conform to ITU-T Recommendation G.652 or ITU-T Recommendation G.657 as appropriate. Their inherent large capacity and interference-free characteristics are suitable for use as the vertical backbone or direct connection to the customer ends that demands high transmission capacity.

Star configuration is recommended for the wiring arrangement up to the respective service points. Suitable types of equipment should be chosen to suit the requirements of the specific types of cables and requirements of the building. If the cables are to be provided by the developer, the developer should co-ordinate with the Network Operators so that suitable optical fibre cables and the installation method can be determined.

The minimum bending radius of optical fibre cable during installation should be 20 times of the cable diameter and the permanent turning radius for an optical fibre cable should at least be 10 times of its diameters.

Attenuation test is required upon completion of the installation of optical fibre cables.

10.3 Coaxial Cables

The coaxial cables to be provided should meet with the following technical requirements —

Nominal impedance :	75 ohms
Attenuation :	not worse than 1.3 dB/10 metres at 100 MHz
	not worse than 1.9 dB/10 metres at 200 MHz
	not worse than 4.6 dB/10 metres at 1000 MHz

The minimum bending radius of the cable during installation should be 20 times of the cable diameter and the permanent turning radius for should at least be 10 times of its diameters.

11. DOCUMENTATION AND RECORD KEEPING

11.1 Information and Record of Cabling Facilities

The developer should maintain an update record of the followings —

(a) layout plan of the TBE Room showing the locations of the lead-in ducts, risers, power points, etc.;
(b) layout plan showing the route of the vertical risers, the lead out point and the sizes;
(c) floor layout plans showing the horizontal distribution ducts, the connection points to the vertical riser, the locations and sizes of distribution boxes, etc.; and
(d) other cabling facilities.

As soon as available, the developer should supply one set of these drawings and their subsequent updates to each of the Network Operators for their planning purpose. After building completion, an up-to-date of the drawings should be kept in the building management office.

11.2 Information of Cabling Network

If the cables are to be provided by the developer, the developer should —

(a) supply a set of wiring network information of the whole development which includes the types of cables used, their connection points, the quantity of cable pairs, etc.;
(b) label all cables for identification and connection in the TBE Room inside the risers, horizontal ducts, distribution boxes and service points; and
(c) maintain an update record of the whole wiring system including their usage, service providers, type of service, etc.

Annex

List of Network Operators
(as at April 2012)

PCCW-HKT Telephone Limited and Hong Kong Telecommunications (HKT) Limited

Manager, Building Access Acquisition
3/F, Lai Chi Kok II Exchange
No. 4 Yuet Lun Street
Lai Chi Kok, Kowloon

Telephone: 2888 5101
Facsimile: 2786 1910

Hutchison Global Communications Limited

Senior Manager
Access Facilities Planning & Implementation
Infrastructure Development
10/F, Hutchison Telecom Tower
99 Cheung Fai Road
Tsing Yi, N.T.

Telephone: 2128 2243
Facsimile: 2133 1665

Wharf T & T Limited

Property Office
11/F, Wharf T&T Square
123 Hoi Bun Road
Kwun Tong, Kowloon

Telephone: 2112 2833
Facsimile: 2112 0622

New World Telecommunications Limited

General Manager, Network Facilities & Support
17/F, Chevalier Commercial Centre
8 Wang Hoi Road
Kowloon Bay, Kowloon

Telephone: 2133 8220
Facsimile: 2133 0903

Hong Kong Cable Television Limited

General Manager, Network Operations
Cable TV Tower
9 Hoi Shing Road
Tsuen Wan, N.T.

Telephone: 2112 5011
Facsimile: 2112 7812

Hong Kong Broadband Network Limited

Building Access Manager
13-16/F, Trans Asia Centre,
18 Kin Hong Street,
Kwai Chung, N.T.

Telephone: 3145 4146
Facsimile: 2199 8213

SmarTone Communications Limited

31/F, JOS Tower, Millennium City 2,
378 Kwun Tong Road,
Kwun Tong, Kowloon

Telephone: 3128 2828
Facsimile: 3128 2266

Towngas Telecommunications Fixed Network Limited

External Plant & Site Acquisition Manager
23/F, 363 Java Road,
North Point, Hong Kong

Telephone: 2963 3666
Facsimile: 2963 3524

ComNet Telecom (HK) Limited

8/F., CITIC Tower,
1 Tim Mei Avenue, Central,
Hong Kong.

Telephone: 2377 8888
Facsimile: 2376 2063

TVB Pay Vision Limited

TVB City, 77 Chun Choi Street,
Tseung Kwan O Industrial Estate,
NT.

Telephone: 2399 9800
Facsimile: 2358 3227

TraxComm Limited

MTR Tower, Telford Plaza,
33 Wai Yip Street,
Kowloon Bay, Kowloon.

Telephone: 2993 8333
Facsimile: 2993 7781

HKC Network Limited

21/F, Wang Cheong Enterprises Centre,
69 Chai Wan Kok Street,
Tsuen Wan, N.T.

Telephone: 2890 7866
Facsimile: 2895 1009

The above list is subject to change. Please contact the In-building Sub-section of OFCA on 8102 4100 for an updated list.

Table 1 – Typical Requirements of Access Facilities for Telecommunications and Broadcasting Services

OFFICE/COMMERCIAL, INDUSTRIAL BUILDINGS AND SHOPPING ARCADES									
Usable floor area, Æ (× 1000 m^2)	Æ ≤ 2	2 <Æ ≤ 4	4< Æ ≤ 12	12 < Æ ≤ 24	24 < Æ ≤ 48	48 < Æ ≤ 72	72 < Æ ≤ 96	96 < Æ ≤ 120	120 < Æ ≤ 144
No. of lead-in duct Inside diameter of lead-in duct (mm)	2 100	3 100	3 100	4 100	4 100	8 100	8 100	8 100	8 100
Area of TBE Room (m^2) Clear Height of TBE Room (m)	0 - 10 -	22 - 28 3	42 - 53 3	51 - 64 3	61 - 77 3	79 - 99 3	88 - 111 3	107 - 134 3	113 - 142 3
Vertical riser (mm) No. of vertical riser slot	100 × 100 2	300 × 200 2	300 × 200 2	400 × 200 2	400 × 200 2	600 × 250 2	650 × 250 2	750 × 250 2	900 × 250 2

RESIDENTIAL BUILDINGS								
No. of flats in a block, N	N ≤ 5	5 < N ≤ 50	50 < N ≤ 100	100 < N ≤ 250	250 < N ≤ 500	500 < N ≤ 750	750 < N ≤ 1000	1000 < N ≤ 1500
No. of lead-in duct Inside diameter of lead-in duct (mm)	2 100	3 100	3 100	3 100	4 100	4 100	4 100	4 100
Area of TBE Room (m^2) Clear Height of TBE Room (m)	0 - 4 -	7 - 9 2.8	21 - 27 2.8	24 - 31 2.8	29 - 37 2.8	39 - 49 2.8	43 - 54 3	48 - 60 3
Vertical riser (mm) No. of vertical riser slot	75 × 75 1	200 × 100 1	200 × 100 1	200 × 200 1	300 × 200 1	300 × 200 2	300 × 200 2	400 × 200 2

HOTELS						
No. of rooms, N	N ≤ 200	200 < N ≤ 400	400 < N ≤ 600	600 < N ≤ 800	800 < N ≤ 1000	1000 < N ≤ 1200
No. of lead-in duct Inside diameter of lead-in duct (mm)	3 100	3 100	3 100	3 100	3 100	3 100
Area of TBE Room (m^2) Clear Height of TBE Room (m)	24 - 30 3	24 - 30 3	26 - 33 3	28 - 36 3	35 - 44 3	37 - 47 3
Vertical riser (mm) No. of vertical riser slot	200 × 200 1	300 × 200 1	300 × 200 2	300 × 200 2	400 × 200 2	400 × 200 2

Note 1 : The definition of "Usable Floor Area" shall have the same meaning as defined in the Building (Planning) Regulations.
Note 2: The maximum non-accountable gross floor area ("GFA") under Building (Planning) Regulations shall be the upper limit of the recommended range.