

Unit 33: Communications Equipment Installation Techniques

Unit code: A/502/3411
QCF Level 3: BTEC Specialist
Credit value: 9
Guided learning hours: 60

Aim and purpose

This unit will give learners an understanding of the operational activities and techniques used by technicians in the communications industries for the installation of new or replacement communications equipment.

Unit introduction

The unit will introduce learners to the planning processes that are required for the installation of communications technology equipment. Learners will practise installing racks, cabinets and associated overhead cable trays and iron work and will learn how to install communications equipment into racks/cabinets. This will include installing and terminating cable links to communications technology equipment and the use of various types of copper and optical fibre cables.

Learners will use manufacturers' diagrams, data sheets and performance specifications to ensure that the installation of the equipment meets the full performance specification. Learners will also apply current legislation, codes of practice and safety precautions related to the installation of communications technology equipment.

Learning outcomes and assessment criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit.

On completion of this unit a learner should:

Learning outcomes	Assessment criteria
1 Know how to plan for the safe installation of communications technology equipment	1.1 describe how to use site information and installation diagrams to plan for the installation of a housing for communications technology equipment 1.2 identify and state the health and safety issues that will apply to the installation of given communications technology equipment
2 Be able to survey, prepare and install housing for communications technology equipment	2.1 survey and use diagrams and plans to prepare an area for the installation of racks, cabinets and overhead ironwork
3 Be able to equip communications technology equipment housing using safe working practices	3.1 install and secure a rack or cabinet and overhead ironwork to specification with the aid of a site plan and other drawings 3.2 use diagrams and plans to prepare one rack or cabinet for the installation of telecommunications equipment
4 Be able to install and terminate cable links to communications technology	4.1 use safe working practices to install three items of communications technology equipment into racks or cabinets 4.2 install and terminate two different types of cables using appropriate tools

Unit content

1 Know how to plan for the safe installation of communications technology equipment

Planning for installation: site construction properties eg walls/flooring/ceilings; diagrams and plans eg site plans, floor plans, equipment layouts (floor mounted racks and wall mounted cabinets), facia layouts, schematics, wiring diagrams; preparation procedures eg example work schedules and parts lists; environmental conditions to be taken into account eg high and low temperature, humidity, airflow and local hazards; routing of cables in order to minimise potential interference problems; types of cable required for connecting to equipment to be installed; types of cable connectors and terminations; hand-tools to be used eg screwdrivers, spanners, pliers, grips, wrenches, socket sets, hammers, chisels, spirit level, tape measure, callipers, plumb lines, pipe locators, saws, power tools, isolation transformer, files, wire cutters, wire strippers, continuity testers

Health and safety: relevant legislation and codes of practice that apply to the installation of communications technology equipment eg Health and Safety at Work Act, Institute of Electrical Engineers (IEE) Wiring Regulations, Control of Substances Hazardous to Health (COSHH), Electromagnetic Compatibility (EMC) – radiation and susceptibility; safety procedures eg 'permit to work' systems, safety equipment (helmets, goggles, shoes, gloves, harnesses)

2 Be able to survey, prepare and install housing for communications technology equipment

Preparation of installation area: use of diagrams and plans eg floor plans, mounting specifications, facia layouts, schematics and wiring diagrams; overhead and/or under floor routing of cable eg cable trays, ducts, conduit; survey of physical aspects of the site eg construction of walls/flooring/ceilings; under floor and overhead routes for access; potential hazards; marking-out installation area eg use of 3:4:5 triangle technique, datum and plumb lines; use of tools eg tape measure, rule, calliper, spirit level, plumb line, square, scribe, centre punch; safe-working practices eg assessment of potential hazards, safe lifting procedures eg hoists and slings for the installation of overhead ironwork/cable trays, checking electrical hand tools for safe operation

Installing and securing racks and cabinets: construction of racks/cabinets; securing of racks/cabinets/overheads to load bearing structures eg racks to floor and cabinets to walls; types of fastenings eg cage nuts/bolts, cavity fixings, expansion bolts and plugs, Rawl bolts, shield anchors, thru-bolts, masonry anchor bolts; quality control eg ensuring that the installation meets specification and is fit for purpose; use of facial layout/drawings to aid equipment installation

3 Be able to equip communications technology equipment housing using safe working practices

Preparation of rack/cabinet for equipment installation: working procedures eg determine job specification and consult relevant installation manuals, interpret given diagrams and plans (facia layouts, schematics and wiring diagrams); select appropriate hand-tools eg screwdrivers, spanners, wrenches, socket sets

Installation of telecommunications equipment: position and mount equipment eg use of plans, parts lists and tools; install cable runs; quality control eg installation meets specification, equipment secure and safe; safe-working practices eg awareness of potential hazards, permit to work procedures (where applicable), personal and protective equipment (safety helmets, goggles, shoes, gloves, harnesses), use of earthing sticks

4 Be able to install and terminate cable links to communications technology equipment

Cable installation: types of cables (unshielded twisted pair (UTP), shielded twisted pair (STP), coaxial cables, multi-core cable, power cables, optical fibre); routing of cables eg run-out lists, route links to the equipment, and connection points according to the installation plan; minimisation of interference problems and cross-talk; cable colour codes; tools eg cable jacks, butting tools, stripping machine/hand stripping tools, continuity tester; installing and securing links between equipment in appropriate conduits and/or cable trays; the use of cable clips; use of cable ties and lashing; cable identification and labelling; ensure that installation meets specification

Cable terminations: types of cable terminations and connectors (unshielded twisted pair (UTP), shielded twisted pair (STP), coaxial cables, multi-core cable, power cables, optical fibre); connection methods eg soldering techniques, crimp, wire wrap and Krone block termination, optical fibre cable connectors; safe working procedures eg knowledge of static hazards; accurately label installed links; updating of records, plans and drawings

Essential guidance for tutors

Delivery

Delivery of this unit should concentrate on the practical application of installation techniques/skills. As a result, it is important to allocate sufficient 'hands-on' time in order to develop the relevant skills and understanding.

Learning outcome 1 is likely to be best achieved with the aid of case studies showing real telecommunications installations, such as a typical small switch in a company, a mobile radio base station, an item of exchange equipment, cellular antenna, or similar installation. This will provide an ideal opportunity for an industrial or site visit to a local installation.

During the delivery of this learning outcome, learners should be given opportunities to consider how to deal with a range of possible site construction properties (eg walls/flooring/ceilings) and work from a variety of diagrams and plans. It is expected that learners will examine both floor-mounted racks and wall-mounted cabinets and their appropriate preparation procedures. Environmental conditions for installations need to be taken into account and the correct routing of cables, to minimise potential interference problems, also need to be considered.

Learners also need to experience as wide a range of cable types, cable connectors and terminations as possible together with relevant hand-tools to be used for an installation. Health, safety and relevant legislation should be a recurrent theme throughout.

Learners are expected to develop the relevant practical skills during the delivery of learning outcomes 2, 3 and 4. They should be able to interpret and work with the relevant plans and diagrams so that they can position and fix racks, cabinets and ancillary equipment in a safe manner.

Appropriate attention must be given to health, safety and welfare arrangements throughout. Wherever possible, a learner centred approach should be adopted.

Opportunities to experience a range of installations, discuss and reflect upon practical activities should be given to learners to help them improve their skills development.

The delivery of this unit can be significantly enhanced if centres can develop links with employers. Such links are important in that they can ensure that the work related activities used for both delivery and assessment are relevant, realistic and address current industry needs.

Note that the use of 'eg' in the content is to give an indication and illustration of the breadth and depth of the area or topic. As such, not all content that follows an 'eg' needs to be taught or assessed.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments. The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
<p>Introduction to the unit</p>
<p>Know how to plan for the safe installation of communications technology equipment:</p> <ul style="list-style-type: none"> • whole-class exercise – tutor presentation on installation planning, followed by individual exercises and case studies • whole-class exercise – tutor presentation on health and safety, risks and precautions associated with installation work • individual exercise – directed research into safety equipment and tools • individual exercise – directed research into current legislation.
<p>Assignment 1 - Planning for the task</p>
<p>Be able to survey, prepare and install housing for communications technology equipment:</p> <ul style="list-style-type: none"> • whole-class exercise – tutor presentation on safe working practices • whole-class exercise – tutor presentation on preparation and interpretation of diagrams, plans and other relevant documentation, followed by practical exercises • whole-class exercise – tutor presentation on surveying and marking out work areas, followed by practical exercises • whole-class exercise – tutor presentation on quality control • whole-class exercise – tutor presentation on construction and installation of racks and cabinets, followed by practical exercises • a mixture of directed learning and practical exercises, with access to practical resources and suitable technology.

Topic and suggested assignments/activities and/assessment
Assignment 2 - Preparing the work area
<p>Be able to equip communications technology equipment housing using safe working practices:</p> <ul style="list-style-type: none"> • whole-class exercise – tutor presentation on safe working practices • whole-class exercise – tutor presentation on working procedures • whole-class exercise – tutor presentation on installation of equipment and cables, followed by practical exercises • a mixture of directed learning and practical exercises, with access to practical resources and suitable technology.
Assignment 3 - The installation
<p>Be able to install and terminate cable links to communications technology:</p> <ul style="list-style-type: none"> • whole-class exercise – tutor presentation on safe working practices • whole-class exercise – tutor presentation on cable types • whole-class exercise – tutor presentation on cable routing, followed by practical exercises • whole-class exercise – tutor presentation on cable termination and testing, followed by practical exercises • whole-class exercise – tutor presentation on cable installation and testing, followed by practical exercises • a mixture of directed learning and practical exercises, with access to practical resources and suitable technology.
Assignment 3 - The installation

Assessment

A large part of the assessment for this unit will be through tutor observation and oral questioning. Learners will also need to produce evidence that they have a clear understanding of the skills and techniques required for installing telecommunications equipment. Such evidence may be in the form of a technicians' logbook/installation record, which could contain a record of all the work carried out, witness statements, diagrams and annotated photographs. It should include evidence of all relevant installation skills and techniques both on-site and off-site, and show that they can work safely with appropriate tools and equipment.

Because of the interrelationship of the learning outcomes and their respective criteria, a coherent approach to assessment is recommended. This could take the form of an extended project that takes learners through from planning to installation.

To achieve the unit however, learners need only work to a given plan since, for 1.1, they are only required to describe how to use site information and installation diagrams to plan for the installation. From this point forward, all the next steps of the extended project can be linked through the actual installation and would be able to cover the remaining criteria (1.2–4.2). Centres would need to take care that the project covered the requirements of all the criteria and related content.

The following guidance is intended to provide further information, at criterion level, which could be of value with the assessment approach suggested above or any other approach to assessment. The first two pass criteria (1.1 and 1.2) relate to the first learning outcome. In order to achieve 1.1, learners should provide evidence that they are able to describe how to use site information and installation diagrams to plan for the installation of communications technology equipment. It is expected that the equipment should include at least three of the following — racks, cabinets, overhead ironwork, cables and cable terminations. Learners need to be able to show that their plan has taken into account the physical construction of the site (walls/flooring/ceilings etc), under floor and overhead cable routes and potential hazards. Tutors may wish to set the context for this activity by providing a suitable case study.

In order to achieve 1.2, learners be able to state the relevant legislation and codes of practice that apply to the installation of communications technology equipment. They should be able to clearly identify how these issues relate to the installation of communications technology equipment. In addition, learners should consider and identify the relevant safety procedures.

For 2.1 learners are expected to be able to prepare the work area and make it ready for the installation of an equipment rack, cabinet and the associated ironwork. Again, a typical case that includes outline plans may provide a useful context for this activity, which could be provided by the tutor. The case study/plans could include details of the building layout in which the installation is to take place and details of the communications technology equipment to be installed.

Learners should take into account the issues listed in the contents section of this unit. In order to achieve 3.1, learners are expected to carry out the safe installation of an equipment rack (or cabinet) and the associated ironwork. This activity may be best achieved by making it an extension of the case study prepared for 2.1. Learners are expected to be able to select fixings and hand tools that are appropriate for the set task from those listed in the contents section of this unit.

In order to achieve 3.2 learners are expected to prepare the equipment rack or cabinet for the installation of communications technology equipment. This activity will also involve the running of cables to interconnect the equipment to be installed.

If desired this activity can be set in context by providing learners with an appropriate case study. In order to achieve 4.1 learners are required to carry out the installation of equipment into the racks or cabinet that they have prepared for 3.2. Three different items of communications technology equipment should be installed in the housing. Learners must work safely and be aware of all potential hazards in order to minimise risk.

To achieve 4.2, learners need to fully install at least two differing types of communications cable. If desired, these could be two of the cables that are required in the activity for 3.2 and 4.1. The selected cables should be fully identified, labelled and secured. The ends of the cables should be stripped, prepared and terminated with appropriate connectors or terminals.

It should be noted that technical drawing skills are not being assessed in this unit. Where learners prepare their own plans they can be in sketch form, although those who have the necessary skills in computer aided drawing (CAD) can use them to good effect here. Evidence from the workplace could also be incorporated provided that this evidence is appropriate and authenticated as the learner's own work

Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass criteria in the outcomes and assessment grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment methods
1.1, 1.2	Planning for the task	You are required to install some equipment housing. Working from the documents provided, produce a plan for the work. The plan must state, and take account of, any health and safety issues that might affect the work.	Witness statements. Observation records. Activity log. Report Presentation.
2.1	Preparing the work area	Your plan has been approved. Working from your plan, prepare the installation area. Write a short report to add to the plan, explaining the work that has been done.	Witness statements. Observation records. Activity log. Report.
3.1, 3.2 4.1, 4.2	The installation	Working from the plan, you must now: <ul style="list-style-type: none"> install the required racks and / or cabinets prepare them for the installation of the required communications technology equipment run, terminate and link the appropriate cables. Make notes as you perform the work and write a short report explaining the work that has been done.	Witness statements. Observation records. Activity log. Report.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC in IT sector suite. This unit has particular links with:

Level 1	Level 2	Level 3
	Systems Architecture	Systems Architecture
	Setting up an IT Network	Networking Principles
	Networking Principles	Computer Networks
	An Introduction to Communication Technologies	Core Network Techniques
		Telephony Voice Systems Operation
		Telecommunication Systems

This unit maps to some of the underpinning knowledge from the following areas of competence in the Level 3 National Occupational Standards for IT (ProCom):

- 4.7 Systems Design
- 5.1 Systems Development
- 5.3 IT/Technology Solution Testing.

Essential resources

Centres delivering this unit should have sufficient physical resources and work areas to support the range of practical activities outlined above. In particular, learners must have sufficient access to a range of equipment housing materials to include racks, cabinets, cable trays, conduit, communications cabling and tools.

Learners will also need to be provided with access to relevant legislation and codes of practice, reference data and manufacturers’ product information. Centres will also need to ensure that learners have the use of relevant safety equipment.

Indicative reading for learners

Textbooks

Dodd AZ – *The Essential Guide to Telecommunications, 4th edition* (Prentice Hall, 2005)
ISBN-10 0131487256, ISBN-13 978-0131487253

Hallberg B – *Networking: A Beginner's Guide, 5th Edition* (Osborne/McGraw-Hill US, 2009)
ISBN-10 0071633553, ISBN-13 978-0071633550

Lowe D – *Networking All-in-One Desk Reference for Dummies, 3rd Edition*
(John Wiley & Sons, 2008) ISBN-10 0470179155, ISBN-13 978-0470179154

Schiller J – *Mobile communications, 2nd Edition* (Addison Wesley, 2003)
ISBN-10 0321123816, ISBN-13 978-0321123817

Websites

www.howstuffworks.com

www.webopedia.com

Functional Skills – Level 2

Skill	When learners are ...
ICT - Using ICT	
Plan solutions to complex tasks by analysing the necessary stages	surveying and using diagrams and plans to prepare an area for the installation of racks, cabinets and overhead ironwork using diagrams and plans to prepare one rack or cabinet for the installation of telecommunications equipment
Select, interact with and use ICT systems safely and securely for a complex task in non-routine and unfamiliar contexts	installing and securing a rack or cabinet
ICT - Finding and selecting information	
Use appropriate search techniques to locate and select relevant information	explaining the health and safety issues that applies to communications technology equipment.