



**Skilled
Trades**
Ontario

**Métiers
spécialisés**
Ontario

Apprenticeship
Curriculum Standard

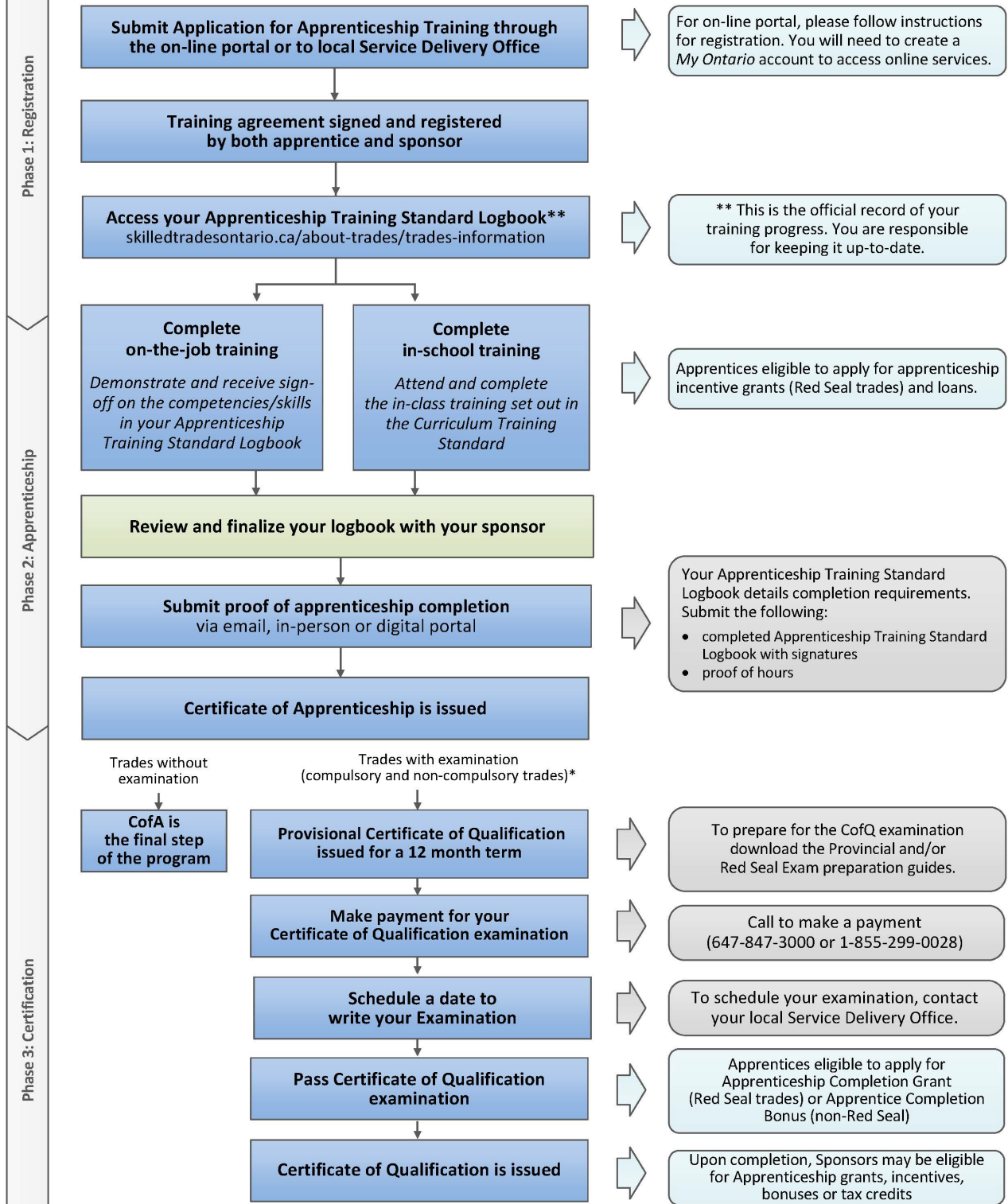
Network Cabling Specialist

Levels 1 & 2

631A

2001

Apprenticeship Pathway to a Certificate of Qualification



* For a list of trades subject to a certification examination, visit: skilledtradesontario.ca

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Please Note: This Standard has been revised to reflect the visual identity of Skilled Trades Ontario (STO) which replaced the Ontario College of Trades on January 1, 2022. The content of this Standard may refer to the former organization; however, all trade specific information or content remains relevant and accurate based on the original date of publishing.

Please refer to STO’s website: skilledtradesontario.ca for the most accurate and up to date information. For information about BOSTA and its regulations, please visit [Building Opportunities in the Skilled Trades Act, 2021 \(BOSTA\)](#).

Any updates to this publication are available on-line; to download this document in PDF format, please follow the link: Skilled Trades Ontario.ca.

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Maintained with transfer to Skilled Trades Ontario 2001 (V100)

Preface

This curriculum standard for the Network Cabling Specialist trade program is based upon the on-the-job performance objectives, located in the industry-approved training standard.

The curriculum is organized into 2 levels of training. The Reportable Subjects Summary chart (located on page 3) summarizes the training hours for each reportable subject.

The curriculum identifies the learning that takes place in-school. The in-school program focuses primarily on the theoretical knowledge and the essential skills required to support the performance objectives of the Apprenticeship Training Standards.

Employers/Sponsors are expected to extend the apprentice's knowledge and skills through practical training on a work site. Regular evaluations of the apprentice's knowledge and skills are conducted throughout training to verify that all apprentices have achieved the learning outcomes identified in the curriculum standard.

It is not the intent of the in-school curriculum to perfect on-the-job skills. The practical portion of the in-school program is used to reinforce theoretical knowledge. Skill training is provided on the job.

Please refer to Skilled Trades Ontario website (www.skilledtradesontario.ca) for the most accurate and up-to-date information about Skilled Trades Ontario. For information on *Building Opportunities in the Skilled Trades Act, 2021 (BOSTA)* and its regulations, please visit [Building Opportunities in the Skilled Trades Act, 2021, S.O. 2021, c. 28 - Bill 288 \(ontario.ca\)](http://www.skilledtradesontario.ca/building-opportunities-in-the-skilled-trades-act-2021-s.o.-2021-c.-28-bill-288)

Pre-requisites

In order to advance to Level 2 of the apprenticeship program, an individual must have completed all of the units outlined in Level 1.

Hours Disclaimer (if applicable)

It is agreed that Training Delivery Agents (TDAs) may need to make slight adjustments (with cause) according to particular apprentice needs and may deviate from the unit sequencing and the prescribed practical and theoretical hours shown within the standard. However, all TDAs will comply with the hours at the reportable subject level.

Suggested Equipment for Training Delivery Agencies

The listing of tools on page 78 and page 79 does not list minimum quantities based on the understanding that the delivering TDA is in the best position to determine the need based on its delivery methodology.

Personal and Safety Equipment: Personal protective equipment is at the discretion of the TDA who must conform to Ontario Provincial Health and Safety Regulations.

Design Process for Curriculum Standards

This document was developed in conjunction with a group of industry representatives and community college instructors. The apprenticeship in-school curriculum standard represents standardized outcomes and learning content that is delivered by all approved Training Delivery Agents (TDAs.) The learning outcome is developed for every performance objective defined in the apprenticeship Training Standard, each outcome having an associated performance indicator. The approved learning outcomes are used to develop the curriculum standard, which is comprised of Units of Learning/Reportable Subjects.

A reportable subject may be considered as:

- a clustering or grouping of related or like learning outcomes,
- a stand alone learning unit with distinct start and end, or
- a course or module.

It is understood that individual instructors will use these Curriculum Standards as the basis for the development of lesson plans.

Levels 1 & 2

Reportable Subject Summary – Levels 1 & 2

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
Unit 1	Safety and Tools	48	38	10
Unit 2	Codes and Standards Part #1	48	48	0
Unit 3	Codes and Standards Part #2	48	48	0
Unit 4	Planning, Preparation and Documentation	48	36	12
Unit 1	Trade Calculations and Electronics	48	36	12
Unit 2	UTP/ScTP Terminating and Splicing	48	28	20
Unit 3	Interpersonal Skills	48	24	24
Unit 4	Optical Fibre Terminating and Splicing	48	28	20
Unit 1	STP/Coaxial Cables	48	38	10
Unit 2	Customer Owned Outside Plant	48	38	10
Unit 3	Networking #1	48	48	0
Unit 4	Networking #2	48	48	0
	Total	576	458	118

Number:	1.0		
Title:	Protect Self and Others		
Duration:	Total Hours: 48	Theory: 38	Practical: 10
Prerequisites:	None		
Co-requisites:	None		

General Learning Outcomes

Upon successful completion of this reportable subject the apprentice is able to demonstrate safe working habits, wear personal protective equipment and clothing, practice good housekeeping, handle and store tools and equipment, ensure equipment and safety devices are in safe working condition, handle hazardous substances, operate lifting and rigging equipment and follow first aid procedures, according to related legislation, industry standards, job specifications and employer and client site-specific standards.

Units of Learning Outcomes

Upon successful completion the apprentice will be able to:

- 1.1 Identify work place health and safety hazards including work site :
 - electrical
 - chemical
 - environmental
 - classified substances
- 1.2 Explain the historical use of asbestos.
- 1.3 Recognize asbestos and Identify typical sources of it on work sites.
- 1.4 Identify safe working levels of asbestos including; OHS Reg 598-94, Reg 510-92
- 1.5 Define the health hazards of working in an asbestos area.
- 1.6 Describe related legislation that is required for protection of self and others.
- 1.7 Identify and define confined spaces. OHS sections 1(1), 60-63.
- 1.8 Identify type of safety equipment required for working in confined spaces.
- 1.9 Describe procedures to check for the quality of air within the confined space.

- 1.10 Describe action to confirm confined spaces are ventilated according to related legislation.
- 1.11 Identify and interpret sections of the Ontario Occupational Health and Safety Act, and bulletins and amendments. Sections 21, 22, 23, 24, 25, 62, 129(4)(a), 141(1)(3), 26, Construction Safety Association of Ontario, employer and client site-specific standards related to personal protection.
- 1.12 Explain the importance and determine the requirements for, and select work dress and personal protective equipment according to related legislation, employer and client site-specific standards including:
- wearing suitable clothing
 - removing jewelry
 - confining of long hair
 - Hard hats
 - Foot wear
 - Gloves
 - Eye wear
 - Special protective clothing for various types of tasks
- 1.13 Explain related sections of the OHS. sections 85, 86
- 1.14 Wear required work dress and personal protective equipment for maximum personal protection according to related legislation, employer and client site-specific standards.
- 1.15 Maintain work dress and personal protective equipment according to related legislation, employer and client site-specific standards.
- Identify and explain expiry dates for safety equipment
- 1.16 Describe the installation of guards and barricades according to related legislation, employer and client site-specific standards.
- 1.17 Explain the importance of good house cleaning practices.
- 1.18 Describe techniques of material handling and disposal.
- 1.19 Describe the storage of tools and equipment to prevent possible accidents.
- 1.20 Explain related sections of the OHS. sections. 35 to 43
- 1.21 Describe the practices for inspection of safety equipment according to manufacturer's specifications.
- 1.22 List and describe the safety equipment for specific applications.

- 1.23 Explain related sections of the OHSA. Sections: 21(3), 93, 94, 147, 129, 78-84
- 1.24 Operate hand and power tools according to CSA standards, OHSA regulations, manufacturer's operating instructions and employer and client site-specific standards.
- 1.25 Identify the frequency of inspections required for all equipment and tools according to the manufacturer's operating instructions and employer and client site-specific standards.
- 1.26 Demonstrate a knowledge of the components of the Workplace Hazardous Material Information System Act including; OHSA sections: 14, 21-25, 30, 39, 41-44, 63, 330.
- documentation
 - accessibility
 - interpretation
 - labeling
 - clients, employer and employee responsibilities
- 1.27 Describe and identify the purpose and uses of MSDS.
- 1.28 Read and interpret the MSDS related to trade.
- 1.29 Identify lifting and hoisting equipment according to the specific task.
- 1.30 Identify the work place conditions affecting the use of hoisting and lifting devices.
- 1.31 Explain rigging terminology.
- 1.32 Identify and use rigging hardware.
- 1.33 Identify and use fibre ropes.
- 1.34 Demonstrate basic knots for rigging of equipment according to industry standards.
- 1.35 Demonstrate the basic hand signals for hoisting according to industry standards.
- 1.36 Explain related sections of the OHSA. sections: 150-156, 168-180.
- 1.37 Identify an emergency situation.

- 1.38 Identify potential health and safety hazards in emergency situations including:
- electrical
 - chemical
 - communicable diseases
- 1.39 Demonstrate emergency communication procedures according to employer and client site-specific standards
- 1.40 Identify emergency equipment and exits.

Number:	2.0		
Title:	Codes and Standards Part #1		
Duration:	Total Hours: 48	Theory: 48	Practical: 0
Prerequisites:	Unit 1 Safety and Tools		
Co-requisites:	None		

General Learning Outcomes

Upon successful completion of this reportable subject the apprentice is able to read and interpret job reference material including Canadian Electrical Code (CEC), Ontario Electrical Safety Code, Telecommunications Industry Association/Electronic Industry Alliance (TIA/EIA) standards, building codes, Canadian Standards Association (CSA) codes, job specifications, manufacturer's specifications, fire codes, interpret and apply codes and standards to perform the installation, identify related drawings, select routing for the installation of the cable plant according to work site conditions, create openings in a structure to allow for the installation of an inside and outside cable plant.

Units of Learning Outcomes

Upon successful completion the apprentice will be able to:

- 2.1 Interpret the current CSA, TIA/EIA standards that are followed to plan an installation including TIA/EIA, 568-A, 569-A, 570-A, 606, 607, 758 and CAN/CSA T525, T527, T528, T529, T530 including bulletins and amendments according to job specifications and employer and client site-specific standards.
- 2.2 Interpret sections of the building codes related to installation according to TIA/EIA 569-A, CAN/CSA T530 Appendix B, CAN4-S101, CAN4-S115, Ontario Building Codes (OBC), including:
 - firestop systems
 - plenum spaces
- 2.3 Describe the function of firestop systems according to manufacturer's specifications and related codes and standards including; building codes, CEC, Ontario Electrical Safety Code and, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.

- 2.4 Describe the selection of firestopping materials to meet job site conditions according to manufacturer's specifications, related codes and standards including; building codes, CEC, Ontario Electrical Safety Code and, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments, including:
- mechanical systems
 - putties
 - caulking
 - cementitious materials
 - Intumescent sheets and wraps
 - silicone foams
 - pre-manufactured pillows
- 2.5 Describe fire rating of cables according to related codes and standards, OBC, CEC, Ontario Electrical Safety Code, TIA/EIA 569-A and CAN/CSA T530.
- 2.6 Describe a plenum and non-plenum area according to related legislation.
- 2.7 Interpret telecommunication symbols. TIA/EIA 606, CAN/CSA T528 - annex C.
- 2.8 Identify limitation of cabling distances for specific applications according to industry standards including TIA/EIA 568-A, CAN/CSA T529, bulletins and amendments for:
- UTP
 - ScTP
 - STP
 - Optical fibre
 - Coaxial
- 2.9 Describe and list requirements for cable installations in raised floor applications according to related codes and standards including TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.

- 2.10 Describe and list requirements for equipment room installations layout according to related legislation and employer and client site-specific standards including TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments for:
- lighting
 - power requirements
 - size
 - HVAC
 - sleeves
 - ceiling
 - walls
 - doors
 - grounding
- 2.11 Describe and list requirements for aerial installations of telecommunication systems according to related legislation and employer and client site-specific standards including TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 2.12 Describe and list requirements for underground installations of telecommunication systems according to related legislation and employer and client site-specific standards including TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 2.13 Describe and list the requirements for raceway installations of telecommunication systems according to related legislation and employer and client site-specific standards including TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 2.14 Describe the requirements for closed and open ceiling space installations of telecommunication systems according to related legislation and employer and client site-specific standards including TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 2.15 Describe bandwidth limits for cable types according to TIA/EIA 568-A , CAN/CSA T529 and bulletins and amendments.
- 2.16 Describe restrictions and distance considerations of installed cables to sources of EMI and RFI according to related codes and standards including; TIA/EIA 568-A, CAN/CSA T529 and TIA/EIA 569-A, CAN/CSA T530.

- 2.17 Differentiate between types of sleeves installed according to related codes and standards including; CEC, OBC, TIA/EIA 569-A and CAN/CSA T530, TIA/EIA 758 for:
- permanent
 - temporary
 - water-tight
 - fire rated
- 2.18 Calculate raceway fill ratios according to CEC, Ontario Electrical Safety Code, CSA Standards and job specifications including CAN/CSA T530 and bulletins and amendments.
- 2.19 Calculate box sizes for pull boxes to CSA Standards and job specifications including CEC Part 1 Ontario Electrical Safety Code and TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 2.20 Describe installation requirements for cable supports in inside plant environments according to related legislation, job specifications and employer and client site- specific standards. TIA/EIA 569-A, CAN/CSA T530, CEC and Ontario Electrical Safety Code including for:
- D-rings
 - J-hooks
 - cable trays
 - conduits
 - wireways
 - threaded rods
 - ceiling hanger brackets
 - wall brackets
 - conduit hangers
- 2.21 Describe protection required to prevent spikes and surges according to CEC, Ontario Electrical Safety Code, TIA/EIA 568-A and CAN/CSA T529 and bulletins and amendments.
- 2.22 Describe components that must be labelled according to job specifications and employer and client site-specific standards including; TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments for:
- spaces
 - pathways
 - cables
 - connecting hardware
 - grounding system
 - equipment
 - hubs
 - racks

Number:	3.0		
Title:	Codes and Standards Part #2		
Duration:	Total Hours: 48	Theory: 48	Practical: 0
Prerequisites:	Unit 1 Safety and Tools Unit 2 Codes and Standards Part #1		

General Learning Outcomes

Upon successful completion of this reportable subject the apprentice is able to verify mounting equipment inside plant by: checking clearance for size, location, openings, height, access; checking type of enclosure including; rack, backboards, wall mount brackets, and cabinet; verifying support structure; attaching support hardware, including; anchors, bolts, washers, screws, adaptors, and labels; using tools and equipment, including; ladders, hand tools, power tools; so that the mounting equipment is installed in accordance with CEC Part 1, manufacturers' and job specifications and industry codes and standards, identify dressing, labelling types of securing device including; tie-wraps, banding, spiral wrap, lashing, and combing; organizing cable entry for location, strain relief, radius, and type of entry; securing cables; and, labelling; so that cables are a organized, labeled, identify telecommunication circuit protection equipment by selecting equipment including; gas tubes, solid state, carbon and data protection; mounting protection equipment; terminating cable on protection equipment, by splicing or direct termination; labelling and documenting installation; so that the installation is completed, identify grounding and bonding connections by selecting a main grounding busbar, telecommunications bonding backbone, bonding conductors to equipment including; racks, hubs, cabinets, conduits, electrical protection equipment, wire ways and cable; ensuring all bonding connections and cables are connected to the main telecommunication grounding bus, in accordance CEC Part I, manufacturer's and job specifications and industry codes and standards, Label cable system components to be labelled including; station and distribution ends; using wrap-around or printed labels; so that the labelled system matches the floor plan, perform final inspection for various types of cable plants, prepare final documentation for various types of cable plants according to industry standards, manufacturer's and job specifications and client and employer standards.

Units of Learning Outcomes

Upon successful completion, the apprentice is able to:

- 3.1 Interpret the sections of the Canadian Electrical Code Part 1, Ontario Electrical Safety Code that are required to plan a cable plant including sections: 0, 2, 10, 12, 16, 18, 24, 26, 54, 56, 60, 80.
- 3.2 Differentiate between federal, provincial and local building codes.

- 3.3 Verify location of equipment rooms, telecommunication closets and entrance facilities to ensure that they are sized according to job specifications and employer and client site-specific standards, including; CEC, Ontario Electrical Safety Code, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 3.4 Describe techniques for fastening backboards, racks according to job specifications and employer and client site-specific standards, including; OBC, CEC, Ontario Electrical Safety Code, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 3.5 Describe requirements for labelling including colour codes according to job specifications and employer and client site-specific standards including; TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments.
- 3.6 Describe components that must be labeled and racks according to job specifications and employer and client site-specific standards including; TIA/EIA 606 and CAN/CSA T528, TIA/EIA 758 and bulletins and amendments.
- spaces
 - pathways
 - cables
 - connecting hardware
 - grounding system
 - equipment
 - hubs
- 3.7 Identify and select label types according to job specifications and client and employer standards, TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.
- adhesive
 - insert
 - tie-on
- 3.8 Plan the routing of grounding and bonding conductors according to related legislation, job specifications and employer and client site-specific standards, CEC, Ontario Electrical Safety Code, TIA/EIA 607 and CAN/CSA T527 and bulletins and amendments.
- 3.9 Select the size of grounding and bonding conductors and system components according to related legislation, job specifications and employer and client site-specific standards, CEC, Ontario Electrical Safety Code. TIA/EIA 607, CAN/CSA T527 and bulletins and amendments.

- 3.10 Explain the terms:
- AWG
 - Components of a grounding system
 - Ground loops
 - Bonding
 - Bonding conductor
 - Ground
 - Ground rod
 - Grounding electrode conductor
 - Telecommunication bonding backbone
 - Telecommunication bonding backbone interconnecting bonding conductor
 - Telecommunication main grounding busbar
 - Telecommunication grounding busbar
 - Lugs, crimp and compression
 - Ground clamp
 - Ground bushing
 - Crimp Tool, Hand and Hydraulic
- 3.11 Describe exothermic welding according to manufacturer's and industry standards CEC, Ontario Electrical Safety Code.

Number:	4.0		
Title:	Planning, Preparation and Documentation		
Duration:	Total Hours: 48	Theory: 36	Practical: 12
Prerequisites:	Unit 1 Safety and Tools Unit 2 Codes and Standards Part #1 Unit 3 Codes and Standards Part #2		

General Learning Outcomes

Upon successful completion of this reportable subject the apprentice will be able to interpret and apply codes and standards to perform the installation, according to job specifications and related legislation, identify related drawings and specifications, identify and select the hand tools, power and powder-actuated tools, required for the installation, identify select and maintain test equipment, perform site inspections to confirm that job specifications, industry standards and building codes match the drawings and calculate the box and conduit fill ratios according to industry standards, select routing for the installation of the cable plant according to work site conditions, create openings in a structure to allow for the installation of an inside and outside cable plant, install supports, cable trays, and raceways in an inside and outside plant, select and use test procedures and prepare the cable for installation in various types of environments, label and dress cables to the termination points, install and connect equipment in a inside and outside plant, label a cable plant, test equipment interconnecting cables, coaxial cable plants, UTP/STP/ScTP cable systems, optical fibre cable plants, perform final inspection and documentation for various types of cable plants, communicate with the client to insure that the installation is to job specifications, identify and select internetworking hardware and components.

Units of Learning Outcomes

Upon successful completion, the apprentice is able to:

- 4.1 Interpret the sections of the Canadian Electrical Code Part 1, Ontario Electrical Safety Code that are required to plan a cable plant including sections: 0, 2, 10, 12, 16, 18, 24, 26, 54, 56, 60, 80.
- 4.2 Interpret the current CSA, TIA/EIA standards that are followed to plan an installation including TIA/EIA, 568-A, 569-A, 570-A, 606, 607, 758 and CAN/CSA T525, T527, T528, T529, T530 including bulletins and amendments according to job specifications and employer and client site-specific standards.

- 4.3 Interpret sections of the building codes related to installation according to TIA/EIA 569-A, CAN/CSA T530 Appendix B, CAN4-S101, CAN4-S115, Ontario Building Codes (OBC).
- firestop systems
 - plenum spaces
- 4.4 Differentiate between federal, provincial and local building codes.
- 4.5 Interpret drawings.
- backbone
 - architectural
 - mechanical
 - electrical
- 4.6 Check that installation drawings match work site.
- 4.7 Note changes and corrections required to drawings and specifications.
- 4.8 Confirm contract and scope of work match.
- 4.9 Confirm information contained in job specifications and contract match.
- 4.10 Interpret telecommunication symbols. TIA/EIA 606, CAN/CSA T528 - annex C.
- 4.11 Interpret manufacturer's drawings.
- 4.12 Differentiate between materials encountered when creating openings.
- concrete
 - steel
 - wood
 - masonry
 - gypsum board
- 4.13 Identify building construction and architectural assemblies and structures encountered when creating openings.
- 4.14 Describe tools and equipment used to create an opening.
- core drills
 - boring tools
 - saws
 - power and air hammers
 - ladders

- 4.15 Differentiate between types of sleeves installed according to related codes and standards, CEC, OBC, TIA/EIA 569-A, CAN/CSA T525 and CAN/CSA T530.
- permanent
 - temporary
 - water- tight
 - fire rated
- 4.16 Calculate the minimum number and size of sleeves and slots required for installations according to TIA/EIA 569-A, CAN/CSA T 525 , CAN/CSA T530 and bulletins and amendments.
- 4.17 Describe precautions taken when core drilling in concrete according to job specifications and employer and client site-specific standards.
- consulting client’s as-built drawings
 - other drawings
 - X-ray
- 4.18 Describe precautions taken when drilling holes in building structures according to related codes and standards, job specifications and employer and client site-specific standards:
- tenting
 - water cleanup
 - removal of material
- 4.19 Describe precautions taken when creating openings in underfloor raceways according to related codes and standards, job specifications and employer and client site-specific standards:
- carpet
 - electrical hazards
 - dust
 - existing cables
- 4.20 Identify and select the tools required for the installation according to job specifications.
- punch down tools (BIX, 110, 66, Krone®)
 - hole punches
 - conduit benders
 - MS², 780
 - reciprocating saws
 - drills
 - tuggers
 - powder-actuated
 - vacuum

- 4.21 Schedule any special equipment required for the installation.
- 4.22 Describe and list requirements for equipment room installations layout according to related legislation and employer and client site-specific standards including TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- lighting
 - power requirements
 - size
 - HVAC
 - sleeves
 - ceiling
 - walls
 - doors
 - grounding
- 4.23 Select the cables copper and optical fibre for both horizontal and backbone installations according to job drawings and specifications, industry standards, application, performance and related codes and standards including; TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments. and building codes.
- UTP - Cat 1, Cat 2, Cat 3, Cat 4, Cat 5, Cat 5e, Cat 6
 - STP - Type 1, Type 2, Type 6, Type 8, Type 9, STP-A.ScTP
 - Coaxial
 - Singlemode and multimode optical fibre cables. (loose tube. tight buffer)
 - size
 - length
 - fire rating
 - performance rating
- 4.24 Describe pre-installation testing procedures for cable:
- damage during shipment
 - manufacturer's defects
 - check attenuation matches manufacturer's specifications

- 4.25 Select test equipment according to the cable type, job specifications and employer and client site-specific standards including; TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- cable certification testers
 - optical source and light meters
 - multi-meter
 - TDR
 - OTDR
 - tone generators and inductive amplifier
 - line test set
 - cable tracer
- 4.26 Demonstrate methods of attaching cables to test equipment according to manufacturer's specifications and employer standards.
- 4.27 Select the cable routing according to work site conditions according to TIA/EIA 569- A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- building design
 - furniture pathways
- 4.28 Describe and list the requirements for the installation of horizontal and backbone cables in a closed and open ceiling space according to related legislation and employer and client site-specific standards including TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 4.29 Describe and list the requirements for the installation of horizontal and backbone cables in raceway installations according to related legislation and employer and client site-specific standards including TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 4.30 Describe and list requirements for the installation of horizontal and backbone cables in a raised floor applications according to related codes and standards including TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 4.31 Describe and list requirements for the installation of horizontal and backbone cables in an aerial installation according to related legislation and employer and client site- specific standards including TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.

- 4.32 Describe and list requirements for the installation of horizontal and backbone cables in an underground installation according to related legislation and employer and client site-specific standards including TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 4.33 Describe and list requirements for the installation methods of horizontal and backbone cables according to manufacturer's specifications and employer standards, CEC, Ontario Electrical Safety Code, OBC, TIA/EIA 568-A and CAN/CSA T529 and bulletins and amendments.
- underfloor ducts
 - poke through
- 4.34 Describe bandwidth limits for cable types according to TIA/EIA 568-A , CAN/CSA T529 and bulletins and amendments.
- 4.35 Describe restrictions and distance considerations of installed cables to sources of EMI and RFI according to related codes and standards including; TIA/EIA 568-A, CAN/CSA T529 and TIA/EIA 569-A, CAN/CSA T530.
- 4.36 Describe the distance limitations of horizontal and backbone telecommunication cables, according to related industry standards, TIA/EIA 568-A , CAN/CSA T529 and bulletins and amendments.
- UTP
 - ScTP
 - STP
 - Optical fibre
 - Coaxial
- 4.37 Calculate the number of cables, pairs and fibre strands required according to job specifications including TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 4.38 Calculate raceway fill ratios according to CEC, Ontario Electrical Safety Code, CSA Standards and job specifications including CAN/CSA T530 and bulletins and amendments.
- 4.39 Calculate box sizes for pull boxes to CSA Standards and job specifications including CEC Part 1 Ontario Electrical Safety Code and TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 4.40 Perform a take-off of job related material.
- length
 - quantities
 - pair and strand counts

- 4.41 Select wall and rack mounting equipment according to manufacturer's and job specifications and employer and client site-specific standards.
- 4.42 Describe techniques for fastening backboards, racks according to job specifications and employer and client site-specific standards, including; OBC, CEC, Ontario Electrical Safety Code, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 4.43 Demonstrate equipment mounting and fastening techniques for copper and optical fibre cable according to manufacturer's specifications.
- BIX
 - 110
 - 66
 - Krone®
 - optical fibre
 - wire management systems
- 4.44 Describe installation of cable supports according to job specifications and employer and client site-specific standards, including; OBC, CEC, Ontario Electrical Safety Code, TIA/EIA 569-A, CAN/CSA T530, CAN/CSA T525 and bulletins and amendments.
- D-rings
 - J-hooks
 - cable tray
 - conduit
 - wireways
 - threaded rods
 - ceiling hanger brackets
 - wall brackets
 - conduit hangers
 - ladder tray
 - innerduct
 - conduits
 - wireways
- 4.45 Install the raceways and supports using tools and equipment and fasteners according to related legislation, job specifications and employer and client site-specific standards including; TIA/EIA 568-A, CAN/CSA T529 , TIA/EIA 569-A, CAN/CSA T530, CEC and Ontario Electrical Safety Code
- 4.46 Describe procedures of labelling cable prior to installation according to client and employer standards including; TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.

- 4.47 Describe the use of power and hand tools for installing inside plant horizontal and backbone cables according to job specifications and employer and client site-specific standards.
- tuggers
 - vacuum systems
 - compressed air
 - trenchers
- 4.48 Demonstrate methods of fastening cables according to manufacturer's specifications and employer standards.
- ropes
 - fish-tapes
 - wire-mesh grips
- 4.49 Identify the maximum pulling tension for telecommunication cables according to manufacturer's specifications and industry standards including; TIA/EIA 568-A and CAN/CSA T529 and bulletins and amendments.
- 4.50 Describe bend radius for telecommunication cables under tension and at rest according to manufacturer's specifications and industry standards including; TIA/EIA 568-A and CAN/CSA T529 and bulletins and amendments.
- 4.51 Label installation according to job specifications ,employer and client site-specific standards and industry standards including; TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments.
- 4.52 Identify and select label types according to job specifications and employer and client site-specific standards, TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.
- adhesive
 - insert
 - tie-on
- 4.53 Describe the function of firestop systems according to manufacturer's specifications and related codes and standards including; building codes, CEC, Ontario Electrical Safety Code and, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.

- 4.54 Describe the selection of firestopping materials to meet job site conditions according to manufacturer's specifications, related codes and standards including; building codes, CEC, Ontario Electrical Safety Code and, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- mechanical systems
 - putties
 - caulking
 - cementitious materials
 - Intumescent sheets
 - Intumescent wraps
 - silicone foams
 - premanufactured pillows
- 4.55 Demonstrate the installation methods of full line firestopping systems according to manufacturer's specifications, related codes and standards including; building codes, CEC, Ontario Electrical Safety Code and, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- floor and wall openings
 - sleeves
 - cables
 - conduits
 - cable trays
- 4.56 Label cable systems according to job specifications and employer and client site-specific standards, TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.
- computer labels
 - machine printed labels
 - hand written labels
- 4.57 Demonstrate labelling for cable systems including closet, equipment rooms, cables, raceways and work station outlets according to related legislation, industry standards, job specifications and employer and client site-specific standards.
- 4.58 Prepare final documentation according to industry standards, manufacturer's and job specifications and employer and client site-specific standards.
- 4.59 Describe cable management systems. [CMS]
- 4.60 Communicate with client using plain language, trade terms and definitions.
- 4.61 Identify and explain alternative solutions according to client needs.
- 4.62 Seek and obtain approvals including purchase order, change order from authorized personnel according to job specifications and employer and client site-specific standards.

Number:	5.0		
Title:	Trade Calculations and Electronics		
Duration:	Total Hours: 48	Theory: 36	Practical: 12
Prerequisites:	Unit 1 Safety and Tools Unit 2 Codes and Standards Part #1 Unit 3 Codes and Standards Part #2 Unit 4 Planning, Preparation and Documentation		

General Learning Outcomes

Upon successful completion of this reportable subject the apprentice will be able to perform mathematical calculations related to telecommunication installations and have a basic understanding of both DC and AC electrical theory and be able to solder a DB - 25 connector.

Units of Learning Outcomes

Upon successful completion, the apprentice is able to:

- 5.1 Define terms used in trade calculations.
- voltage
 - current
 - resistance
 - power
 - capacitance
 - impedance
 - inductance
 - attenuation
 - decibels
 - NEXT
 - FLEXT
 - ELFEXT
 - ACR
 - NVP
 - Delay skew
 - Propagation delay
 - Headroom
 - return loss
 - wiremap
 - dBm
 - Hz

- baud
 - byte
 - Mbps
 - power sum
 - pair to pair
- 5.2 Describe mathematical relationships between;
- voltage
 - current
 - resistance
 - power
- 5.3 Perform calculations for
- current
 - voltage
 - resistance
 - power
- 5.4 Explain DC and AC circuit theory.
- 5.5 Convert between Metric and Imperial measurements.
- 5.6 Describe relationship of decibels to power levels and attenuation for copper and optical fibre cables.
- 5.7 Perform calculation for decibels to power levels and attenuation for copper and optical fibre cables.
- 5.8 Demonstrate the operation of soldering equipment according to manufacturer's specifications and employer standards.
- 5.9 Select type of solder for the application according to employer and industry standards.
- 5.10 Demonstrate soldering and solder removal techniques according to employer and industry standards.
- solder wicks
 - solder suckers
- 5.11 Describe and use products to protect connections from environmental and physical damage according to manufacturer's and job specifications and employer and client site-specific standards.
- heat shrinks
 - tapes

Number:	6.0		
Title:	UTP/ScTP Terminating and Splicing		
Duration:	Total Hours: 48	Theory: 28	Practical: 20
Prerequisites:	Unit 1 Safety and Tools Unit 2 Codes and Standards Part #1 Unit 3 Codes and Standards Part #2 Unit 4 Planning, Preparation and Documentation Unit 5 Trade Calculations and Electronics		

General Learning Outcomes

Upon successful completion of this reportable subject the apprentice is able to interpret and apply codes and standards to perform the installation, identify related drawings, specifications, identify and select the hand tools, power and powder-actuated tools, select and maintain test equipment, perform site inspections to confirm that job specifications, industry standards and building codes match the drawings and calculate the box and conduit fill ratios, select routing for the installation of the cable plant according to work site conditions, select routing for the installation of the cable plant according to work site conditions, demonstrate the procedures for pulling a medium into cable pathways, select and use test procedures and prepare the cable for installation in various types of environments, install a UTP and ScTP cable as a backbone or horizontal cable in an inside plant installation, label and dress cables to the termination points, install and connect equipment in a inside plant, label and dress cables for termination, prepare and terminate UTP and ScTP cables in an inside plant, prepare and splice UTP and ScTP cables in an inside plant, select and install protection equipment, install and connect various types of patch panels and cross-connects, label a cable plant, test various types of unshielded twisted- pair, and screened twisted-pair cable plants, perform final inspection, prepare final documentation, identify and repair UTP and ScTP cable systems.

Units of Learning Outcomes

Upon successful completion, the apprentice is able to:

- 6.1 Interpret the sections of the Canadian Electrical Code Part 1, Ontario Electrical Safety Code that are required to plan a cable plant including sections: 0, 2, 10, 12, 16, 18, 24, 26, 54, 56, 60, 80
- 6.2 Interpret the current CSA, TIA/EIA standards that are followed to plan an installation including TIA/EIA, 568-A, 569-A, 570-A, 606, 607, 758 and CAN/CSA T525, T527, T528, T529, T530 including bulletins and amendments according to job specifications and employer and client site-specific standards.

- 6.3 Describe types of backbone, horizontal, physical and logical topologies including
- Bus
 - Ring
 - Star
 - Mesh
- 6.4 Interpret sections of the building codes related to installation according to TIA/EIA 569-A, CAN/CSA T530 Appendix B, CAN4-S101, CAN4-S115, Ontario Building Codes (OBC).
- firestop systems
 - plenum spaces
- 6.5 Describe a plenum and non-plenum area according to related legislation.
- 6.6 Describe fire rating of cables according to related codes and standards, OBC, CEC, Ontario Electrical Safety Code, TIA/EIA 569-A and CAN/CSA T530.
- 6.7 Verify that installation drawings match work site.
- 6.8 Select backbone and horizontal cables according to environment, application, performance and related codes and standards including; TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- UTP - Cat 1, Cat 2, Cat 3, Cat 4, Cat 5, Cat 5e, Cat 6
 - ScTP
 - size
 - length
 - fire rating
 - performance rating
- 6.9 Select termination tools and equipment for specific connectors, patch panels and cross-connects according to manufacturer's and job specifications and employer and client site-specific standards.
- punch down tools: (BIX, 110, 66, Krone®)
 - sheath removal tools
 - scissors
 - terminal blocks
 - patch panels
 - modular jacks
 - designation strips
 - cable management hardware
 - crimp tools
 - wire wrap tool

- 6.10 Describe the distance limitations of telecommunication cables, according to related industry standards, TIA/EIA 568-A , CAN/CSA T529 and bulletins and amendments.
- UTP
 - ScTP
- 6.11 Describe and list requirements for cable installations in raised floor applications according to related codes and standards including TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 6.12 Describe and list the requirements for raceway installations of telecommunication systems according to related legislation and employer and client site-specific standards including TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 6.13 Describe the requirements for closed and open ceiling space installations of telecommunication systems according to related legislation and employer and client site-specific standards including TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 6.14 Describe bandwidth limits for cable types according to TIA/EIA 568-A , CAN/CSA T529 and bulletins and amendments.
- 6.15 Describe restrictions and distance considerations of installed cables to sources of EMI and RFI according to related codes and standards including; TIA/EIA 568-A, CAN/CSA T529 and TIA/EIA 569-A, CAN/CSA T530.
- 6.16 Calculate the number of cables, pairs required according to job specifications including TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 6.17 Calculate raceway fill ratios according to CEC, Ontario Electrical Safety Code, CSA Standards and job specifications s including CAN/CSA T530 and bulletins and amendments.
- 6.18 Calculate box sizes for pull boxes to CSA Standards and job specifications s including CEC Part 1 Ontario Electrical Safety Code and TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 6.19 Select the cable routing according to work site conditions according to TIA/EIA 569- A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- building design
 - furniture pathways

- 6.20 Describe techniques for fastening backboards, racks according to job specifications and employer and client site-specific standards, including; OBC, CEC, Ontario Electrical Safety Code, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 6.21 Select wall and rack mounting equipment according to manufacturer's and job specifications and employer and client site-specific standards.
- 6.22 Verify location of equipment rooms, telecommunication closets and entrance facilities to ensure that they are sized according to job specifications and employer and client site-specific standards, including; CEC, Ontario Electrical Safety Code, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 6.23 Demonstrate equipment mounting and fastening techniques for copper cable according to manufacturer's specifications.
- BIX
 - 110
 - 66
 - Krone®
 - wire management systems
 - wire wrap systems
- 6.24 Schedule any special equipment required for installation.
- 6.25 Operate hand tools according to manufacturer's instructions and to related legislation, job specifications and employer and client site-specific standards and OHS standards section 93.
- conduit benders
 - hole punches
 - cable strippers
 - cable grips
 - hand saws
 - drywall saws

- 6.26 Describe installation requirements for cable supports in inside plant environments according to related legislation, job specifications and employer and client site-specific standards. TIA/EIA 569-A, CAN/CSA T530, CEC and Ontario Electrical Safety Code.
- D-rings
 - J-hooks
 - bridle rings
 - mushrooms
 - cable trays
 - conduits
 - wireways
 - threaded rods
 - ceiling hanger brackets
 - wall brackets
 - conduit hangers
- 6.27 Install the raceways and supports using tools and equipment and fasteners according to related legislation, job specifications and employer and client site-specific standards including; TIA/EIA 568-A, CAN/CSA T529 , TIA/EIA 569-A, CAN/CSA T530, CEC and Ontario Electrical Safety Code.
- drills
 - powder-actuated devices
- 6.28 Organize cables at demarcation point, equipment facility and telecommunication closets according to job specifications and employer and client site-specific standards.
- 6.29 Describe pre-installation testing procedures for cable
- damage during shipment
 - manufacturer's defects
- 6.30 Select test equipment according to the cable type, job specifications and employer and client site-specific standards including; TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 6.31 Demonstrate methods of attaching cables to test equipment according to manufacturer's specifications and employer standards.
- 6.32 Perform and interpret test procedures using equipment according to job specifications, employer and client site-specific standards including; TIA/EIA 568- A, CAN/CSA T529 and bulletins and amendments.
- cable certification testers
 - multi-meters
 - TDRs

- 6.33 Describe procedures of labelling cable prior to installation according to employer and client site-specific standards including; TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.
- 6.34 Select pulling equipment and method.
- fish tapes
 - jet lines
 - ropes
 - tuggers
 - reel jacks and stands
 - reel brakes
- 6.35 Select pulling medium according to manufacturer's specifications and industry standards.
- 6.36 Install pulling medium according to manufacturer's specifications and related codes and standards.
- 6.37 Demonstrate pulling techniques for telecommunication cables according to manufacturer's specifications and employer standards.
- ropes
 - fish-tapes
 - tuggers
- 6.38 Describe factors that affect pulling tension.
- number of bends in conduit
 - armoured cable
 - type of copper
- 6.39 Demonstrate methods of fastening cables according to manufacturer's specifications and employer standards.
- ropes
 - fish-tapes
 - wire-mesh grips
- 6.40 Label installation according to job specifications, employer and client site-specific standards and industry standards including; TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments.
- 6.41 Identify the maximum pulling tension for telecommunication cables according to manufacturer's specifications and industry standards including; TIA/EIA 568-A and CAN/CSA T529 and bulletins and amendments.

- 6.42 Describe bend radius for telecommunication cables according to manufacturer's specifications and industry standards including; TIA/EIA 568-A and CAN/CSA T529 and bulletins and amendments.
- 6.43 Describe the documentation required for labelling raceways and cables according to job specifications, employer and client site-specific standards and industry standards including; TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments.
- 6.44 Describe methods of installing backbone cable in raceways, according to manufacturer's specifications and employer standards.
- 6.45 Verify the distance limitations of horizontal cables including; UTP, ScTP according to TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 6.46 Label installation according to job specifications, employer and client site-specific standards and industry standards including; TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments.
- 6.47 Describe installation methods for horizontal cables according to manufacturer's specifications and employer standards, CEC, Ontario Electrical Safety Code, OBC, TIA/EIA 568-A and CAN/CSA T529 and bulletins and amendments.
- ceiling spaces
 - raceways
 - underfloor ducts
 - poke through
 - raised floors
- 6.48 Describe dressing and supporting of cables in ceiling spaces according to CEC, Ontario Electrical Safety Code, TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 6.49 Describe components to be labeled according to job specifications and employer and client site-specific standards including, TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments.
- spaces
 - pathways
 - cables
 - connecting hardware
 - grounding system
 - equipment
 - racks

- 6.50 Describe records including user, building, system and equipment according to job specifications and employer and client site-specific standards including; TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments.
- Cable management data base
 - Cable management software (CMS)
 - Labeling software
 - Cable certification records
- 6.51 Demonstrate labeling and dressing techniques for copper according to industry standards and manufacturer's specifications and employer standards.
- 6.52 Describe requirements for labelling including colour codes according to job specifications and employer and client site-specific standards including; TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments.
- 6.53 Prepare cables for termination in both backbone and horizontal applications according to manufacturer's specifications and employer standards.
- UTP
 - ScTP
- 6.54 Describe dressing and supporting of cables in ceiling spaces according to CEC, Ontario Electrical Safety Code, TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 6.55 Terminate copper cables using T568-A, T568-B, Universal Service Order Code (USOC) configurations according to job specifications, manufacturer's specifications and employer and client site-specific standards, TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.
- modular patch panels
 - wall outlets
 - BIX
 - 110
 - 66
 - Krone®
 - wirewrap
 - IDC
 - D subminiature

- 6.56 Select splicing tools and equipment according to manufacturer's and job specifications and employer and client site-specific standards.
- crimp tool
 - punch down tools
 - sheath removal tools
 - scissors
 - 780
 - MS²
 - terminal blocks
 - designation strips
 - splice kits
 - tapes
 - heat shrinks
 - cable management hardware
- 6.57 Select the type of splice hardware according to manufacturer's and job specifications and employer and client site-specific standards for a given application.
- splice enclosure
 - free standing racks
 - wall mount racks
- 6.58 Prepare cables for splicing according to manufacturer's and job specifications and employer and client site-specific standards including; TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 606, CAN/CSA T528, TIA/EIA 607 and CAN/CSA T527 and bulletins and amendments.
- sheath removal
 - sheath bonding
 - binder group separation
 - labelling techniques
- 6.59 Demonstrate splice techniques for inside plants according to manufacturer's and job specifications and employer and client site-specific standards.
- in-line
 - butt
 - branch
 - fold back

- 6.60 Identify and select test equipment according to clients and manufacturers test requirements for the particular application.
- cable certification testers
 - multi-meter
 - TDR
 - tone generators and inductive amplifier
 - line test set
 - cable tracer
- 6.61 Demonstrate the care and handling of test equipment according to the manufacturer's specifications and employer standards.
- 6.62 Demonstrate the methods of loading software upgrades to test equipment.
- 6.63 Describe testing methods according to TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 6.64 Test cables according to manufacturer's and job specifications and employer and client site-specific standards TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 6.65 Document and interpret test results according to manufacturer's and job specifications and client and employer standards, TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.
- 6.66 Prepare final documentation according to industry standards, manufacturer's and job specifications and client and employer standards.
- 6.67 Describe cable management systems. [CMS]
- 6.68 Clarify problem by interpreting symptoms with client and co-worker according to job specifications and employer and client site-specific standards.
- 6.69 Visually inspect cable systems to determine problem according to TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- breaks
 - twists
 - length
 - location to heat
 - EMI
 - RFI

- 6.70 Test and interpret results according to manufacturer's and job specifications or client and employer standards, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- cable certification testers
 - tone generator and inductive amplifier
 - multi meter
- 6.71 Discuss corrective options with client.
- 6.72 Repair cable system as directed by client according to employer and client site- specific standards.
- 6.73 Perform final inspection according to manufacturer's and job specifications and employer and client site-specific standards.

Number:	7.0		
Title:	Interpersonal Skills		
Duration:	Total Hours: 48	Theory: 24	Practical: 24
Prerequisites:	Unit 1 Safety and Tools Unit 2 Codes and Standards Part #1 Unit 3 Codes and Standards Part #2 Unit 4 Planning, Preparation and Documentation Unit 5 Trade Calculations and Electronics		

General Learning Outcomes

Upon successful completion of this reportable subject the apprentice is able to perform professional business practices and effective client service by: communicating with client and co-workers verbally; communicating with client and co-workers in writing; performing work demonstrating accountability; presenting a professional image; resolving conflicts; and, performing client relation activities. Communicate with client and co-workers in writing by: writing legibly; presenting documents and information in a clear and concise format; using common trade or layperson's language; and, completing all required information on documents; in order that all parties will be able to understand the documentation. Resolve conflicts by: recognizing an escalating situation; remaining calm; asking questions; restating concerns; focusing on resolving the problem; offering options to the client; and, taking a report for referral to management; so that conflict is clarified, solutions are recommended, and management is aware of problem according to company standards.

Units of Learning Outcomes

Upon successful completion, the apprentice is able to:

- 7.1 List and describe trade terminology, according to glossaries and trade-related documentation.
- 7.2 Interpret code of professional conduct, according to employer standards.
- 7.3 Practice active listening techniques, by listening attentively, asking open and closed- ended questions, using plain language, paraphrasing ideas and statements, speaking clearly and concisely, corroborating feedback and ensuring client satisfaction, according to employer and client site-specific standards.

- 7.4 Demonstrate communication techniques with client and co-workers, by using plain language and trade terms, practising active listening techniques, interpreting non- verbal communication, speaking clearly and concisely, corroborating feedback and ensuring client satisfaction, according to employer and client site-specific standards.
- 7.5 Describe employer policies to answer, resolve or re-direct all enquiries or concerns to management, according to employer standards.
- 7.6 Demonstrate telephone communication techniques, including; identifying name and organization, practicing active listening techniques, demonstrating constructive feedback techniques, speaking clearly and concisely, using plain language and trade terms, noting comments of client and ensuring client satisfaction, according to employer and client site-specific standards.
- 7.7 Interpret job-related information during work-site client consultation, according to job specifications and employer and client site-specific standards.
- 7.8 Differentiate between features of products, according to job specifications and employer and client site-specific standards.
- 7.9 Report discrepancies on job-site to management, using clear, concise and specific details, ensuring client satisfaction according to employer and client site-specific standards.
- 7.10 Describe approval process, according to job specifications and employer and client site-specific standards.
- 7.11 Identify the tasks, events or requests to be documented in writing, including; time sheets, material list, tracking sheets, accident and incident reports.
- 7.12 Interpret manufacturer's Material Safety Data Sheets, according to related legislation and employer and client site-specific standards.
- 7.13 Interpret manufacturer's operating instructions, according to manufacturer's specifications and employer and client site-specific standards.
- 7.14 Prepare information for cost estimates including time, materials and equipment according to job specifications, and employer and client site-specific standards.
- 7.15 Review documentation to verify information for completion, according to job specifications and employer and client site-specific standards.

- 7.16 Organize information and complete job related documentation according to manufacturer's specifications, job specifications and employer and client standards.
- 7.17 Complete written documentation, including client service records, employer forms and incident and management reports, by identifying name, date and organization, writing clearly and concisely, using plain language and trade terms, completing all areas of forms, noting comments of client and ensuring client satisfaction, according to employer and client site-specific standards.
- 7.18 Identify distribution method for completed documentation, according to employer standards.
- 7.19 Describe and identify potential conflicts in job specifications, cost estimates, work completed and personnel, according to job specifications, and employer and client site-specific standards.
- 7.20 Describe types of verbal and non-verbal communication.
- 7.21 List elements of escalating situations between co-workers and with client and other job-site personnel, by identifying heightened non-verbal communication and raised voices, and non-verbal body language.
- 7.22 Describe techniques used to offer alternative solutions.
- 7.23 Describe alternative options to offer co-workers, other job-site personnel and client, according to employer and client site-specific standards.
- 7.24 Demonstrate problem solving techniques, including; practising active listening techniques, clarifying (identifying?) source of problem or conflict, remaining calm, offering options and negotiating solutions, according to client standards.
- 7.25 Document incident by completing employer forms, according to related legislation and employer standards.
- 7.26 Describe application of workplace-related legislation including labour, human rights and health and safety, according to related legislation and employer standards.

Number:	8.0		
Title:	Optical Fibre Terminating and Splicing		
Duration:	Total Hours: 48	Theory: 28	Practical: 20
Prerequisites:	Unit 1 Safety and Tools Unit 2 Codes and Standards Part #1 Unit 3 Codes and Standards Part #2 Unit 4 Planning, Preparation and Documentation Unit 5 Trade Calculations and Electronics		

General Learning Outcomes

Upon successful completion of this reportable subject the apprentice will interpret and apply codes and standards, identify related drawings and specifications, identify and select hand tools, power and powder-actuated select and maintain test equipment, perform site inspections to confirm that job specifications, industry standards and building codes match the drawings and calculate the box and conduit fill ratios, select routing, demonstrate the procedures for pulling a medium into cable pathways, install supports, cable tray, and raceways, select and use test procedures and prepare the cable for installation in various types of environments, install a fibre-optic cable for backbone and horizontal applications in an inside plant installation, label and dress cables to the termination points, install and connect equipment in a inside plant, label and dress cables for termination, prepare and terminate fibre- optic cables in an inside, prepare and splice a fibre-optic cables in an inside plant, install and connect various types of patch panels and cross-connects, label a cable plant, test various types of optical fibre cable, perform final inspection, identify and repair optical fibre cable systems.

Units of Learning Outcomes

Upon successful completion, the apprentice is able to:

- 8.1 Interpret the sections of the Canadian Electrical Code Part 1, Ontario Electrical Safety Code that are required to plan a cable plant including sections: 0, 2, 10, 12, 16, 18, 24, 26, 54, 56, 60, 80
- 8.2 Interpret the current CSA, TIA/EIA standards that are followed to plan an installation including TIA/EIA, 568-A, 569-A, 570-A, 606, 607, 758 and CAN/CSA T525, T527, T528, T529, T530 including bulletins and amendments according to job specifications and employer and client site-specific standards.

- 8.3 Describe types of backbone, horizontal, physical, and logical topologies including
- Bus
 - Ring
 - Star
 - Mesh
- 8.4 Interpret sections of the building codes related to installation according to TIA/EIA 569-A, CAN/CSA T530 Appendix B, CAN4-S101, CAN4-S115, Ontario Building Codes (OBC).
- firestop systems
 - plenum spaces
- 8.5 Describe a plenum and non-plenum area according to related legislation.
- 8.6 Describe fire rating of cables according to related codes and standards, OBC, CEC, Ontario Electrical Safety Code, TIA/EIA 569-A and CAN/CSA T530.
- 8.7 Select optical fibre backbone and horizontal cables according to environment, application, performance and related codes and standards including; TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- loose tube
 - tight buffer
 - ribbon
 - air blown
 - optical size
 - length
 - fire rating
 - performance rating
- 8.8 Verify the distance limitations of backbone and horizontal optical fibre cables according to TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- singlemode
 - multimode
- 8.9 Describe bandwidth limits for cable types according to TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 8.10 Describe restrictions and distance considerations of installed cables to sources of EMI and RFI according to related codes and standards including; TIA/EIA 568-A, CAN/CSA T529 and TIA/EIA 569-A, CAN/CSA T530.

- 8.11 Select the cable routing according to work site conditions according to TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- building design
 - furniture pathways
- 8.12 Describe and list requirements for cable installations in raised floor applications according to related codes and standards including TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 8.13 Describe and list the requirements for raceway installations of telecommunication systems according to related legislation and employer and client site-specific standards including TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 8.14 Describe the requirements for closed and open ceiling space installations of telecommunication systems according to related legislation and employer and client site-specific standards including TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 8.15 Describe dressing and supporting of cables in ceiling spaces according to CEC, Ontario Electrical Safety Code, TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 8.16 Calculate the number of fibre strands required according to job specifications including TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 8.17 Calculate raceway fill ratios according to CEC, Ontario Electrical Safety Code, CSA Standards and job specifications including CAN/CSA T530 and bulletins and amendments.
- 8.18 Calculate box sizes for pull boxes to CSA Standards and job specifications including CEC Part 1 Ontario Electrical Safety Code and TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 8.19 Verify location of equipment rooms, telecommunication closets and entrance facilities to ensure that they are sized according to job specifications and employer and client site-specific standards, including; CEC, Ontario Electrical Safety Code, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 8.20 Select wall and rack mounting equipment according to manufacturer's and job specifications and employer and client site-specific standards.

- 8.21 Demonstrate equipment mounting and fastening techniques for optical fibre cable according to manufacturer's specifications.
- 8.22 Describe techniques for fastening backboards, racks according to job specifications and employer and client site-specific standards, including; OBC, CEC, Ontario Electrical Safety Code, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 8.23 Describe installation requirements for cable supports in inside plant environments according to related legislation, job specifications and employer and client site-specific standards. TIA/EIA 569-A, CAN/CSA T530, CEC and Ontario Electrical Safety Code.
- D-rings
 - J-hooks
 - cable tray
 - conduit
 - wireways
 - threaded rods
 - ceiling hanger brackets
 - wall brackets
 - conduit hangers
 - wire management systems
 - inner duct
- 8.24 Install the raceways and supports using tools and equipment and fasteners according to related legislation, job specifications and employer and client site-specific standards including; TIA/EIA 568-A, CAN/CSA T529 , TIA/EIA 569-A, CAN/CSA T530, CEC and Ontario Electrical Safety Code
- drills
 - powder-actuated devices
- 8.25 Identify, select and operate hand tools according to manufacturer's instructions and to related legislation, job specifications and employer and client site-specific standards and OHS standards section 93.
- conduit benders
 - hole punches
 - cable strippers
 - cable grips
 - hand saws
 - drywall saws
- 8.26 Schedule any special equipment required for installation.

- 8.27 Describe pre-installation testing procedures for cable;
- damage during shipment
 - manufacturer's defects
 - check attenuation matches manufacturer's specifications
- 8.28 Select test equipment according to the cable type, job specifications and employer and client site-specific standards including; TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- cable certification testers
 - multi-meters
 - OTDRs
 - light source and power meters
 - optical fibre flash light
- 8.29 Demonstrate methods of attaching cables to test equipment according to manufacturer's specifications and employer standards.
- 8.30 Perform and interpret test procedures using equipment according to job specifications, employer and client site-specific standards including; TIA/EIA 568- A, CAN/CSA T529 and bulletins and amendments.
- 8.31 Select and describe the use of pulling equipment and methods.
- fish tapes
 - jet lines
 - ropes
 - tuggers
 - reel jacks and stands
 - reel brakes
- 8.32 Describe factors that affect pulling tension according to manufactures specifications.
- number of bends in conduit
 - armoured cable
- 8.33 Describe procedures of labelling cable prior to installation according to employer and client site-specific standards including; TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.
- 8.34 Demonstrate methods of fastening cables according to manufacturer's specifications and employer standards.
- ropes
 - fish-tapes
 - wire-mesh grips

- 8.35 Demonstrate the method of pulling cable.
- air blown methods
 - vacuums
 - jet lines
 - power tuggers
- 8.36 Demonstrate dressing techniques for optical fibre according to industry standards and manufacturer's specifications and employer standards.
- 8.37 Organize cables at demarcation point, equipment facility and telecommunication closets according to job specifications and employer and client site-specific standards.
- 8.38 Select termination tools for specific connectors according to job specifications and employer and client site-specific standards.
- buffer removal tools.
 - scissors
 - cleaners
 - microscopes
 - polishing jigs and pads
 - polishing films
 - scribes
 - cleavers
 - crimp tools
 - manufacturer's specific splice kits
 - splice trays
 - fanout kits
- 8.39 Prepare loose-tube and tight buffer inside plant cables according to CEC, Ontario Electrical Safety Code TIA/EIA 606, CAN/CSA T528, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- sheath and buffer tube removal
 - cleaning
 - cleaving
 - dressing
 - labelling
 - bonding to ground
- 8.40 Terminate singlemode and multimode optical fibre using crimp, adhesive and epoxy, according to manufacturer's and job specifications and employer and client site- specific standards.
- ST
 - SC
 - small form factor connectors

- 8.41 Describe the splicing techniques for optical fibre ribbon cable.
- 8.42 Demonstrate fusion and mechanical splicing techniques according to manufacturer's and job specifications and employer and client site-specific standards.
- 8.43 Select and install cross-connects and patch panels according to manufacturer's and job specifications and employer and client site-specific standards.
- 8.44 Install cross-connect jumpers and patch cables according to manufacturer's and job specifications and employer and client site-specific standards.
- 8.45 Select test equipment according to manufacturer's and job specifications and employer and client site-specific standards TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- OTDR
 - optical source and light meter
 - optical fibre flashlight
- 8.46 Describe testing methods according to TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 8.47 Test cables according to manufacturer's and job specifications and employer and client site-specific standards TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 8.48 Demonstrate the care and handling of test equipment according to the manufacturer's specifications and employer standards.
- 8.49 Demonstrate the methods of loading software upgrades to test equipment.
- 8.50 Document and interpret test results according to manufacturer's and job specifications and client and employer standards, TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.
- 8.51 Label cross-connect and patch cabling according to job specifications and employer and client site-specific standards TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.
- 8.52 Label installation according to job specifications, employer and client site-specific standards and industry standards including; TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments.

- 8.53 Identify and select label types according to job specifications and employer and client site-specific standards, TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.
- adhesive
 - insert
 - tie-on
- 8.54 Describe requirements for labelling including colour codes according to job specifications and employer and client site-specific standards including; TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments.
- 8.55 Label cable systems according to job specifications and employer and client site-specific standards, TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.
- computer labels
 - machine printed labels
 - hand written labels
- 8.56 Describe the documentation required for labelling raceways and cables according to job specifications, employer and client site-specific standards and industry standards including; TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments.
- 8.57 Describe records including user, building, system and equipment according to job specifications and employer and client site-specific standards including; TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments.
- Cable management data base
 - Cable management software (CMS)
 - Labelling software
 - Cable certification records
- 8.58 Demonstrate labelling and dressing techniques for optical fibre according to industry standards and manufacturer's specifications and employer standards.
- 8.59 Demonstrate labelling for cable systems including closet, equipment rooms, cables, raceways and work station outlets according to related legislation, industry standards, job specifications and employer and client site-specific standards.
- 8.60 Perform final inspection and verify installation according to manufacturer's and job specifications and client and employer standards OBC, CEC, Ontario Electrical Safety Code TIA/EIA 606, CAN/CSA T528, TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 607, CAN/CSA T527, TIA/EIA 758 and bulletins and amendments.

- 8.61 Document items of non-compliance according to job specifications and employer and client site-specific standards.
- 8.62 Clarify problem by interpreting symptoms with client and co-worker according to job specifications and employer and client site-specific standards.
- 8.63 Visually inspect cable systems to determine problem according to TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- breaks
 - twists
 - length
 - location to heat
- 8.64 Discuss corrective options with client.
- 8.65 Repair cable system as directed by client according to employer and client site-specific standards.
- 8.66 Perform final inspection according to manufacturer's and job specifications and employer and client site-specific standards.

Number:	9.0		
Title:	STP/Coaxial Cable Terminating and Splicing		
Duration:	Total Hours: 48	Theory: 28	Practical: 20
Prerequisites:	Unit 1 Safety and Tools Unit 2 Codes and Standards Part #1 Unit 3 Codes and Standards Part #2 Unit 4 Planning, Preparation and Documentation Unit 5 Trade Calculations and Electronics		

General Learning Outcomes

Upon successful completion of this reportable subject the apprentice is able to interpret and apply codes and standards, identify related drawings and specifications, identify and select the hand tools, power and powder-actuated tools, select and maintain test equipment, perform site inspections to confirm that job specifications, industry standards and building codes match the drawings and calculate the box and conduit fill ratios, select routing, demonstrate the procedures for pulling a medium into cable pathways, install supports, cable tray, and raceways, select and use test procedures and prepare the cable for installation in various types of environments, install STP/Coaxial cables as a backbone or horizontal application in an inside plant installation; label and dress cables to the termination points, install and connect equipment, label and dress cables for termination, prepare and terminate STP/Coaxial cables, install and connect various types of patch panels and cross-connects, label a cable plant, test various types of copper cables, perform final inspection, in an inside plant, identify and repair STP, coaxial cable systems.

Units of Learning Outcomes

Upon successful completion, the apprentice is able to:

- 9.1 Interpret the sections of the Canadian Electrical Code Part 1, Ontario Electrical Safety Code that are required to plan a cable plant including sections: 0, 2, 10, 12, 16, 18, 24, 26, 54, 56, 60, 80
- 9.2 Interpret the current CSA, TIA/EIA standards that are followed to plan an installation including TIA/EIA, 568-A, 569-A, 570-A, 606, 607, 758 and CAN/CSA T525, T527, T528, T529, T530 including bulletins and amendments according to job specifications and employer and client site-specific standards.
- 9.3 Verify that installation drawings match work site.

- 9.4 Describe types of backbone, horizontal, physical, and logical topologies including
- Bus
 - Ring
 - Star
 - Mesh
- 9.5 Interpret sections of the building codes related to installation according to TIA/EIA 569-A, CAN/CSA T530 Appendix B, CAN4-S101, CAN4-S115, Ontario Building Codes (OBC).
- firestop systems
 - plenum spaces
- 9.6 Describe a plenum and non-plenum area according to related legislation.
- 9.8 Describe fire rating of cables according to related codes and standards, OBC, CEC, Ontario Electrical Safety Code, TIA/EIA 569-A and CAN/CSA T530.
- 9.9 Select backbone or horizontal cables according to environment, application, performance and related codes and standards including; TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- STP. - Type 1, Type 2, Type 6, Type 8, Type 9, STP-A
 - Coaxial
 - size
 - length
 - fire rating
 - performance rating
- 9.10 Describe bandwidth limits for cable types according to TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 9.11 Select the cable routing according to work site conditions according to TIA/EIA 569- A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- building design
 - furniture pathways
- 9.12 Describe and list requirements for cable installations in raised floor applications according to related codes and standards including TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.

- 9.13 Describe and list the requirements for raceway installations of telecommunication systems according to related legislation and employer and client site-specific standards including TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 9.14 Describe the requirements for closed and open ceiling space installations of telecommunication systems according to related legislation and employer and client site-specific standards including TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 9.15 Describe dressing and supporting of cables in ceiling spaces according to CEC, Ontario Electrical Safety Code, TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 9.16 Describe restrictions and distance considerations of installed cables to sources of EMI and RFI according to related codes and standards including; TIA/EIA 568-A, CAN/CSA T529 and TIA/EIA 569-A, CAN/CSA T530.
- STP
 - Coaxial
- 9.17 Describe the distance limitations of telecommunication cables, according to related industry standards, TIA/EIA 568-A , CAN/CSA T529 and bulletins and amendments.
- 9.18 Calculate the number of cables, pairs required according to job specifications including TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 9.19 Calculate raceway fill ratios according to CEC, Ontario Electrical Safety Code, CSA Standards and job specifications s including CAN/CSA T530 and bulletins and amendments.
- 9.20 Calculate box sizes for pull boxes to CSA Standards and job specifications s including CEC Part 1 Ontario Electrical Safety Code and TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 9.21 Identify and select and demonstrate the use of the tools required for the installation according to manufacturer’s instructions and to related legislation, job specifications and employer and client site-specific standards and OHS standards section 93.
- conduit benders
 - hole punches
 - cable strippers
 - cable grips
 - hand saws
 - drywall saws

- 9.22 Schedule any special equipment required for installation.
- 9.23 Select wall and rack mounting equipment according to manufacturer's and job specifications and employer and client site-specific standards.
- 9.24 Verify location of equipment rooms, telecommunication closets and entrance facilities to ensure that they are sized according to job specifications and employer and client site-specific standards, including; CEC, Ontario Electrical Safety Code, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 9.25 Demonstrate equipment mounting and fastening techniques for copper cable according to manufacturer's specifications.
- crimp tools
 - soldering
 - twist-on
 - wire management systems
- 9.26 Describe techniques for fastening backboards, racks according to job specifications and employer and client site-specific standards, including; OBC, CEC, Ontario Electrical Safety Code, TIA/EIA 569-A, CAN/CSA T530 and bulletins and amendments.
- 9.27 Describe installation requirements for cable supports in inside plant environments according to related legislation, job specifications and employer and client site-specific standards. TIA/EIA 569-A, CAN/CSA T530, OBC, CEC and Ontario Electrical Safety Code and bulletins and amendments.
- D-rings
 - J-hooks
 - bridle rings
 - mushrooms
 - cable trays
 - ladder trays
 - conduits
 - wireways
 - threaded rods
 - ceiling hanger brackets
 - wall brackets
 - conduit hangers

- 9.28 Install the raceways and supports using tools and equipment and fasteners according to related legislation, job specifications and employer and client site-specific standards including; TIA/EIA 568-A, CAN/CSA T529 , TIA/EIA 569-A, CAN/CSA T530, CEC and Ontario Electrical Safety Code
- drills
 - powder-actuated devices
- 9.29 Interpret sections of the CEC and the Ontario Electrical Safety Code according to job specifications.
- 9.30 Describe pre-installation testing procedures for cable.
- damage during shipment
 - manufacturer's defects
 - check continuity
- 9.31 Select test equipment according to the cable type, job specifications and employer and client site-specific standards including; TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- cable certification testers
 - multi-meters
 - TDRs
- 9.32 Demonstrate methods of attaching cables to test equipment according to manufacturer's specifications and employer standards.
- 9.33 Perform and interpret test procedures using equipment according to job specifications, employer and client site-specific standards including; TIA/EIA 568- A, CAN/CSA T529 and bulletins and amendments.
- 9.34 Describe procedures of labelling cable prior to installation according to employer and client site-specific standards including; TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.
- 9.35 Describe the use of and select pulling equipment and demonstrate pulling methods.
- fish tapes
 - jet lines (compressed air)
 - ropes
 - tuggers
 - reel jacks and stands
 - reel brakes

- 9.36 Describe factors that affect pulling tension.
- number of bends in conduit
 - armoured cable
 - type of copper
 - manufacturers specifications
- 9.37 Select pulling medium according to manufacturer's specifications and industry standards.
- 9.38 Install pulling medium according to manufacturer's specifications and related codes and standards.
- 9.39 Demonstrate methods of fastening cables to the pulling medium according to manufacturer's specifications and employer standards.
- ropes
 - fish-tapes
 - wire-mesh grips
- 9.40 Demonstrate dressing techniques for copper according to industry standards and manufacturer's specifications and employer and client site-specific standards.
- 9.41 Organize cables at demarcation point, equipment facility and telecommunication closets according to job specifications and employer and client site-specific standards.
- 9.42 Select termination tools and equipment for specific connectors, patch panels and cross-connects according to manufacturers and job specifications and employer and client site-specific standards.
- sheath removal tools
 - scissors
 - terminal blocks
 - patch panels
 - modular jacks
 - designation strips
 - grounding frames
 - cable management hardware
 - crimp tools
- 9.43 Prepare copper cables for termination in both backbone and horizontal applications according to manufacturer's specifications and employer and client site-specific standards.
- STP
 - Coaxial

- 9.44 Terminate copper cables using configurations according to job specifications, manufacturer's specifications and employer and client site-specific standards, TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.
- modular patch panels
 - wall outlets
 - IDC
- 9.45 Identify and select test equipment according to clients and manufacturers test requirements for the particular application.
- cable certification testers
 - multi-meter
 - TDR
 - tone generators and inductive amplifier
 - line test set
 - continuity tester
 - cable tracer
- 9.46 Demonstrate the care and handling of test equipment according to the manufacturer's specifications and employer standards.
- 9.47 Demonstrate the methods of loading software upgrades to test equipment.
- 9.48 Describe testing methods according to TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 9.49 Test cables according to manufacturer's and job specifications and employer and client site-specific standards TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 9.50 Document and interpret test results according to manufacturer's and job specifications and client and employer standards, TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.
- 9.51 Describe components to be labelled according to job specifications and employer and client site-specific standards including; TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments.
- spaces
 - pathways
 - cables
 - connecting hardware
 - grounding system
 - equipment
 - racks

- 9.52 Describe records including user, building, system and equipment according to job specifications and employer and client site-specific standards including; TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments.
- Cable management data base
 - Cable management software (CMS)
 - Labeling software
 - Cable certification records
- 9.53 Demonstrate labelling and dressing techniques for copper according to industry standards and manufacturer's specifications and employer standards.
- 9.54 Describe requirements for labelling including colour codes according to job specifications and employer and client site-specific standards including; TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments.
- 9.55 Describe records including user, building, system and equipment according to job specifications and employer and client site-specific standards including; TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments.
- Cable management data base
 - Cable management software (CMS)
 - Labelling software
- 9.56 Prepare final documentation according to industry standards, manufacturer's and job specifications and client and employer standards.
- 9.57 Describe cable management systems. [CMS]
- 9.58 Clarify problem by interpreting symptoms with client and co-worker according to job specifications and employer and client site-specific standards.
- 9.59 Visually inspect cable systems to determine problem according to TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- breaks
 - twists
 - length
 - location to heat
 - EMI
 - RFI
- 9.60 Interpret test results according to manufacturer's and job specifications and employer and client site-specific standards, TIA/EIA 568-A CAN/CSA T529 and bulletins and amendments.

- 9.61 Discuss corrective options with client.
- 9.62 Repair cable system as directed by client according to employer and client site- specific standards.
- 9.63 Perform final inspection according to according to manufacturer's and job specifications and employer and client site-specific standards.

Number:	10.0		
Title:	Customer Owned Outside Plant		
Duration:	Total Hours: 48	Theory: 28	Practical: 20
Prerequisites:	Unit 1 Safety and Tools Unit 2 Codes and Standards Part #1 Unit 3 Codes and Standards Part #2 Unit 4 Planning, Preparation and Documentation Unit 5 Trade Calculations and Electronics		

General Learning Outcomes

Upon successful completion of this reportable subject the apprentice will interpret and apply codes and standards to perform the installation, identify related drawings and specifications, identify and select the hand tools, power and powder-actuated tools to be used for an installation, select and maintain test equipment, perform site inspections to confirm that job specifications, industry standards and building codes match the drawings and calculate the box and conduit fill ratios, select routing for the installation of the cable plant according to work site conditions, demonstrate the procedures for pulling a medium into cable pathways, install supports, cable trays, and raceways in an outside plant, select and use test procedures and prepare the cable for installation in various types of environments, install a fibre-optic or copper cables as a backbone in an outside plant installation, label and dress cables to the termination points, install and connect equipment in an outside plant, label and dress cables for termination, prepare and terminate optical fibre cables in an outside plant, prepare and splice optical fibre or copper cables in an outside plant, select and install protection equipment, plan and install grounding and bonding systems, label a cable plant, test various types of copper and optical fibre cable plants, perform final inspection, prepare final documentation, identify and repair UTP, ScTP, STP, coaxial and optical fibre cable systems.

Units of Learning Outcomes

Upon successful completion, the apprentice is able to:

- 10.1 Interpret the sections of the Canadian Electrical Code Part 1, Ontario Electrical Safety Code that are required to plan a cable plant including sections: 0, 2, 10, 12, 16, 18, 24, 26, 54, 56, 60, 80
- 10.2 Interpret the current CSA, TIA/EIA standards that are followed to plan an installation including TIA/EIA, 570-A, 606, 607, 758 and CAN/CSA T525, T527, T528, including bulletins and amendments according to job specifications and employer and client site-specific standards.

- 10.3 Differentiate between federal, provincial and local building codes.
- 10.4 Check that installation drawings match work site.
- 10.5 Note changes and corrections required to drawings and specifications.
- 10.6 Confirm contract and scope of work match.
- 10.7 Confirm information contained in job specifications and contract match.
- 10.8 Interpret telecommunication symbols. TIA/EIA 606, CAN/CSA T528 - annex C.
- 10.9 Interpret manufacturer's drawings.
- 10.10 Interpret drawings.
- backbone
 - architectural
 - mechanical
 - electrical
- 10.11 Describe types of backbone, horizontal, physical, and logical topologies including
- Bus
 - Ring
 - Star
 - Mesh
- 10.12 Select the cables according to environment, application, performance and related codes and standards including; TIA/EIA 758 and bulletins and amendments. and materials used for installation according to job drawings and specifications, industry standards and building codes.
- UTP - Cat 1, Cat 2, Cat 3, Cat 4, Cat 5, Cat 5e, Cat 6
 - STP - Type 1
 - ScTP
 - Coaxial
 - Singlemode and multimode optical fibre cables
 - size
 - length
 - performance rating

- 10.13 Describe the distance limitations of telecommunication cables, according to related industry standards, TIA/EIA 568-A CAN/CSA T529 and bulletins and amendments.
- UTP
 - ScTP
 - STP
 - Optical fibre (singlemode, multimode)
 - Coaxial
- 10.14 Select the cable routing according to work site conditions according to TIA/EIA 758 and bulletins and amendments.
- 10.15 Describe installation requirements for cable supports in outside plant environments according to related legislation, job specifications and employer and client site- specific standards. TIA/EIA 758 and Ontario Electrical Safety Code.
- cable trays
 - conduits
 - wireways
 - threaded rods
 - hanger brackets
 - wall brackets
 - conduit hangers
- 10.16 Describe aerial, underground and buried cable installations.
- confined spaces
 - tunnels
 - trenching
 - boring
- 10.17 Install raceways according to related legislation, job specifications and employer and client site-specific standards including; TIA/EIA 758 and bulletins and amendments.
- 10.18 Describe types of trenching and boring techniques.
- compact trencher
 - vibratory plow
 - directional boring
- 10.19 Describe methods of installing underground cables.
- power winches
 - ropes
 - pulleys
 - breakway devices

- 10.20 Describe the procedure for planning for aerial installation.
- pole line location
 - joint use of poles
 - crossing roadways
 - crossing railways
 - crossing power lines
 - crossing navigable waterways
- 10.21 Describe self-supporting cable verses lashed cables according to related codes and standards.
- 10.22 Describe the use and restrictions of conduits and raceways in an outside plant installation according to related codes and standards.
- 10.23 Calculate the number of cables, pairs and fibre strands required according to job specifications including TIA/EIA 758 and bulletins and amendments.
- 10.24 Perform a take-off of job related material.
- length
 - quantities
 - pair and strand counts
- 10.25 Differentiate between types of sleeves installed according to related codes and standards including; CEC, OBC, TIA/EIA 758.
- permanent
 - temporary
 - water- tight
 - fire rated
- 10.26 Describe pre-installation testing procedures for cable.
- damage during shipment
 - manufacturer's defects
 - check attenuation matches manufacturer's specifications
- 10.27 Select test equipment according to the cable type, job specifications and employer and client site-specific standards including; TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 10.28 Demonstrate methods of attaching cables to test equipment according to manufacturer's specifications and employer and client site-specific standards.

- 10.29 Perform and interpret test procedures using equipment according to job specifications, employer and client site-specific standards including; TIA/EIA 568- A, CAN/CSA T529 and bulletins and amendments.
- cable certification testers
 - multi-meters
 - TDRs
 - OTDRs
 - light source and power meters
 - optical fibre flash light
- 10.30 Describe procedures of labelling cable prior to installation according to employer and client site-specific standards including; TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.
- 10.31 Select pulling equipment and method.
- fish tapes
 - jet lines
 - ropes
 - tuggers
 - reel jacks and stands
 - reel brakes
- 10.32 Describe factors that affect pulling tension.
- number of bends in conduit
 - armoured cable
 - type of copper or optical fibre cable
 - Manufacturers specifications
- 10.33 Install pulling medium according to manufacturer's specifications and related codes and standards.
- 10.34 Demonstrate methods of fastening cables to pulling medium according to manufacturer's specifications and employer and client site-specific standards.
- ropes
 - fish-tapes
 - wire-mesh grips
- 10.35 Demonstrate the method of pulling cable.
- air blown methods
 - vacuums
 - jet lines
 - power tuggers

- 10.36 Describe methods of installing aerial cables according to manufacturer's specifications and related codes and standards.
- climbing
 - power augers
 - power drills
 - bucket trucks
 - lashing equipment
- 10.37 Describe methods of installing cable in raceways, and underground according to manufacturer's specifications and employer and client site-specific standards.
- trenching
 - boring
 - direct buried
 - buried
- 10.38 Describe the use of power and hand tools for installing outside plant backbone cables according to job specifications and employer and client site-specific standards.
- tuggers
 - compressed air
 - trenchers
 - bucket trucks
- 10.39 Operate hand and power tools according to manufacturer's instructions and to related legislation, job specifications and employer and client site-specific standards.
- conduit benders
 - hole punches
 - cable strippers
 - cable grips.
 - hand saws
 - drywall saws
 - reciprocating saws
 - drills
 - tuggers
 - vacuums
- 10.40 Describe scheduling procedures for any special equipment required for work site installation.

- 10.41 Operate powder-actuated tools according to manufacturer's instructions, related legislation, job specifications and client, employer standards and licensing procedures.
- 10.42 Select wall and rack mounting equipment according to manufacturer's and job specifications and employer and client site-specific standards.
- 10.43 Verify location and size of equipment facilities according to job specifications, employer and client site-specific standards and related codes and standards, including; CEC, Ontario Electrical Safety Code, TIA/EIA 569-A, CAN/CSA T529 , CAN/CSA T530, TIA/EIA 758 and bulletins and amendments.
- 10.44 Demonstrate equipment mounting and fastening techniques for copper and optical fibre cable according to manufacturer's specifications.
- BIX
 - 110
 - 66
 - Krone®
 - optical fibre
 - wire management systems
 - binding posts
- 10.45 Describe techniques for fastening backboards, racks and wire management systems according to job specifications and employer and client site-specific standards, including; OBC, CEC, Ontario Electrical Safety Code, TIA/EIA 569-A, CAN/CSA T529 , CAN/CSA T530 and bulletins and amendments.
- 10.46 Describe installation of cable supports according to job specifications and employer and client site-specific standards, including; OBC, CEC, Ontario Electrical Safety Code, TIA/EIA 569-A, CAN/CSA T530, CAN/CSA T529 and bulletins and amendments.
- ladder trays
 - inner-ducts
 - conduits
 - wireways
- 10.47 Demonstrate dressing techniques for copper and optical fibre according to industry standards and manufacturer's specifications and employer and client site-specific standards.
- 10.48 Organize cables at demarcation point, equipment facility and telecommunication closets according to job specifications and employer and client site-specific standards.

- 10.49 Select termination tools and equipment for optical fibre according to job specifications and employer and client site-specific standards.
- tents
 - heaters
 - ladders
 - buffer removal tools
 - curing ovens
 - UV curing lamps
 - microscopes
 - polishing jigs and pads
 - polishing films
 - scribes
 - cleaners
 - cleavers
 - scissors
 - crimp tools
 - manufacturer's specific termination kits
 - splice trays
 - fanout kits
- 10.50 Prepare loose-tube and tight buffer outside plant cables according to CEC, Ontario Electrical Safety Code TIA/EIA 758 and bulletins and amendments.
- sheath and buffer, tube removal
 - cleaning
 - cleaving
 - dressing
 - labelling
 - bonding to ground
- 10.51 Terminate singlemode and multimode optical fibre connectors according to manufacturer's and job specifications and employer and client site-specific standards.
- using crimps
 - adhesives
 - epoxys
 - fusion splices
 - mechanical splices
 - splice trays
 - environmental and sealing of enclosures

- 10.52 Select termination tools and equipment for copper specific connectors according to manufacturer's and job specifications and employer and client site-specific standards.
- tents
 - ladders
 - patch panels
 - cross-connects
 - punch down tools: BIX, 110, 66, Krone®
 - sheath removal tools
 - terminal blocks
 - modular jacks
 - designation strips
 - dressing blocks
 - cable management hardware
 - crimp tools
- 10.53 Prepare copper cables for termination according to manufacturer's specifications and employer and client site-specific standards.
- UTP
 - ScTP
 - STP
 - Coaxial
- 10.54 Terminate copper cables using T568-A, T568-B, Universal Service Order Code(USOC) configurations according to manufacturer's and job specifications and employer and client site-specific standards, including CEC, Ontario Electrical Safety Code, TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 606, CAN/CSA T528, TIA/EIA 758 and bulletins and amendments.
- modular and wall outlets
 - BIX
 - 110
 - 66
 - Krone®
 - Data connector [STP]
 - coaxial connectors [BNC, N, F]
 - D subminiature

- 10.55 Select splice tools and equipment for optical fibre according to job specifications and employer and client site-specific standards.
- bucket trucks
 - tents
 - heaters
 - ladders
 - buffer removal tools
 - cleaners
 - cleavers
 - scissors
 - crimp tools
 - manufacturer's specific splice kits
 - splice trays
 - enclosures
- 10.56 Prepare loose-tube and tight buffer outside plant cables according to CEC, Ontario Electrical Safety Code TIA/EIA 606, CAN/CSA T528, TIA/EIA 758 and bulletins and amendments.
- sheath and buffer, tube removal
 - cleaning
 - cleaving
 - dressing
 - labelling
 - bonding to ground
- 10.57 Describe splicing techniques for splicing optical fibre ribbon cables.
- 10.58 Demonstrate fusion and mechanical splicing techniques according to manufacturer's and job specifications and employer and client site-specific standards.
- 10.59 Select splicing tools and equipment for copper according to manufacturer's and job specifications and employer and client site-specific standards.
- bucket trucks
 - tents
 - heaters
 - ladders
 - crimp tools
 - punch down tools
 - splice rigs
 - sheath removal tools
 - 780
 - MS².

- terminal blocks
 - designation strips
 - dressing blocks
 - splice kits
 - tapes
 - heat shrinks
 - cable management hardware
- 10.60 Select the type of splice hardware according to manufacturer's and job specifications and employer and client site-specific standards for a given application.
- splice enclosures
 - free standing racks
 - wall mount racks
- 10.61 Prepare copper cables for splicing according to manufacturer's and job specifications and employer and client site-specific standards including; CEC, Ontario Electrical Safety Code, TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 606, CAN/CSA T528 and TIA/EIA 607, CAN/CSA T527, TIA/EIA 758 and bulletins and amendments.
- sheath removal
 - sheath bonding
 - binder group separation
 - cleaning
 - labelling techniques
- 10.62 Splice outside plants according to manufacturer's and job specifications and employer and client site-specific standards.
- in-line
 - butt
 - branch
 - fold back
- 10.63 Identify and select test equipment according to clients and manufacturers test requirements for the particular application;
- cable certification testers
 - optical source and light meters
 - multi-meter
 - TDR
 - OTDR
 - tone generators and inductive amplifier
 - line test set
 - cable tracer

- 10.64 Describe and select protection equipment according to related legislation, job specifications and employer and client site-specific standards, CEC, Ontario Electrical Safety Code.
- primary protectors: carbon blocks, gas tubes, solid state
 - secondary protection: heat coils, sneak current fuses, positive temperature coefficient resistors
 - enhanced protection: clamping diodes, opti-couplers, filters .
- 10.65 Plan the routing of grounding and bonding conductors according to related legislation, job specifications and employer and client site-specific standards, CEC, Ontario Electrical Safety Code, TIA/EIA 607 and CAN/CSA T527 and bulletins and amendments.
- 10.66 Select the size of grounding and bonding conductors and system components according to related legislation, job specifications and employer and client site- specific standards, CEC, Ontario Electrical Safety Code, TIA/EIA 607, CAN/CSA T527 and bulletins and amendments.
- 10.67 Explain the terms:
- AWG
 - Components of a grounding system
 - Ground loops
 - Bonding
 - Bonding conductor
 - Ground
 - Ground rod
 - Grounding electrode conductor
 - Telecommunication bonding backbone
 - Telecommunication bonding backbone interconnecting bonding conductor
 - Telecommunication main grounding busbar
 - Telecommunication grounding busbar
 - Lugs, crimp and compression
 - Ground clamps
 - Ground bushings
 - Hand and Hydraulic Crimp Tool
- 10.68 Describe exothermic welding according to manufacturer’s and industry standards CEC, Ontario Electrical Safety Code.
- 10.69 Demonstrate the installation methods, inspect and test grounding and bonding conductors according to related legislation, job specifications and employer and client site-specific standards.

- 10.70 Describe components to be labelled according to job specifications and employer and client site-specific standards including; TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments.
- spaces
 - pathways
 - cables
 - connecting hardware
 - grounding system
 - equipment
 - hubs
 - racks
- 10.71 Describe records including user, building, system and equipment according to job specifications and employer and client site-specific standards including; TIA/EIA 606 and CAN/CSA T528 and bulletins and amendments.
- Cable management data base
 - Cable management software (CMS)
 - Labelling software
 - Cable certification records
- 10.72 Identify and select label types according to job specifications and employer and client site-specific standards, TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.
- adhesive
 - insert
 - tie-on
 - computer labels
 - machine printed labels
 - hand written labels
- 10.73 Demonstrate labelling for cable systems including closet, equipment rooms, cables, raceways and work station outlets according to related legislation, industry standards, job specifications and employer and client site-specific standards.
- 10.74 Label and prepare documentation according to job specifications and employer and client site-specific standards, CEC, Ontario Electrical Safety Code, TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.

- 10.75 Select test equipment according to manufacturer's and job specifications and employer and client site-specific standards.
- TDR
 - multi-meters
 - cable certification tester
 - continuity testers
 - tone generator and inductive amplifier
 - OTDR
 - optical source and light meter
 - optical fibre flashlight
- 10.76 Describe testing methods according to TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 10.77 Test cables according to manufacturer's and job specifications and employer and client site-specific standards TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- 10.78 Interpret and document test results according to manufacturer's and job specifications and client and employer standards, TIA/EIA 606, CAN/CSA T528 and bulletins and amendments.
- 10.79 Perform final inspection and verify installation according to manufacturer's and job specifications and client and employer standards OBC, CEC, Ontario Electrical Safety Code TIA/EIA 606, CAN/CSA T528, TIA/EIA 569-A, CAN/CSA T530, TIA/EIA 568-A, CAN/CSA T529, TIA/EIA 607, CAN/CSA T527, TIA/EIA 758 and bulletins and amendments.
- 10.80 Prepare final documentation according to industry standards, manufacturer's and job specifications and client and employer standards. .
- 10.81 Document items of non-compliance according to job specifications and employer and client site-specific standards.
- 10.82 Clarify problem by interpreting symptoms with client and co-worker according to job specifications and employer and client site-specific standards.
- 10.83 Visually inspect cable systems to determine problem according to TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- breaks
 - twists
 - length
 - location to heat
 - EMI
 - RFI

- 10.84 Test and interpret results according to manufacturer's and job specifications or client and employer standards, TIA/EIA 568-A, CAN/CSA T529 and bulletins and amendments.
- cable certification testers
 - tone generator and inductive amplifier
 - multi meter
- 10.85 Discuss corrective options with client.
- 10.86 Repair cable system as directed by client according to employer and client site- specific standards.

Number:	11.0		
Title:	Networking Part #1		
Duration:	Total Hours: 48	Theory: 48	Practical: 0
Prerequisites:	Unit 1 Safety and Tools Unit 2 Codes and Standards Part #1 Unit 3 Codes and Standards Part #2 Unit 4 Planning, Preparation and Documentation Unit 5 Trade Calculations and Electronics		

General Learning Outcomes

Upon successful completion of this reportable subject the apprentice will be able to interpret and apply codes and standards to perform the installation, communicate with the client to insure that the installation is to job specifications, identify and select internetworking hardware and components.

Units of Learning Outcomes

Upon successful completion, the apprentice is able to:

- 11.1 Interpret the current CSA, TIA/EIA standards that are followed to plan an installation including TIA/EIA, 568-A, 569-A, 570-A, 606, 607, 758 and CAN/CSA T525, T527, T528, T529, T530 including bulletins and amendments according to job specifications and employer and client site-specific standards.
- 11.2 Describe types of backbone, horizontal, physical, and logical topologies including
 - Bus
 - Ring
 - Star
 - Mesh
- 11.3 Communicate with client using plain language, trade terms and definitions.
- 11.4 Identify and explain alternative solutions according to client needs.

- 11.5 Differentiate internetworking hardware and components;
- Hubs: passive and active
 - Switches
 - Bridges
 - Routers
 - Routers
 - Modems
 - Network Interface Cards
 - Servers: file, print, communication
 - Peripheral devices: printers, fax, hard disk, CD-Rom,
 - Transceivers: 10Base2, 10Base5,
 - PBX/KSU
 - CSU/DSU
 - Multiplexers/ Demultiplexers
 - PAD/FRAD
 - Head end equipment
 - Directional coupler
 - Splitter

Number:	12.0		
Title:	Networking Part #2		
Duration:	Total Hours: 48	Theory: 28	Practical: 20
Prerequisites:	Unit 1 Safety and Tools Unit 2 Codes and Standards Part #1 Unit 3 Codes and Standards Part #2 Unit 4 Planning, Preparation and Documentation Unit 5 Trade Calculations and Electronics		

General Learning Outcomes

Upon successful completion of this reportable subject the apprentice is able to install internetworking hardware and components, test internetworking hardware and components.

Units of Learning Outcomes

Upon successful completion, the apprentice is able to:

- 12.1 Select tools required to install internetworking hardware and components according to job specifications and employer and client site-specific standards.

- 12.2 Install internetworking hardware and components according to manufacturer's and job specifications and employer and client site-specific standards.
 - Hubs: passive and active
 - Switches
 - Repeaters: Multi-port repeaters
 - Bridges
 - Routers
 - Routers
 - Modems
 - Network Interface Cards
 - Transceivers: 10Base2, 10Base5
 - PBX

- 12.3 Identify and select test equipment to monitor network traffic according to manufacturer's and job specifications and client and employer standards.
- cable certification testers
 - Lan analyzers
 - cable certification testers
- 12.4 Test components to ensure system operation according to manufacturer's and job specifications and client and employer standards.

APPENDIX A: Tools and Equipment List

Suggested Minimum Network Cabling Specialist Tool List

General Equipment List	Supplied by Apprentice	Training Delivery Agent (TDA) supplied
Protective Equipment	Safety glasses. Hearing protection. Green Patch shoes/boots. Gloves. Hard Hat.	
Hand Tools	Splicer's knife. Scissors. Punch down tools. Screwdrivers Side cutters. Drywall saw. Slip joint pliers. Hammer. Measuring tape. Level.	Hole punches. Conduit benders ½ " to 1-1/4 " Stud finder. Caulking gun. Wrenches. Hacksaw. Tri-tap. Crimp tool.
Power Tools		Powder-actuated tools. Drills:hole saws and drill bits. Reciprocal saw. Soldering iron. Heat gun.
Pulling Equipment and related materials.		Fish tapes. Cable grips (swivels) Tuggers. Reel stands. Pulleys. Rope. Vacuum. Rod.

General Equipment List	Supplied by Apprentice	Training Delivery Agent (TDA) supplied
Test Equipment:		Tone generator and inductive amplifier Pair tester. Line test set. TDR (Time Domain Reflectometer) OTDR (Optical Time Domain Reflectometer) Optical power meter and source. Optical Flashlight. Multi-meter. Cable certification tester. (Level I & II & III)
Optical Fibre tools:		Curing oven UV Curing lamp. Microscope. Cleavers. Scribes. Fibre crimping tool. Buffer tube cutter. Buffer removal tube. Polishing jig. Polishing plate. Fusion splicer. Mechanical splicing rig. Connector kit for mechanical connections. Splice trays
Internetworking:		Computers (minium 386 more than two) NIC cards. Routers. Repeaters. Bridges Brouters. MAU (multi attachment unit) Modem. Balun. Transceiver.
Labelling printer:		Can be hand held or computer base.



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