Imperial College London

Information & Communications Technology
Network Infrastructure Group

Network Infrastructure Standards
January 2018

Appendix C – CWC

Version 1.5

Appendix C – CWC

1.1 Introduction

The international standards defining structured cabling for data systems dictate that the maximum length of a main link cable should not exceed 90m.

When installing UTP cabling systems within buildings, it is therefore necessary to logically divide the building into one or more individual cabling zones. These will be discussed in the topic "Equipment cabinet capacities".

At the heart of each cabling zone is a CWC which contains equipment cabinets providing termination and racking space for cabling, voice, fibre optic and active data equipment services. ***The premise of a cabling zone should ensure that the maximum length of a main link UTP cable should not exceed 90m. Typically it should not be more than 45m away from the furthest point to safely guarantee cable specifications, as allowance is made within this premise for the routing of the cable within both the vertical and horizontal planes***.

As further information, we need to make sure that a single comms room provides access to the space being connected. There will be absolutely no intermixing of sockets from two or more comms rooms into a space on the building. A single comms room will provide connectivity to the spaces and clearly demarcation line/point is to be achieved.

For further information please see "Appendix B – Examples."

1.2 Equipment cabinet capacities

Our initial specifications for every installation are 4 outlets per 11 Square metres or 4 outlets per person in office space, whichever is the greater. Any specific areas (i.e. labs and lecture theatres) will have to be individually evaluated on each occasion according to the occupier's requirements and ICT's expectations and experience.

Over and above this initial requirement there will always be considered a 40% capacity increase for future expansion. This extra capacity is important to the College's infrastructure as it will increase also mechanical and electrical protection to the cables.

Typically, it is possible to terminate 336 in a single cabinet. This figure will change to 480 in high density installations with flat V panels (see Appendix E - Ordering for part information). ***Flat V*** installations are to be made by ***default*** but essential when high density installation is required.

This specification will enable the initial calculations for the number of cabinets needed per floor and therefore the size of the CWC required.

We will go into further detail of the room construction and fit out right after so that spacing and materials can be taken into consideration and a full sizing

exercise can be done.

For further information please see Appendix “B – Examples”.

1.3 Room construction and fit out

Due to the equipment to be installed, there are strict specifications for size and construction of CWCs.

1.3.1 CWC Construction

• Item	• Detail
• Construction	• To provide a minimum 1 hour fire rating. (Imperial College Regulations = 30mins)
• Access	• Access to the CWC must be from a corridor and completely unrestricted.
• Room Height	• Minimum 2.4m throughout. • No raised floor or false ceiling to be installed.
• Wall Covering	• Painted / low dust, anti-static
• Floor covering	• Low dust and Anti-static finish. • No carpets or bare concrete screed will be accepted.
• Wet Services	• No wet services within or running through room. If there are wet services in the vicinity appropriate measures must be taken to prevent water ingress in the room. • Data cables will not run in the same risers as wet services
• Dado Containment	• No dado containment within CWC. All power services to be provided on standard back-boxes (Wall Mounted, Floor or Sub-Floor)
• Door(s)	• As detailed, minimum opening per door 840mm (Width) x 2200mm (Height) • Room designation – CWC XXX, ROOM YYY (where XXX is CWC ID provided by ICT and YYY a room ID provided by Estates). • “Permit to work area” notice.
• Security	• Security will be provided by way of Lenel or Aperio E100 or L100 Access Control and be fitted with an appropriate override cylinder as per the Building Engineering Services Particular Requirements (BESPR’s). • Keypad combination locks shall not be fitted. • A small sign on the inner side of the door will be placed by the lock with the following: “ICT lock. Please do not remove without prior contacting the ICT department.” • Room designation on doors will be CWC XXX (where XXX is a number allocated by ICT) and room number. No further description should be written on the door. Contact ICT for CWC ID information. • When the use of the room deems it applicable, consideration should be given to the installation of an intruder alarm system, monitored in the Security Control room in the Sherfield building.
• Other:	• The room should not be located in a location accessible from the outside through a window. If no other suitable location is found and such solution is sanctioned by ICT some actions should be taken: - Secure the window against external access. - Make the window weatherproof so that: o There is no temperature gain from sun exposure o No water or humidity can ingress o No condensation can accumulate • The room cannot have a door to the outside of the building. • No other accesses to both man and external environmental conditions can be made (i.e. holes or other). • A hard plastic pouch for documents should be placed within the room. • If not already installed, 4 no. J-Hooks to be installed on the wall for patch cables

	storage. . See Appendix E – Ordering for reference. • A data socket will be provided to each of the following services, if presented in the room: - Security - BMS

1.3.2 Power, Light & Temperature

• Item	• Detail
• Electrical:	Each dedicated CWC distribution board shall be fed from an ATS with manual by pass. The supplies to the ATS should be as follows: New Build: each supply should be derived from each section of the main LV panel. Refurb: The supplies to the ATS can be derived from either boards from alternative floors levels within the building or from and adjacent building. Each CWC room shall be provided with a dedicated distribution board, complete with type C miniature circuit breakers (MCB's). The final circuit provision form this distribution board shall be as follows (Note: ICT as referred to below shall mean Imperial College London, Information and Communication Technology Department): Designer and/or contractor: • 2No. 16amp unswitched BS EN 60309-1 (BS 4343) socket outlets per cabinet. (Location to be confirmed by ICT). Socket outlets to be as manufactured by MK Electric, selected from their `Commando` range • 1No. 13amp 2 gang switched socket outlet. (Height and location to be agreed with ICT). • A clean earth bar complete with a test link connection. Number of connections available to equal number of cabinets installed plus an allowance for future cabinets, as agreed with ICT. • All cabinets to have their frame connected to the clean earth bar • All socket outlets to be labelled with a circuit reference. • Warning labels noting the presence of a clean earth system (in accordance with BS 7671). • 1No. 63 amp switched interlocked BS EN 60309-1 (BS 4343) socket outlet to be provided per router location (it is recommended that this supply is served from the distribution board in the CWC room). Socket outlets to be as manufactured by MK Electric, selected from their `Commando` range. • At least 2 to 3No. of the spare ways in the DB should be wired to fused connection units located adjacent to the DB for future connections of equipment's without the need to turn off the DB. • Each cabinet to be provided with 2 no. 16 amp commando-type socket outlets to B EN 60309 on dedicated circuits, to be protected by 16A Type C MCBs. They will be connected to power bars inside cabinets with 12 no. 13 amp sockets (leads to be fed overhead). • 1 no. 63amp commando-type socket to BS EN 60309 per Router Location • During a construction of a CWC power will be installed considering the maximum number of cabinets possible to be installed in the space. • Type B MCBs shall not be used to supply IT equipment. • 1 no. wall-mounted dual 13 Amp switched gang for dirty power requirements, provisioned from standard electrical ring. • All will be labelled with circuit number. • ICT prefers sockets supplying CWCs to be mounted at high level above cabinets where feasible, Where they are not feasible, the wall on the back of the cabinets should be used and the sockets will be placed at height with cables feeding from the top. • Please refer to estates Building Engineering Services Particular Requirements for details. • Commando sockets to be installed on overhead containment.
• Earth:	• High integrity earthing will be supplied as per IEEE 17th edition specifications and Estates Technical Policies Specifications.

• Lighting:	• 500 Lux at floor level, locally switched& Emergency lighting. This will be in line with the Estates BESPR's.

• Item	• Detail
• Temperature:	• Minimum 18 degrees C to Maximum 24 degrees C. To be monitored with a Trend temperature sensor via the BEMS and displayed appropriately on the Trend building management system server. Appropriate alarms are to be generated if the conditions drift from the above mentioned parameters. • An air-conditioning unit should be provided to maintain environment, run and fault signals should be monitored and displayed via the BEMS to ensure good functioning at all times. • The air-conditioning unit will be resettable via the BMS system. • All Air conditioning units should operate 24/7 and be programmed to resume after any failure (either the unit's or power) • On router CWCs a resilient air-conditioning unit should be installed due to location criticality. These are to be controlled / monitored via the BEMS and displayed appropriately on the Trend building management system server. Appropriate alarms are to be generated for fault condition. • Any condensate pumps to be sited outside the CWC. • The alarms will be sent via email to the FM team and to the Network Infrastructure group on ictns-infra-dl@imperial.ac.uk
• Humidity:	• 30% to 60% non-condensing.
• Heat Generation:	• Currently Juniper EX4300-48P switches should be considered http://www.juniper.net/assets/us/en/local/pdf/datasheets/1000467-en.pdf , with . Estimated requirement maximum of 10 units per cabinet should be considered when calculating loads and requirements of the CWC. • In each router location an UPS of 7500VA will have to be considered. Currently APC Smart-UPS RT 7500VA RM 230V.
• Other:	• No heat exchange or other services that might influence room temperature may be within or running through the room. Other than the local CWC Distribution Board (DB) no other DB should be within the room. No water services should be routed in or through the CWC.

1.3.3 Fire Detection & Suppression

• Item	• Detail
• Fire Detection	• Appropriate Fire Detection is to be installed within the room, and connected to the Fire Detection and Alarm System..
• Fire Suppression	• Electrical fire extinguisher outside door (2Kg Co2 extinguisher). • No automated fire suppression to be installed.
• Cable Entries	• All cable entry holes are to be appropriately fire stopped in accordance with the appropriate standards. EZ-paths to be used where possible. • All new CWCs will be fitted with Ez-Path cable routes for data cables. This will be done taking into consideration future capacity for expansion, meaning that on all comms rooms the first installation of EZ-Paths will be sized to enable the installation of cables for the full capacity of the room. This will prevent further drilling and dusty works. Legacy CWCs will be fitted with these when they are part of the building strategy (please contact ICT for information). Ez-Paths are to be installed by accredited Contractors.

1.3.4 Miscellaneous

• Item	• Detail
• Cable Entries	• All cable entry holes to be sleeved.

• Containment	• Minimum 600mm cable tray from room entry point to the cabinet(s).

Note: No active equipment or other will be installed in the CWC without power, security and environmental work being finished and the CWC being protected from any construction site in the vicinity, and even this will be exceptional as rooms and surrounding environment should be completed for delivery.

1.3.5 Sizing

The size of the CWC will be directly linked to the number of floors served, total gross area, number of people using the services, type of CWC and space allocation. (See Appendix B Examples)

Inside of the CWCs there will be cabinets installed with the equipment as described in the specific cabinet installation in "Item 3.0 – Cabinets".

The following sizing rules will be applied:

- All cabinets will be installed in a line
- There will be 1,000mm of free space around the line of cabinets (front, sides and back)
- Consider that each cabinet will be 800Wx1,000D

The types of CWC are:

- ***Standard***; implies that the location will be used for copper cable distribution.
- ***Fibre aggregation***; this implies that this location will be a point to which all standard CWC's link back to (via backbone fibre). The fibre aggregation is usually done in 1 or 2 racks depending on the size of the building and number of CWCs.
- ***Router***; implies a building or core router in the location. For this we will consider an extra cabinet.

They can be more than one type simultaneously. As an example, CWC 42, in SAF, is a standard, fibre (figure 1) and router (figure 2) CWC as it is used to provide copper connection to some areas in the building, it is the location to which all other CWC's connect to and it is where the router is located. *Please note that this installation is a legacy one and the cabinets do not represent current cabinet standards.*

Note: As the CWCs are reduced in number but increase in size it is important to pay special attention to cable route sizing into the rooms and within the rooms.

Figure 1

Figure 2

Because of all of this the placement and sizing of the CWCs is quite important. In this and in other areas of the standards we need to comply with a 40% capacity to increase.

1.4 Construction

- All cabinets should be of 42u with 800x1,000mm footprint;
- The cabinet should be earth bonded in accordance with IEE 17th Edition. All doors and side panels (when needed) should have earth straps connected;
- An open space in lieu of one of the top panels for top entry;
- A cabinet baying kit to facilitate the baying together of multiple cabinets;
- Front and rear adjustable rails for equipment, providing standard 19" rack mounting. (The front rails should be recessed by 120mm)
- One no. vertical cable basket installed in each side of the rear of the cabinet to facilitate cable looming and routing to patch / termination panels

1.5 Labelling

Each equipment cabinet should be labelled with ICT's CWC identification code in the format "CWC xxx Cabinet yyy" where xxx is the CWC number and yyy is the local cabinet designation A, B or C etc where multiple cabinets exist (or may exist) in the same CWC.

The picture on the left shows labelling done on the door with CWC ID and cabinet ID. The one on the right Shows CWC ID on the cabinet frame with 'traffolyte' type laser engraved label (only cabinet ID is missing).

All cabinets will be labelled as per right picture (adding the cabinet ID) and, as an optional, the same information can be placed on the door (minus the slash) as per left picture.

1.6 Patch Cable Management

The College has been installing "traditional" flat panels which are 24 way Unscreened (1U) (for part code, see appendix E – Ordering). In this configuration, the management implementation should be as below:

- A minimum of 40 no. vertical cable management twist and lock arms per 42u Cabinet;
- One no. 1u horizontal cable management bar following each 4u of fibre patch panels;
- One no. 1u horizontal cable management bar following each 2u (48 ports) of UTP patch panels;
- One no. 1u horizontal cable management bar following each 1u (48 ports) active data switch;
-
- One no. 1u horizontal cable management bar before each fibre tray, UTP and voice panels and active equipment;

Note: A total of 16 horizontal management bars will be provided for the cabinets as represented in the standard cabinet elevation drawing.

In the new cabinets a different configuration is sought so that greater densities are achieved.

In new installations, the College will be installing Flat V panels 24 way Unscreened (1U 24) (for part code, see appendix E – Ordering). In this configuration, the management implementation should be as bellow:

- A minimum of 40 no. vertical cable management rings per 42u Cabinet;

- One no. 1u horizontal cable management bar following each 4u of fibre patch panels;
- One no. 1u horizontal cable management bar following each 1u (48 ports) active data switch;
-
- One no. 1u horizontal cable management bar before each fibre tray, UTP and voice panels and active equipment;
- Full vertical management 19-inch mounting angles on new cabinets earmarked for flat V panels or Panduit cable management fingers (see Appendix E – Ordering).

Note: When retro-fitting flat V panels on the cabinets with the Panduit vertical management (see Appendix E – Ordering) please note that these should only be fitted where copper panels have been installed and never with the active devices.

Note: A total of 10 horizontal management bars will be provided for the cabinets as represented in the standard cabinet elevation drawing. Please contact ICT for drawings.

Typical cabinet elevation drawings:

Standard Cabinet Layouts

High Density Cabinet (480 ports)	Conventional cabinet (336 ports)
Fibre Presentation	Fibre Presentation
Switch	Fibre Presentation
Horizontal Management	Horizontal Management
Switch	Switch
Horizontal Management	Horizontal Management
Switch	Switch
Horizontal Management	Horizontal Management
Switch	Switch
Horizontal Management	Horizontal Management
Switch	Switch
Horizontal Management	Horizontal Management
Switch	Switch
Horizontal Management	Horizontal Management
Switch	Switch
Horizontal Management	Horizontal Management
Switch	Switch
Horizontal Management	Horizontal Management
Switch	Horizontal Management
Horizontal Management	copper patch panel
Switch	copper patch panel
Horizontal Management	Horizontal Management
24 pair Flat V patch panel	copper patch panel
24 pair Flat V patch panel	copper patch panel
24 pair Flat V patch panel	Horizontal Management
24 pair Flat V patch panel	copper patch panel
24 pair Flat V patch panel	copper patch panel
24 pair Flat V patch panel	Horizontal Management
24 pair Flat V patch panel	copper patch panel
24 pair Flat V patch panel	copper patch panel
24 pair Flat V patch panel	Horizontal Management
24 pair Flat V patch panel	copper patch panel
24 pair Flat V patch panel	copper patch panel
24 pair Flat V patch panel	Horizontal Management
24 pair Flat V patch panel	copper patch panel
24 pair Flat V patch panel	copper patch panel
24 pair Flat V patch panel	Horizontal Management
24 pair Flat V patch panel	copper patch panel
24 pair Flat V patch panel	copper patch panel
24 pair Flat V patch panel	Horizontal Management
24 pair Flat V patch panel	Voice
24 pair Flat V patch panel	Voice
Voice	Horizontal Management

1.7 Miscellaneous

- The room must be cleaned prior to handover. Any subsequent work will imply cleaning the CWC.

1.8 Intake Rooms

Every intake room will be the handover point for Telco operators. This will be for both fibre and copper.

Each of these rooms will have to include the following:

- One 13amp power outlet.
- Lighting as per current College Standards

It will have to be sized to include a:

- Corning Centrix ODF (See appendix E – Ordering).
- Krone 108a frame

Corning Centrix Frame

Krone 108a Frame

There needs to be some space for puling fibre from ducts and done in a way that no water or other debris will be falling on top of the cabinet and frame from the ducts whilst puling fibre and multipair copper cabling.

Also care needs to be taken that the fibre and copper multicore are to be pulled within acceptable bend radius to the cabinets, and frame, within the intake room.

1.9 Completion documentation

For each new cabinet a Contractor should provide the following information in printed and electronic format;

- A schematic in Visio or AutoCAD depicting the 'As installed' cabinet layout (to be placed on the CWC hard plastic pouch as per construction details and delivered in digital format);
- Digital photographs of the front, side and rear of the cabinet;
- Digital photographs of the area to both sides, the rear and above the cabinet;
- A certificate confirming that the cabinet has been electrically tested and that installation complies with IEE 17th Edition (to be placed on the cabinet wallet and delivered in digital format);

Following subsequent installation of cabling or active equipment within the cabinet, or any amendments to the layout, the completion documentation should be updated by ICT or the cabling Contractor and re-issued, as required.