DCIC - Data Cabling Installer Certification Program – 2007

CATEGORIES LIST for DCIC
The following list identifies the major **categories** of knowledge and skills that the data cabling installer must acquire. Certification **test questions**, both written and manual, are based on the individual subjects contained in the **Items List**, from which the verbalized **Competencies** are evolved.

1. **Basic Electricity & Safety**
2. **Data Communications Basics**
3. **Definitions, Symbols and Abbreviations**
4. **Cable Construction and Types**
5. **Cable Performance Characteristics**
6. **Cabling Standards**
7. **Basic Network Topologies**
8. **Basic Network Architectures**
9. **National Electric Code**
10. **Cabling System Components**
11. **DCIC Installation tools**
12. **Connectors and Outlets**
13. **Cabling System Design**
14. **Cabling Installation**
15. **Connector Installation**
16. **Cabling Testing and Certification**
17. **Cabling Troubleshooting**
18. **Documentation**

DCIC ITEMS LISTING 2007 - ETA International

The DCIC ITEMS listing is an exhaustive list that should include every item upon which the student should be trained and upon which the student is likely to be tested. Only the topic name is listed. What the student or examinee is expected to be able to do with the topic is explained in the Competencies Listing.

1.0 Basic Electricity & Safety
- 1.1 Voltage, Current, Resistance, Power
- 1.2 Cabling resistances
- 1.3 Ohms Law
- 1.4 Noise in cabling systems
- 1.5 Impedance
- 1.6 Signal to Noise relationships
- 1.7 Reactance
- 1.8 Grounding
- 1.9 Wire size requirements
- 1.10 Wiring insulation
- 1.11 AC & DC circuits

2.0 Data Communications Basics
- 2.1 Telephone history
- 2.2 Telephone circuits
- 2.3 Analog/digital transmission
- 2.4 Transfer modes and speeds

3.0 Definitions, Symbols and Abbreviations
- 3.1 Audio/Video/Radio RF frequencies
- 3.2 Bandwidth
- 3.3 Bit rate and Baud rate
- 3.4 Decibels, history and usage
- 3.5 Decibel/voltage-level conversion
- 3.6 Decibel gain/loss conversion
- 3.7 Attenuation
- 3.8 Crosstalk
- 3.9 Basic link. UTP, NEXT and other terms

4.0 **Cable Construction and Types**
- 4.1 Electrical wiring, coaxial cable, 150 ohm shielded twisted pair (STP), 4-pair untwisted pair (UTP)
- 4.2 Coaxial cable usage
- 4.3 Cat 1, 2, 3, 4, 5, 5e and 6 telephone data cabling types

5.0 Cable Performance Characteristics
- 5.1 Twisted pair cabling electrical characteristics
- 5.2 Coaxial cable electrical characteristics
- 5.3 Performance characteristics of coaxial and TP cables

6.0 National Electrical Code and Communications Standards
- 6.1 Purpose and requirements of standards:
  - 6.1.1 ANSI/TIA/EIA 568A
  - 6.1.2 ANSI/TIA/EIA 569A
  - 6.1.3 ANSI/TIA/EIA 607; CSA T527, C22.1; NFPA 70
  - 6.1.3 ANSI/TIA/EIA 570A (Residential Telecom cabling standard)
  - 6.1.4 ISO/IEC 11801

7.0 Basic Network Topologies

7.1 Star
7.2 Bus
7.3 Ring
7.4 Topologies advantages

8.0 Basic Network Architectures
8.1 Ethernet
8.2 Token Ring
8.3 ATM
8.4 100VG-Any LAN

9.0 National Electrical Code – NEC & UL Requirements
9.1 Purposes and requirements of:
9.1.1 Chapter 1 – General Requirements
9.1.2 Chapter 2 – Wiring Protection
9.1.3 Chapter 3 – Wiring Methods and Materials
9.1.4 Chapter 5 – Special Occupancy Requirements
9.1.5 Chapter 7 – Special Conditions Requirements
9.1.6 Chapter 8 – Communications systems wiring
9.1.7 UL 1863 and EIA/TIA 606 standards

10.0 Cabling System Components
10.1 Horizontal and Backbone Cables
10.2 Patch cords
10.3 Pathways
10.4 Wiring Closets
10.5 MDF and IDF, Punch-down blocks
10.6 Telecom power sources

11.0 Data Cabling Installation Tools
11.1 Wire strippers
11.2 Wire cutters and Prep tools
11.3 Twisted Pair and Coaxial crimpers
11.4 Punch Town tool
11.5 Fish tape and 'pulling' devices

12.0 Connectors and Outlets
12.1 Plug and Jack numbering
12.2 Coaxial plugs, splices, jacks numbering
12.3 Wall plates
12.4 Modular wall plates
12.5 Biscuit jacks; floor telecom outlets
12.6 Cable splitters
12.7 Junction boxes

13.0 Cabling System Design
13.1 Cable topology block diagram
13.2 Telecommunications Closet wiring
13.3 'Cabling Management', outlet placement and design

14.0 Cabling Installation
14.1 Installation steps
14.2 Cable pulling tensions and Bend Ratio; aerial construction; underground and duct; plenums
14.3 Cable 'Dressing' and securing
14.4 Wire map and labeling
14.5 Stripping

14.6 OSHA height regulations
14.7 Underground installation safety precautions
14.8 CAM splice

15.0 Connector Installation
15.1 Twisted pair connector
15.2 Coaxial cable connectors
15.3 Color code for telecom cables and pin/pair assignments
15.4 Installation ducts

16.0 Cabling Testing and Certification
16.1 Installation testing purpose
16.2 Cable plant certification
16.3 Testing tools and equipment

17.0 **Cabling Troubleshooting**
17.1 Testing and repairing Baseline
17.2 Locating defects
17.3 Common cable problems/resolutions
17.4 Cross talk – florescent lighting
17.5 Loop testing
17.6 Radio detectors – interference

18.0 **Documentation**
18.1 Purpose of documentation
18.2 Ingredients of installation documents
18.3 Preparing sample standard document

ETA Competency Requirements—2007
Certified Data Cabling Installer - DCIC

Data cabling installers are expected to obtain knowledge of basic concepts of copper cabling installation and service, which are then applicable to all the functions required to safely and competently install communications cabling. Once a CDCI has acquired these skills, abilities and knowledge, he or she should be able to enter employment in the telecommunications cabling field. With minimal training in areas unique to the special requirements of individual products or systems designs, the Data Cabling Installer should become a profitable and efficient part of the workforce.

Data Cabling Installers must be knowledgeable and have abilities in the following technical areas:

1.0 BASIC ELECTRICITY

- 1.1 Describe the relationships between voltage, current, resistance and power.
- 1.2 Identify components called resistors and also non-component types of resistance in cabling technology.
- 1.3 Use ohms law to calculate power usage and power losses in cabling circuits
- 1.4 Explain how noise may be generated onto communications cabling and components.
- 1.5 Define impedance and compare impedance with resistance
- 1.6 Explain Signal-to-Noise Ratio
- 1.7 Explain the difference between inductance and inductive reactance; capacitance and capacitive reactance
- 1.8 Explain the importance of grounding cabling and electronics communications products
- 1.9 Identify wire sizes needed for grounding
- 1.10 Describe the types of conductor insulation used for communications wiring
- 1.11 Explain the difference between AC and DC circuits

2.0 DATA COMMUNICATIONS BASICS

- 2.1 Provide a brief history of telephone and wireless communications
- 2.2 Draw a simple diagram of a basic telephone system
- 2.3 Describe the differences between analog and digital communications signals
- 2.4 Define 'Transfer mode' and explain 'Transfer Speeds'

3.0 DEFINITIONS, SYMBOLS AND ABBREVIATIONS

- 3.1 Define audio and radio or RF frequencies
- 3.2 Explain the term 'Bandwidth'
- 3.3 Explain the difference between frequency, bit rate and baud
- 3.4 Trace the history of the BEL and decibel and explain how and why these terms are used
- 3.5 Convert signals from voltage levels to their corresponding decibel equivalents and decibel levels to their corresponding voltage or current levels
- 3.6 Convert signal gains or losses to comparative decibel readings
- 3.7 Define 'Attenuation'
- 3.8 Define 'Crosstalk' and explain how it occurs in communications cabling
- 3.9 Define 'Basic Link', UTP, NEXT and other common telco terms

4.0 CABLE CONSTRUCTION

- 4.1 Explain the differences between electrical power wiring, 22 AWG twisted-pair telephone wiring; coaxial and fiber optics cables - 150 ohm shielded (STP); 4 pair 100 Ohm UTP
- 4.2 Describe coaxial cable and explain where it is normally the choice
- 4.3 Describe the differences between CAT 1, 2, 3, 4, 5, 5e and 6 telephone-data cables

5.0 CABLE PERFORMANCE CHARACTERISTICS

- 5.1 Explain the electrical characteristics of twisted pair cabling
- 5.2 Explain the electrical characteristics of coaxial cable
- 5.3 Explain the performance characteristics of twisted pair and coaxial cables

6.0 CABLING STANDARDS

6.1 Explain the purpose and basic requirements of the following standards:

- 6.1.1 ANSI/TIA/EIA-568A
- 6.1.2 ANSI/TIA/EIA-569A
- 6.1.3 ANSI/TIA/EIA-607. Also CSA T527 and C22.1. Also NFPA 70
- 6.1.4 ANSI/TIA/EIA-570A (Residential telecom cabling standard)
- 6.1.5 ISO/IEC 11801

7.0 BASIC NETWORK TOPOLOGIES

- 7.1 Draw a block diagram of a computer network using STAR topology
- 7.2 Draw a block diagram of a computer network using BUS topology
- 7.3 Draw a block diagram of a computer network using RING topology
- 7.4 Explain an advantage of each type of topology

8.0 BASIC NETWORK ARCHITECTURES

- 8.1 Describe a network using Ethernet
- 8.2 Describe how a TOKEN RING network operates
- 8.3 Define ATM
- 8.4 Describe 100VG-Any LAN

9.0 NATIONAL ELECTRIC CODE - NEC and UL requirements

.9.1 Explain the purpose and requirements for the following NEC code chapters

- 9.1.1 Chapter 1 - General Requirements
- 9.1.2 Chapter 2 - Wiring Protection
- 9.1.3 Chapter 3 - Wiring Methods and Materials
- 9.1.4 Chapter 5 - Special Occupancy Requirements
- 9.1.5 Chapter 7 - Special Conditions Requirements

9.1.6 Chapter 8 - Communications Systems wiring

9.1.7 Explain UL 1863; Explain EIA/TIA 606 standard

10.0 CABLING SYSTEM COMPONENTS

- 10.1 Describe Horizontal and Backbone Cables
- 10.2 Explain why patch cords are used and describe them
- 10.3 Explain the differences between the various segments of cabling Pathways
- 10.4 Describe the purpose, construction and usage of communications wiring closets
- 10.5 Define MDF and IDF. Define 'punch down block'
- 10.6 Compare power sources for telephone-data cabling equipment

11.0 DCIC INSTALLATION TOOLS

- 11.1 Explain the purpose and proper usage of wire strippers
- 11.2 Show how wire cutters and cable 'prep' tools are used
- 11.3 Demonstrate the proper methods of using cable crimpers (TP and Coaxial)
- 11.4 Describe a 'punch-down' tool, show where it is used and how it is used
- 11.5 Explain the purpose and proper use of 'fish tape' and 'pull' devices

12.0 CONNNECTORS AND OUTLETS

- 12.1 List the proper identification number for twisted pair plugs and jacks
- 12.2 List the proper identification numbers for coaxial cable plugs, splices and jacks
- 12.3 Describe Fixed Design Wall Plates and explain where they are used
- 12.4 Describe a Modular Wall Plate, why and where it is used
- 12.5 Describe a 'biscuit jack' and why it is used. Describe a floor telecom outlet
- 12.6 Describe a cable splitter
- 12.7 Describe a cable junction box

13.0 CABLING SYSTEM DESIGN

13.1 Draw a block diagram showing a cabling topology
13.2 Describe how the telecommunications closet is wired
13.3 Explain the concept of 'cabling management' and proper outlet placement and requirements

14.0 CABLING INSTALLATION

14.1 Describe the steps used in installing communications cabling
14.2 Explain cable stress and the precautions for aerial construction; underground and ducts and plenum installation; define pulling tension and 'bend radius'
14.3 Describe cabling dressing and methods of securing cabling
14.4 Explain proper labeling of cables and what a wire map is
14.5 Demonstrate proper cable stripping
14.6 Explain the purpose of and requirements for OSHA height regulations
14.7 Explain safety precautions for underground construction
14.8 Explain what a CAM splice is

15.0 CONNECTOR INSTALLATION

15.1 Demonstrate proper installation of twisted pair connectors
15.2 Demonstrate proper installation of coaxial cable connectors
15.3 Describe the color code for telecom cabling and the pin/pair assignments
15.4 Explain how ducts are used for cabling installations

16.0 CABLING TESTING AND CERTIFICATION

16.1 Explain the purpose of installation testing
16.2 Describe the purpose and methods of certifying the cable plant
16.3 Show the proper selection and use of cable testing tools and equipment

17.0 CABLING TROUBLESHOOTING

17.1 Explain how to establish a baseline for testing or repairing a cabling system
17.2 Demonstrate a method of locating a cabling defect or problem
17.3 Describe commonly encountered cable problems and the methods used to resolve them
17.4 Define cross-talk and florescent lighting interference
17.5 Explain loop-testing
17.6 Describe a radio detector and how it is used to locate interference sources

18.0 DOCUMENTATION

18.1 Explain the purpose of documenting a cabling installation
18.2 Explain the required ingredients of the installation documents
18.3 Prepare a sample cable documentation record that meets industry standards

Suggested Texts for DCIC Training Courses:

Cabling - The Complete Guide to Network Wiring; Groth, McBee; Sybex; $49.95; ISBN 0-7821-2645-6
BICSI Telecommunications Distribution Methods Manual; BICSI, Tampa, FL; 813-979-1991
Data Communications; Marcraft, Pasco, WA; Randy Ratliff; ISBN 1-884268-03-X; 800 441 6006
Electromagnetic Compatibility in Medical Equipment; Kimmel and Gerke; IEEE, 732 981 0060; $89
Installer's Guide to Local Area Networks by Buddy Shipley; call ETA-I Headquarters at 800-288-3824
Premises Cabling 2nd Edition by Donald J. Sterling, Jr. and Les Baxter; call ETA-I Headquarters at 800-288-3824
Data, Voice, and Video Cabling by Jim Hayes and Paul Rosenberg; call ETA-I Headquarters at 800-288-3824

HANDS-ON PRACTICAL DEMONSTRATION CATEGORIES: DCIC
ETA International, 2007

The following hands-on demonstrations will be performed by each student enrolled in a Data Cabling Installer course at an ETA Approved Educational Institution: The Hands-On Documentation form is to be submitted along with the examination answer sheet for the DCIC Knowledge Exam. Much of the new content is courtesy of Bob Dickerson of the North Caroline Department of Public Instruction and the Skills U.S.A. national contest outline.

TERMINATION:

1. Cable length remaining in box
2. 25 pair color code
3. 110 panel termination 25 pr (from hub/switch/router)
4. Cable dressing
5. Cross connect routing
6. C4 & C5 clip installation
7. Proper slack
8. RJ-45 plug/jack installation
9. Clean-up

CABLE CONSTRUCTION:

Patch Cable:

1. Labeling
2. Crimping
3. Pairs fully inserted
4. Nylon reinforcement cord trimmed
5. Wire map – CAT5e

Crossover Cable:

1. Labeling
2. Crimping
3. Pairs fully inserted
4. Nylon reinforcement cord trimmed
5. Wire map – CAT5e

Coaxial Cable: (RG 6, 58, 59)

1. Labeling
2. Crimping
3. Proper length
4. Outer shield trimmed
5. Test cable

DCIC Hands-On Documentation, 2007

INSTALLING:

1. Identifying demarcation point
2. Securing work area – clean up area
3. Labeling (to 606 labeling standard)
4. Cable pulling – ladder rack
5. Wall/conduit fishing – draw string installation
6. Pulling cable

7. TIA/EIA 568 B cable termination (wall jack/patch panel/punch down tool)
8. Installing faceplate/outlet/remodel box
9. Dress & secure cables
10. Documentation

TROUBLESHOOTING:

A. Cable Related:
1. Determining correct type (plenum – riser – GP) (UL listing)
2. T568-A jack improperly wired
3. Identifying 25 pair wiring
4. Correct CAT5e connector
5. Detect poor strain relief
6. Detect untwisted pair
7. Detect mis-wired crossover cable
8. Verify 25 pr link using TDR to be TIA/EIA 568 compliant

B. Troubleshooting:
1. Use VOM to detect bad termination
2. Use VOM to find open pin at connector
3. Use VOM to test continuity
4. Use VOM to find mis-wired crossover cable
5. Use VOM to find shorted wires
6. Using tone generator for identification
7. Identify probable excessive cross-talk source in link using TDR
8. Identify cause of excess attenuation in horizontal link

C. Patch Panel
1. Mounting
2. Correct side connections
3. Use network cable tester to test panel connections to wall jack

D. Grounding
1. TBB wiring
2. Ground wire stripping

E. Fiber Optic Cabling
1. Eye-Skin safety
2. Connector recognition
3. FO disposal

PROFESSIONALISM

1. Job application
2. People Communications
3. CSS – Customer Service Specialist skills

(End of HO Skills Docs)

Classroom Equipment Requirements - Data Cabling Installer Certification - ETA, 2007

Classroom:

1. Manuals (10)
2. Workbooks (10)
3. Support and resource materials (Videos, Catalogs, Books)
4. Slide or video presentation(s)
5. Cable samples (Cat 3, 5, 5e, 6)

Lab Items:

a. Long nose pliers
b. Razor knives
c. Pliers (common)
d. Diagonal pliers
e. Miller wire strippers
f. Punch down tool
g. Screwdrivers
h. Handtowels (box)
i. Drop cloths (2/class)
j. Wipes (box)
k. Fish tape
l. RJ11 / 45 & RG 6/59 Crimpers
m. VOM – voltage/resistance meter
n TDR – Time Domain Reflectometer
o. Tape measure
p. Twisted pair continuity tester
q. Tone/frequency generator
r. Cable marking supplies
s. Cable prep tool TJ11/45 & Coax
t.

Optional test equipment suggestions:

aa. Dynatel 965 or equivalent
bb. Radio detection 5000 or equiv
cc. Resistance simulator
dd. Split simulator
ee. Open simulator
ff. Megohmeter
gg. Oscilloscope
hh. Gopher pole
ii. Cable pulleys
jj. Wire pulling lubricant

Noise mitigation tools suggestions for CAT-5

i. Student manuals
ii. Wilcom noise lab
iii. Wilcom T-136 loop tester
iv. Current meter (T304B)
v. Wilcom T-132 E2 UF Spectrum analyzer
vi. Cable pair (5 mi. length) running parallel to power line

Thanks to Guam Community College; KITCO Fiber Optics; ECPI; WRSystems and other members of the ETA Cabling Committees for their contributions to the above list.

(End of equipment requirements)

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