STANDARD KEMAHIRAN PEKERJAAN KEBANGSAAN
(NATIONAL OCCUPATIONAL SKILLS STANDARD)

STANDARD PRACTICE & STANDARD CONTENTS
FOR

EE-324-3:2013
FIBRE OPTIC INSTALLATION & MAINTENANCE - TELECOMMUNICATION
LEVEL 3

JPK

Jabatan Pembangunan Kemahiran
Kementerian Sumber Manusia, Malaysia

TABLE OF CONTENTS

STANDARD PRACTICE

NATIONAL OCCUPATIONAL SKILLS STANDARD (NOSS)

FOR;

FIBRE OPTIC INSTALLATION & MAINTENANCE - TELECOMMUNICATION LEVEL 3

1. INTRODUCTION

A fibre optics technician maintains fibre optic cable systems that carry both voice and digital transmissions. They install the cables following precise schematics, locate and repair defects in existing systems, placing, rearranging, and removing cables when necessary. They also install supports and insulation and perform other tasks to maintain cables. With computer networks, these technicians run the cables through the office buildings to connect computers.

Fibre optics technicians are usually employed by telecommunications companies. Individuals who choose a career as a fibre optic technician may work in a multitude of settings applying their knowledge of fibre optics operation, networking and routing integrity. They are responsible for maintaining fibre optic cable quality as well as pulling, terminating and repairing telecommunication cables.

Technicians install new cable lines, both underground and on telephone poles, and also perform maintenance on existing cables, including evaluation tests and repairing old or malfunctioning cables. Technicians cut and splice fibre optic cables, locate problem areas and perform other repairs as needed. Technicians also install and maintain network systems for private lines and determine solutions for any issues preventing the service from operating normally.

Thus, proper training is essential to provide students with theoretical knowledge as well as operational skills for installing, jointing, testing and maintaining the fibre optic cable network.

Pre-requisite

The candidate must be able to read, write and possess basic mathematical skills. The candidate must also possess a high level of physical fitness and alertness and must not be colour blind. In addition, the candidate must have good communication skills, problem solving abilities and the desire to advance in the field of fibre optics.

2. OCCUPATIONAL STRUCTURE (OS)

Sector	**Electrical & Electronic, Telecommunication & Broadcasting Industry** *(Elektrikal & Elektronik, Telekomunikasi & Industri Penyiaran)*		
Sub-sector	**Telecommunication** *(Telekomunikasi)*		
Job Area	**Customer Access Network** *(Rangkaian Perhubungan Pelanggan)*	**Fibre Optic Services - Telecommunication** *(Fiber Optik Servis - Telekomunikasi)*	
L5	Telecommunication Engineer – Customer Access Network Operation *(Jurutera Telekomunikasi – Operasi Rangkaian Perhubungan Pelanggan)*	Fibre Optic Engineer *(Jurutera Fiber Optik)*	
L4	Telecommunication Assistant Engineer – Customer Access Network Operation *(Penolong Jurutera Telekomunikasi – Operasi Rangkaian Perhubungan Pelanggan)*	Fibre Optic Executive Technical *(Eksekutif Teknik Fiber Optik)*	
L3	Telecommunication Technician – Installation *(Juruteknik Telekomunikasi - Pemasangan)*	Telecommunication Technician – Maintenance *(Juruteknik Telekomunikasi - Penyenggaraan)*	Fibre Optic Technician - Telecommunication *(Juruteknik Fiber Optik - Telekomunikasi)*
L2	Telecommunication Assistant Technician – Installation *(Pembantu Juruteknik Telekomunikasi – Pemasangan)*	Telecommunication Assistant Technician – Maintenance *(Pembantu Juruteknik Telekomunikasi – Penyenggaraan)*	Fibre Optic Assistant Technician - Telecommunication *(Penolong Juruteknik Fiber Optik - Telekomunikasi)*
L1	No Level *(Tiada Tahap)*		

Figure 1.1 Existing Occupational Framework Matrix for Telecommunication – Sub-sector of Electrical & Electronic, Telecommunication & Broadcasting Industry in Malaysia

OCCUPATIONAL AREA STRUCTURE (OAS)

<table>
<tr><td>Sector</td><td colspan="4">Electrical & Electronic, Telecommunication & Broadcasting Industry
(Elektrikal & Elektronik, Telekomunikasi & Industri Penyiaran)</td></tr>
<tr><td>Sub-sector</td><td colspan="4">Telecommunication
(Telekomunikasi)</td></tr>
<tr><td>Job Area</td><td colspan="2">Customer Access Network
(Rangkaian Perhubungan Pelanggan)</td><td colspan="2">Fibre Optic Services - Telecommunication
(Fiber Optik Servis - Telekomunikasi)</td></tr>
<tr><td>L5</td><td colspan="2">Telecommunication Engineer – Customer Access Network Operation
(Jurutera Telekomunikasi – Operasi Rangkaian Perhubungan Pelanggan)</td><td colspan="2">Fibre Optic Installation & Maintenance Management - Telecommunication</td></tr>
<tr><td>L4</td><td colspan="2">Telecommunication Assistant Engineer – Customer Access Network Operation
(Penolong Jurutera Telekomunikasi – Operasi Rangkaian Perhubungan Pelanggan)</td><td colspan="2">Fibre Optic Installation & Maintenance Management - Telecommunication</td></tr>
<tr><td>L3</td><td>Telecommunication Technician – Installation
(Juruteknik Telekomunikasi - Pemasangan)</td><td>Telecommunication Technician – Maintenance
(Juruteknik Telekomunikasi - Penyenggaraan)</td><td colspan="2" rowspan="2">Fibre Optic Installation & Maintenance – Telecommunication</td></tr>
<tr><td>L2</td><td>Telecommunication Assistant Technician – Installation
(Pembantu Juruteknik Telekomunikasi – Pemasangan)</td><td>Telecommunication Assistant Technician – Maintenance
(Pembantu Juruteknik Telekomunikasi – Penyenggaraan)</td></tr>
<tr><td>L1</td><td colspan="4">No Level
(Tiada Tahap)</td></tr>
</table>

Figure 1.2 Occupational Area Framework Matrix for Telecommunication – Sub-sector of Electrical & Electronic, Telecommunication & Broadcasting Industry in Malaysia

3. DEFINITION OF COMPETENCY LEVEL

The NOSS is developed for various occupational areas. Candidates for certification must be assessed and trained at certain levels to substantiate competencies. Below is the ISA guideline of each NOSS Level as defined by the Department of Skills Development, Ministry of Human Resources, Malaysia.

Malaysia Skills Certificate: Level 1	Competent in performing a range of varied work activities, most of which are routine and predictable.
Malaysia Skills Certificate: Level 2	Competent in performing a significant range of varied work activities, performed in a variety of contexts. Some of the activities are non-routine and require individual responsibility and autonomy.
Malaysia Skills Certificate: Level 3	Competent in performing a broad range of varied work activities, performed in a variety of contexts, most of which are complex and non-routine. There is considerable responsibility and autonomy and control or guidance of others is often required.
Malaysia Skills Diploma: Level 4	Competent in performing a broad range of complex technical or professional work activities performed in a wide variety of contexts and with a substantial degree of personal responsibility and autonomy. Responsibility for the work of others and allocation of resources is often present.
Malaysia Skills Advanced Diploma: Level 5	Competent in applying a significant range of fundamental principles and complex techniques across a wide and often unpredictable variety of contexts. Very substantial personal autonomy and often significant responsibility for the work of others and for the allocation of substantial resources feature strongly, as do personal accountabilities for analysis, diagnosis, planning, execution and evaluation.

4. MALAYSIAN SKILLS CERTIFICATION

Candidates, after being assessed and verified as having fulfilled the Malaysian Skills Certification requirements, shall be awarded with *Sijil Kemahiran Malaysia* (SKM) for Level 3.

This NOSS outlines competency unit and competency profile in the fibre optic installation and maintenance - telecommunication working environment as required by the industry and has been developed and documented following extensive collaboration across key Malaysian organisations. To meet the requirements of this industry, it is imperative that the competency unit and competency profile outlined follow a high standard as well as maintenance of consistency throughout the assessment process. This can only be done by stipulating a precise framework in which the assessment of competency unit and competency profile must be conducted. The training and assessment of a fibre optic - telecommunication practitioner must be deployed in accordance with *JPK* policy and in adherence to the Occupational Safety and Health Act (OSHA) requirements.

5. JOB COMPETENCIES

The fibre optic installation & maintenance – telecommunication (L3) is competent in performing the following core competencies:-

- Fibre Optic Cable Network Project Pre Installation
- Fibre Optic Cable Network Outside Plant Installation
- Fibre Optic Cable Network Inside Plant Installation
- Fibre Optic Cable Network Jointing
- Fibre Optic Cable Network Testing & Commissioning
- Fibre Optic Cable Network Maintenance
- Fibre Optic Cable Network Installation & Maintenance Supervision

6. WORKING CONDITIONS

Generally they work under normal working hours from morning to evening depending on the organisation's nature of business. They may be required to work extra hours to fulfil internal and external requirements. In fibre optic operation, they may be needed to work at night to accommodate customer or service provider's requirements. They need to use/wear appropriate attire during the commencement of their jobs. They may work individually or in a modular group. The occupation requires high level of physical fitness and alertness, good communication skills, cooperativeness and the ability to understand and execute work instructions from superior.

Fibre optic installation & maintenance - telecommunication Level 3 personnel trained under this training programme are eligible to be employed in the Electrical & Electronic, Telecommunication & Broadcasting Industry sector. The work of the fibre optic installation & maintenance – telecommunication personnel L3 revolves around the field of installing, testing and maintaining fibre optic cables. This training occupation includes the integration

of knowledge and skills, which involves outdoor and indoor installation, jointing, testing, commissioning and maintenance of fibre optic cables. In order to perform all the technical tasks at site, technicians must be supported with Green Card from the Construction Industry Development Board (CIDB) and NIOSH Card from the National Institute of Occupational Safety and Health (NIOSH).

7. EMPLOYMENT PROSPECTS

There are excellent prospects in private sectors due to the shortage of hands-on experts in fibre optic operation. Fibre optic installation & maintenance - telecommunication Level 3 personnel trained under this training programme are eligible to be employed in the Telecommunication Sub sector. This area has a potential job market abroad due to a shortage of such highly skilled personnel in this region.

Other related occupations with respect to employment opportunities are:

- Site/Project Supervisor
- Fibre Optic Operation Trainer

Other related industries with respect to employment opportunities are:

- Fibre Related Manufacturing
- Training Centres

8. TRAINING, INDUSTRIAL/PROFESSIONAL RECOGNITION, QUALIFICATIONS AND ADVANCEMENTS

As for career advancement, most competent fibre optic installation & maintenance - telecommunication Level 3 personnel learn their competency on the job. They usually begin as technicians and gradually learn their new skills as they gain experience for career advancement.

9. SOURCES OF ADDITIONAL INFORMATION

- Suruhanjaya Komunikasi dan Multimedia Malaysia
  Off Persiaran Multimedia
  63000 Cyberjaya
  Selangor
  Tel : 603-8688 8000
  Fax : 603-8688 1000
  URL : www.skmm.gov.my

- Fiber Optic Association
  1119 S Mission Road, # 355
  Fallbrook, California 92028 USA
  Tel : 1-760-451-3655
  Fax : 1-781-207-2421
  URL : www.thefoa.org

- International Telecommunication Union
  Place des Nations
  1211 Geneva 20 Switzerland
  Tel : 41227305111
  Fax : 41227337256
  URL : www.itu.int

10. ACKNOWLEDGEMENT

The Director General of DSD would like to extend his gratitude to the organisations and individuals who have been involved in developing this standard.

This standard has been checked by the Standard Technical Evaluation Committee (STEC). Panel members of STEC are listed below:

- En. Nordin Bin Zakaria – Nova Global Communications (M) Sdn. Bhd.
- En. Mohamad Ibnusina Bin Mohamad Padzil – TM Training Centre
- En. Ruzaimi Bin Sakio – Jalur Lebar Nasional Sdn. Bhd
- En Marzenan Bin Mokhtar – IKE Sdn. Bhd.

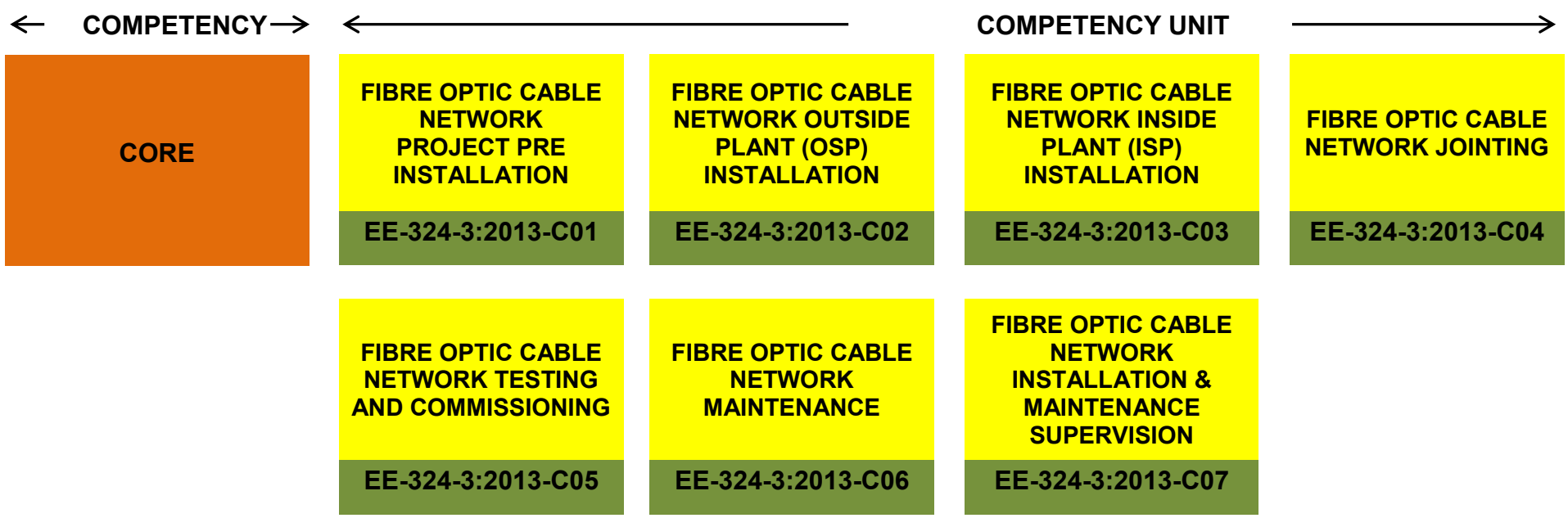
11. COMMITTEE MEMBERS FOR DEVELOPMENT OF STANDARD PRACTICE (SP), COMPETENCY PROFILE CHART (CPC), COMPETENCY PROFILE (CP) AND CURRICULUM OF COMPETENCY UNIT (CoCU)

FIBRE OPTIC INSTALLATION & MAINTENANCE - TELECOMMUNICATION LEVEL 3

PANEL EXPERTS		
1.	En. Muhammad Hafizzuddin Bin Mohd Noor	Implementation Assistant Manager TM Klang
2.	En. Mohd Nazarulfitri Bin Jambari	Senior Technician Fie N Zal Synergy Sdn. Bhd.
3.	En. Zaini Bin Isthnin	Technician TIME dotcom Berhad
4.	En. Shamsul Mazli Bin Masri	Senior Technician D Uffuk Enterprise
5.	En. Mohd Fuad Bin Turiman	Assistant Technical Officer TM Shah Alam
6.	En. Muhamad Izat Bin Nasrudin	Technician Fie N Zal Synergy Sdn Bhd
7.	En. Shamsol Bin Mat Sa'at	Cable Jointer & Tester Ifactor (M) Sdn Bhd
8.	En. Rusman Affandi Bin Saidun	Cable Jointer NSW Submarine Cable Systems Sdn Bhd
9.	Pn. Hidayati Binti Che Mat	Trainer TM Training Centre
10.	En Azraimi Bin Mohd	Project Manager/Trainer Pcom Tecnologies Sdn Bhd
FACILITATOR		
1.	Pn. Eliza Binti Ramly	Precious Galaxy Sdn. Bhd.
DOCUMENTOR		
1.	Pn. Khairul Alia Binti Mohd Kharuddin	Precious Galaxy Sdn. Bhd.

COMPETENCY PROFILE CHART (CPC)

SECTOR	ELECTRICAL&ELECTRONIC,TELECOMMUNICATION & BROADCASTING INDUSTRY		
SUB-SECTOR	TELECOMMUNICATION		
JOB AREA	FIBRE OPTIC SERVICES TELECOMUNICATON		
NOSS TITLE	FIBRE OPTIC INSTALLATION & MAINTENANCE - TELECOMMUNICATION		
JOB LEVEL	THREE (3)	JOB AREA CODE	EE-324-3:2013



COMPETENCY PROFILE (CP)

Sub-Sector	**TELECOMMUNICATION**
NOSS Title	**FIBRE OPTIC INSTALLATION & MAINTENANCE - TELECOMMUNICATION**
Level	**THREE (3)**

CU Title	CU Code	CU Descriptor	CU Work Activities	Performance Criteria
1. Fibre optic cable network project pre installation EE-324-3:2013-C01		Fibre optic cable network project pre installation involves all the pre installation activities. The technician conducts site survey to collect installation information. Prior to any installation, the technician assesses the route carefully to determine the methods of installation and obstacles likely to be encountered. The information should include fibre cable specification, testing requirements, personnel experience level and assignment, installation methods, identification of potential problem areas and safety issues. The person who is competent in this CU shall be able to interpret fibre optic cable network installation job order, conduct site survey, apply authority and service provider way leave, prepare installation material requisition and report fibre optic cable network project pre installation activities to superior in accordance to client's requirements.	1. Interpret fibre optic cable network installation job order 2. Conduct site survey	1.1 Job order obtained from client 1.2 Type of client (new, regular, priority) determined to confirm the level of complexity of the project 1.3 Installation requirements determined according to the job order 1.4 Installation timeline determined according to the installation requirements 2.1 Site survey tools prepared according to the job order 2.2 Person in charge met 2.3 Cable layout plan interpreted 2.4 Job site location confirmed with the person met 2.5 Type of cable way (underground, overhead, internal) determined 2.6 Duct way condition

CU Title	CU Code	CU Descriptor	CU Work Activities	Performance Criteria
		Proper pre installation activities will ensure accurate fibre optic installation design and appropriate project schedule would be produced by the superior with the provided information.		confirmed 2.7 Space for under floor trunking checked 2.8 Types and length of cables determined 2.9 Cable layout drafted and submitted to superior for fibre optic network design preparation
			3. Apply authority and service provider way leave	3.1 Way leave application documents prepared according to the authority and service provider's requirements 3.2 Authority and service provider way leave application submitted for approval 3.3 Work permit payment arranged after the application approved 3.4 work permit preliminary briefing from authority and service provider attended upon collection of work permit
			4. Prepare installation material requisition	4.1 Types and quantity of materials determined according to the fibre optic network design 4.2 Installation materials requested according to the company Standard Operating Procedures (SOP)

CU Title	CU Code	CU Descriptor	CU Work Activities	Performance Criteria
				4.3 Requested installation materials collected 4.4 Collected materials condition and quantity checked based on the requisition form
			5. Report fibre optic cable network project pre installation activities to superior	5.1 Report format and content determined 5.2 Fibre optic site documentation report prepared 5.3 Fibre optic cable network project pre installation activities report submitted to superior
2. Fibre optic cable network Outside Plant (OSP) installation EE-324-3:2013-C02		Fibre optic cable may be installed outside or inside a plant using several different installation processes. OSP may be direct buried, pulled or blown into conduit or inner duct, or installed aerially between poles. The fibre optic cables are installed outside of customer's premises. The installation process will depend on the nature of the installation and the type of cable being used. The person who is competent in this CU shall be able to arrange fibre optic cable network OSP installation resources, barricade working area, inspect duct way availability for underground installation and perform underground and overhead	1. Arrange fibre optic cable network Outside Plant (OSP) installation resources 2. Barricade working area	1.1 Type of OSP installation (overhead/ underground) determined according to the job order 1.2 Types of OSP installation resources identified according to the job order and fibre optic cable network design 1.3 Resource logistics requirements identified according to company SOP 2.1 Confinement area identified according to OSHA requirements 2.2 Safe working environment arranged (safety equipment) according to OSHA requirements

CU Title	CU Code	CU Descriptor	CU Work Activities	Performance Criteria
		installation cable pulling in accordance with installation guidelines and Occupational Safety and Health Act (OSHA) requirements. Particular care should be taken during OSP installation to prevent kinking the cable which can harm the fibres.	3. Inspect duct way availability for underground installation	3.1 Telecommunication manhole opened in compliance with service provider and authority requirements 3.2 Manhole conditions checked according to OSHA requirements 3.3 Fresh air blowing executed into the manhole according to OSHA requirements 3.4 Water drained out from the manhole according to OSHA requirements 3.5 Duct way space checked according to OSHA requirements 3.6 Duct space rode according to OSHA requirements
			4. Perform underground installation cable pulling	4.1 Fibre optic draw rope pulled according to technical specifications 4.2 Cable roller positioned on the manhole according to technical specifications 4.3 Fibre optic sub-duct pulled according to technical specifications 4.4 Fibre optic cable pulled according to technical specifications 4.5 Figure 8 technique applied for long cable pulling 4.6 Installed fibre optic cable labelled

CU Title	CU Code	CU Descriptor	CU Work Activities	Performance Criteria
				4.7 Wiring technique applied in manhole according to technical specifications 4.8 Fibre optic underground installation checklist updated
			5. Perform overhead installation fibre optic cable pulling	5.1 Cable pulley positioned on pole according to technical specification 5.2 Fibre optic cable pulled according to technical specifications 5.3 Support hook and Integral Barrel (IB) clamp installed on selected pole according to technical specifications 5.4 Perform grip installed to hold cable on pole according to technical specifications 5.5 Dead end and dead in cable terminated according to technical specifications 5.6 Fibre optic overhead installation checklist updated
3. Fibre optic cable network Inside Plant (ISP) installation EE-324-3:2013-C03		ISP cables can be installed in raceways, cable trays above ceilings or under floors, placed in hangers, pulled into conduit or inner-duct. The fibre optic cables are installed inside of customer's premises. The installation process will depend on the nature of the installation and the type of cables	1. Arrange fibre optic cable network Inside Plant (ISP) installation resources 2. Barricade working area	1.1 Types of ISP installation resources identified according to the job order and fibre optic cable network design 1.2 Resource logistics requirements identified according to company SOP 2.1 Confinement area identified

CU Title	CU Code	CU Descriptor	CU Work Activities	Performance Criteria
		being used. The person who is competent in this CU shall be able to arrange fibre optic cable network ISP installation resources, barricade working area, inspect cable trunking and tray availability and perform fibre optic cable pulling in accordance with installation guidelines and OSHA requirements. Particular care should be taken during installation to prevent kinking the cable which can harm the fibres.		according to OSHA requirements 2.2 Safe working environment arranged (safety equipment) according to OSHA requirements
			3. Inspect cable trunking and tray availability	3.1 Indoor cable trunking opened in compliance with service provider and authority requirement 3.2 Cable trunking and tray space checked according to OSHA requirements 3.3 Junction box opened 3.4 Under floor trunking rodding executed according to OSHA requirements
			4. Perform fibre optic cable pulling	4.1 Fibre optic draw rope pulled according to technical specifications 4.2 Fibre optic micro-duct pulled according to technical specifications 4.3 Fibre optic cable pulled according to technical specifications 4.4 Wiring technique applied in cable tray according to technical specifications 4.5 Installed fibre optic cable labelled according to company SOP 4.6 Fibre optic cable network ISP installation checklist updated

CU Title	CU Code	CU Descriptor	CU Work Activities	Performance Criteria
4. Fibre optic cable network jointing EE-324-3:2013-C04		Fibre optic cable network jointing is the process of joining two fibres together to form a continuous optical waveguide. Optical fibres may be connected to each other by connectors or by splicing. The generally accepted splicing method is arc fusion splicing, which melts the fibre ends together with an electric arc. For termination point a "mechanical splice" is used. The person who is competent in this CU shall be able to arrange fibre optic cable network jointing resources, set fibre optic cable for jointing and perform fibre optic cable splicing in accordance with jointing guidelines and service provider's specifications. A good jointer would ensure the fibre optic cables are precisely joined in proper condition.	1. Arrange fibre optic cable network jointing resources 2. Barricade working area 3. Set fibre optic cable for jointing 4. Perform fibre optic cable	1.1 Types of fibre optic jointing (straight joint / multi joint) determined according to the job order 1.2 Types of fibre optic jointing resources identified according to the job order and fibre optic cable network design 1.3 Resource logistics requirements identified according to company SOP 2.1 Confinement area identified according to OSHA requirements 2.2 Safe working environment arranged (safety equipment) according to OSHA requirements 3.1 Cables to be jointed identified according to technical specifications 3.2 Fibre jacket removed according to technical specification specifications 3.3 Cable buffer cleaned using alcohol according to technical specifications 3.4 Cables fixed into cable closure according to technical specifications 3.5 Buffer tube removed according to technical specification 4.1 Fibre core stripped

CU Title	CU Code	CU Descriptor	CU Work Activities	Performance Criteria
			splicing	according to technical specifications 4.2 Protection sleeve fixed into fibre core according to technical specifications 4.3 Fibre core cleaned using alcohol 4.4 Fibre core cleaved using cleaver 4.5 Fibre core set into splicing machine 4.6 Fibre core spliced using splicing machine 4.7 Protection sleeve heated according to technical specifications 4.8 Fibre core managed into splicing tray 4.9 Joint closure mounted according to technical specifications
5. Fibre optic cable network testing and commissioning EE-324-3:2013-C05		As network speeds and bandwidth demands increase, distance and loss limitations have decreased, making fibre optic testing more important than ever. Fibre optic tester performs basic inspection and analysis to measure fibre length and optical loss on two fibres at two wavelengths, computes the optical loss budget, compares the results to the selected industry standard and provides an instant PASS or FAIL indication. While, commissioning a fibre optic network involves a series of steps	1. Prepare testing instrument 2. Perform cable loss test	1.1 Type of test determined 1.2 Fibre core to be tested confirmed 1.3 Types and functions of testing instruments determined according to type of test 2.1 OTDR instrument set according to job order specifications 2.2 OTDR instrument connected to fibre core using patch cord 2.3 Cable loss testing

CU Title	CU Code	CU Descriptor	CU Work Activities	Performance Criteria
		that are taken to prove that the system meets the specified requirements. The person who is competent in this CU shall be able to prepare testing instruments, perform cable loss test, perform end to end test, perform Insertion Loss (IL) and Optical Return Loss (ORL) bi-directional test, report fibre optic testing activities to superior and perform fibre optic commissioning in accordance with testing and commissioning guidelines. Proper testing would ensure the fibre optic cables are in good quality before handing over to the service provider/clients.	3. Perform end to end test 4. Perform Insertion Loss (IL) and Optical Return Loss (ORL) bi-directional test	conducted according to specifications requirement 2.4 Cable loss test results recorded 3.1 Starting point and ending point determined according to work requirements 3.2 Light source set at starting point according to job order specifications 3.3 Power meter set at ending point according to job order specifications 3.4 Power meter connected to cable end using patch cord 3.5 Light source connected to cable in using patch cord 3.6 Power meter test conducted according to specifications requirement 3.7 End to End testing results recorded 4.1 OLTS instrument set according to job order specifications 4.2 OLTS instrument connected to ending point using patch cord 4.3 OLTS instrument connected to starting point using patch cord 4.4 IL and ORL bi-directional test conducted 4.5 OLTS test results recorded

CU Title	CU Code	CU Descriptor	CU Work Activities	Performance Criteria
			5. Report fibre optic testing activities to superior	5.1 Tested cable tagged according to company SOP 5.2 Fibre optic test results assessed according to testing requirements 5.3 Rectification recommended to superior base on fibre optic test result 5.4 Fibre optic testing report prepared according to company or client SOP 5.5 Fibre optic testing report submitted to superior
			6. Perform fibre optic installation commissioning	6.1 Commissioning details (venue, date, time, participant) set 6.2 Fibre optic installation verified with service provider/client 6.3 Installation errors rectified, if necessary 6.4 Technical documents prepared for installation commissioning
6. Fibre optic cable network maintenance EE-324-3:2013-C06		Like any equipment, fibre optic cable requires both preventive and corrective maintenance over time. All measurements for preventive maintenance shall be carried out as per prior agreed time schedule, which is given by the service provider/client. On the other hand, corrective maintenance technician rectifies any faults or immediate breakdowns of fibre optic cables	1. Arrange fibre optic cable network maintenance resources	1.1 Type of fibre optic cable network maintenance (preventive, corrective) determined according to the job order 1.2 Maintenance location area determined 1.3 Types of faultiness determined 1.4 Types of maintenance resource identified

CU Title	CU Code	CU Descriptor	CU Work Activities	Performance Criteria
		upon the detection or occurrence of a failure. The person who is competent in this CU shall be able to arrange fibre optic cable network maintenance resources, perform fibre optic preventive maintenance, perform fibre optic corrective maintenance and report fibre optic maintenance activities to superior in accordance with maintenance Standard Operating Procedure (SOP). Proper maintenance would avoid fibre optic defects and maintain the condition of the fibre optic cable simultaneously, fix any damages occurred within the time frame.	2. Perform fibre optic preventive maintenance 3. Perform fibre optic corrective maintenance 4. Report fibre optic maintenance activities to superior	according to company SOP 2.1 Preventive maintenance schedule interpreted 2.2 Preventive maintenance conducted according to company SOP and contract agreement 2.3 Preventive maintenance checklist updated 3.1 Faulty cable checked 3.2 Faulty cable rectified 3.3 Rectified cable tested 3.4 Cable labelling and tagging updated 3.5 Cable inventory record updated according to maintenance procedures 3.6 Corrective maintenance activities recorded 4.1 Fibre optic maintenance report format and contents determined 4.2 Fibre optic maintenance report prepared 4.3 Fibre optic maintenance report submitted to superior

CU Title	CU Code	CU Descriptor	CU Work Activities	Performance Criteria
7. Fibre optic cable network installation & maintenance supervision EE-324-3:2013-C07		A senior technician monitors all installation and maintenance activities at site. The person who is competent in this CU shall be able to monitor fibre optic installation work progress, monitor subordinates' performance, control materials, tools and equipment movement and prepare daily progress report in accordance with company's guidelines. The outcome of this competency is to ensure that work progress runs smoothly within the given time frame.	1. Monitor fibre optic installation work progress	1.1 Project briefing conducted to the subordinates 1.2 Timeline and schedule compliance ensured 1.3 Standard Operating Procedure compliance by subordinate ensured
			2. Monitor safe working environment practices by subordinate	2.1 Safe working environment practices briefing conducted to subordinate 2.2 Subordinate instructed to follow safety requirements 2.3 Safe working environment practices by subordinate ensured according to OSHA requirements
			3. Monitor subordinates' performance	3.1 Subordinates' performance observed 3.2 Subordinates' performance evaluated 3.3 Subordinates' performance reported to superior
			4. Control materials, tools and equipment movement	4.1 Types of materials, tools and equipment used determined 4.2 Movement of materials, tools, and equipment recorded 4.3 Material settlement executed according to company's SOP 4.4 Tools and equipment calibration coordinated according to the calibration

CU Title	CU Code	CU Descriptor	CU Work Activities	Performance Criteria
			5. Prepare daily progress report	schedule 5.1 Daily progress report format and contents identified 5.2 Daily progress report (site location, weather, working time, manpower strength, work activities, reviews/comments) written 5.3 Daily progress report submitted to superior

CURRICULUM of COMPETENCY UNIT (CoCU)

Sub-Sector	TELECOMMUNICATION						
NOSS Title	FIBRE OPTIC INSTALLATION & MAINTENANCE - TELECOMMUNICATION						
Competency Unit Title	FIBRE OPTIC CABLE NETWORK PROJECT PRE INSTALLATION						
Learning Outcome	The person who is competent in this CU shall be able to conduct site survey in order to ensure accurate fibre optic installation design and appropriate project schedule would be produced by superior. Upon completion of this competency unit, trainees will be able to: - • Interpret fibre optic cable network installation job order • Conduct site survey • Apply authority and service provider way leave • Prepare installation material requisition • Report fibre optic cable network project pre installation activities to superior						
Competency Unit ID	EE-324-3:2013-C01	**Level**	3	**Training Duration**	180 Hours	**Credit Hours**	18

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
1. Interpret fibre optic cable network installation job order	i. Fibre optic cable network project pre installation process flow ii. Job order component such as :- • Clients' details • Service requirements • Project timeline iii. Type of client and level of complexity • New • Regular • Priority	i. Obtain job order from client ii. Determine type of client to confirm the level of complexity of the project iii. Determine installation requirements iv. Determine installation timeline according to the installation requirements	*Attitude:* Knowledgeable and resourceful in interpreting fibre optic cable network installation job order	6 13	Lecture Demonstration & Observation	i. Type of client and level of project complexity explained ii. Installation requirements determined iii. Installation timeline determined based on the installation requirements

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	iv. Installation requirements • Types of areas • Types of services					
2. Conduct site survey	i. Related OSHA requirement on • Traffic control zone • Telecommunication Manhole (Confine space) • Inside building • On pole ii. Types of site survey tools such as :- • Measurement meter • Measuring tape • Camera • Metal detector • Manhole key iii. Components of cable layout plan such as :- • Legend/symbols • Cable route plan • Types and location of manhole • Types and length of cable • Types of road iv. Purpose of confirming job site location with the person met v. Types of cable way • Outside plant ▪ Underground	i. Prepare site survey tools ii. Meet person in charge iii. Interpret cable layout plan iv. Confirm job site location with the person met v. Determine type of cable way vi. Confirm manhole availability vii. Confirm duct way condition viii. Check space for under floor trunking ix. Determine type and length of cables x. Apply basic drawing software xi. Draft and submit cable layout to superior for fibre optic network design preparation	*Attitude:* i. Knowledgeable and detailed in conducting site survey *Safety:* i. Adhere to safety precautions and procedures	22 50	Lecture Demonstration & Observation	i. Related OSHA requirements explained ii. Site survey tools listed iii. Cable layout plan interpreted iv. Types of cable way listed v. Manhole availability checked vi. Duct way condition confirmed vii. Space for under floor trunking checked viii. Types of cables listed ix. Basic drawing software applied x. Cable layout drafted and submitted to superior for fibre optic network design preparation

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	▪ Overhead • Inside plant vi. Duct way condition • Manhole availability • Duct way availability • Duct way clarity vii. Types of under floor trunking such as :- • Branch system • Grid system viii. Types and lengths of cables such as :- • Outdoor cable ▪ Slotted cable ▪ Loose tube cable ▪ External drop fibre • Indoor cable ▪ Internal drop fibre ▪ Internal fibre cable ix. CAD software application for drafting cable layout					
3. Apply authority and service provider way leave	i. Way leave application requirements of authority such as :- • Local Authority • *Jabatan Kerja Raya* • *Lembaga Lebuhraya Malaysia* ii. Way leave application requirements of service	i. Prepare way leave application documents ii. Submit authority and service provider way leave application for approval iii. Arrange Permit To Work (PTW) payment	<u>*Attitude:*</u> i. Responsible in applying authority and service provider way leave	10 24	Lecture Demonstration & Observation	i. Way leave application documents listed ii. Local authority and service provider way leave application submitted for approval

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	provider such as:- • Telekom • Digi • Maxis • Celcom • Time.com iii. Way leave application documents such as :- • Application letter • Approval plan • Work schedule proposal iv. Methods of Permit To Work (PTW) payment such as :- • Bank draft • Bank guarantee • Cash	upon application approval iv. Attend Permit To Work (PTW) preliminary briefing from authority and service provider upon collection of work permit				iii. Permit To Work (PTW)payment method explained
4. Prepare installation material requisition	i. Components of fibre optic network design such as:- • Cable information ▪ Cable type ▪ Cable length ▪ Cable size • Joint information ▪ Core detail ▪ Methods of jointing ▪ Number of joints • Termination details ii. Types of pulling materials such as:-	i. Determine type and quantity of materials according to the fibre optic network design ii. Request installation materials iii. Collect requested installation materials iv. Check collected materials condition and quantity based on the requisition form	*Attitude:* i. Knowledgeable in identifying materials and tools required ii. Responsible in preparing installation material requisition	14 32	Lecture Demonstration & Observation	i. Types and quantity of materials listed according to the fibre optic network design ii. Installation material requisition procedures explained iii. Collected materials condition and quantity checked based on the

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	• Cable • Sub duct • Inner duct • B plate/simplex • Cable tagging iii. Types of jointing materials such as:- • Jointing closure • Protection sleeve • Single entry kits • Fibre termination box iv. Types of pulling tools such as:- • Rodding cane • Rope • Cable roller • Cable pulley • Swivel • Cable gripper v. Types of jointing and testing tools such as:- • Splicing machine ▪ Cleavers ▪ Stripper • Hand tools set • OTDR • Live fibre detector • Power meter • Light source vi. Required materials and tools estimation based on site survey results vii. Installation material					requisition form

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	requisition procedure viii. Material collection procedure: • Quantity checking • Condition checking					
5. Report fibre optic cable network project pre installation activities to superior	i. Report writing skills ii. Fibre optic project pre installation report content such as:- • Site survey result • Local authority and service provider way leave status • Material requisition	i. Determine report format and content ii. Prepare fibre optic project pre installation report iii. Submit fibre optic cable network project pre installation activities report to superior	*Attitude:* i. Meticulous in preparing fibre optic cable network project pre installation report ii. Adhere to report submission deadline	3 6	Lecture Demonstration & Observation	i. Report format drafted ii. Fibre optic project pre installation report prepared and submitted to superior

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information. 01.02 Document information procedures or processes. 01.03 Utilise basic IT applications. 01.04 Analyse information. 01.08 Utilise spreadsheet applications to locate and process information. 01.10 Apply a variety of mathematical techniques. 01.11 Apply thinking skills and creativity. 02.01 Interpret and follow manuals, instructions and SOP. 02.02 Follow telephone/telecommunication procedures. 02.03 Communicate clearly. 02.04 Prepare brief reports and checklist using standard forms. 02.05 Read/Interpret flowcharts and pictorial information. 02.06 Write memos and letters. 02.08 Prepare pictorial and graphic information. 02.09 Prepare flowcharts. 02.10 Prepare reports and instructions. 02.11 Convey information and ideas to people. 03.02 Demonstrate integrity and apply practical practices. 03.03 Accept responsibility for own work and work area. 03.05 Demonstrate safety skills. 03.06 Respond appropriately to people and situations. 03.14 Facilitate and coordinate teams and ideas. 03.15 Liaise to achieve identified outcomes. 03.16 Identify and assess client/customer needs. 04.01 Organise own work activities. 04.02 Set and revise own objectives and goals. 04.04 Apply problem solving strategies. 04.05 Demonstrate initiative and flexibility. 04.07 Negotiate acceptance and support for objectives and strategies. 05.01 Implement project/work plans. 06.02 Comply with and follow chain of command. 06.03 Identify and highlight problems. 06.04 Adapt competencies to new situations/systems. 06.05 Analyse technical systems.	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Multitasking and prioritising 5. Self-discipline 6. Teamwork 7. Learning skills 8. Leadership skills

Tools, Equipment and Materials (TEM)

ITEMS	RATIO (TEM : Trainees)
1. Job order sheet	1:1
2. Measurement meter	1:5
3. Measuring tape	1:1
4. Camera	1:5
5. Metal detector	1:5
6. Manhole key	1:25
7. Cable layout plan	1:1
8. Basic drawing software	1:25
9. Way leave application documents (Application letter, Approval plan, Work schedule proposal)	1:1
10. Bank draft form	1:1
11. Bank guarantee form	1:1
12. Fibre optic network design	1:1
13. Cable	1:5
14. Sub duct	1:5
15. Inner duct	1:5
16. B plate/simplex	1:5
17. Cable tagging	1:1
18. Jointing closure	1:5
19. Protection sleeve	1:1
20. Single entry kits	1:5
21. Fibre termination box	1:5
22. Rodding cane	1:5
23. Rope	1:5
24. Cable roller	1:5
25. Cable pulley	1:5
26. Swivel	1:5
27. Cable gripper	1:5
28. Splicing machine (Cleavers, Stripper)	1:5
29. Hand tools set	1:1
30. OTDR	1:10
31. Live fibre detector	1:5

32. Power meter	1:5
33. Light source	1:5
34. Materials requisition form	1:1
35. Stationery	1:1
36. Computer	1:2
37. Printer	1:10
38. Fibre optic project pre installation report format	1:1
39. Full body harness	1:5
40. Personal Protective Equipment (PPE)	1:1
41. Standard Operating Procedures (SOP) sample	1:1
42. Occupational Safety and Health Act (OSHA)	1:1

References

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1. Patric Argiro, CreateSpace Independent Publising Platform (2012), Fiber Optic Networks Outside Plant Construction and Project Management Techniquies: A Guide to Outside Plant Engineering, ISBN: 978-1475156034
2. Eric Pearson, Cengage Learning; 1 Edition (1996), The Complete Guide to Fiber Optic Cable System Installation, ISBN: 978-0827373181
3. Jim Hayes, CreateSpace Independent Publishing Platform (2010), The FOA Reference Guide to Outside Plant Fiber Optics, ISBN: 978-1450559676
4. Bob Chomycz, Mc Graw-Hill Professional, 1 Edition (2000), Fiber Optic Installer's Field Manual, ISBN: 978-0071356046
5. Bill Woodward, Emile B. Husson, Sybex, 1 Edition (2005), Fiber Optics Installer and Technician Guide, ISBN: 978-0782143904

CURRICULUM of COMPETENCY UNIT (CoCU)

Sub-Sector	TELECOMMUNICATION						
NOSS Title	FIBRE OPTIC INSTALLATION & MAINTENANCE - TELECOMMUNICATION						
Competency Unit Title	FIBRE OPTIC CABLE NETWORK OUTSIDE PLANT (OSP) INSTALLATION						
Learning Outcome	The person who is competent in this CU shall be able to ensure the OSP cables are installed properly without harming the fibres. Upon completion of this competency unit, trainees will be able to: - • Arrange fibre optic cable network Outside Plant (OSP) installation resources • Barricade working area • Inspect duct way availability for underground installation • Perform underground installation cable pulling • Perform overhead installation fibre optic cable pulling						
Competency Unit ID	EE-324-3:2013-C02	**Level**	3	**Training Duration**	450 Hours	**Credit Hours**	45

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
1. Arrange fibre optic cable network Outside Plant (OSP) installation resources	i. Fibre optic cable network OSP installation process flow ii. Types of OSP installation • Overhead • Underground iii. Types of OSP installation resources such as:- • Manpower • Materials ▪ Overhead - Cable	i. Determine type of OSP installation ii. Identify types of OSP installation resources iii. Identify resources logistics requirements	*Attitude:* i. Knowledgeable and resourceful in arranging fibre optic cable network OSP installation resources	14 32	Lecture Demonstration & Observation	i. Types of OSP installation listed ii. Types of OSP installation resources listed and described iii. Resource logistics requirements explained

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	- Cable tagging - Cable grip ▪ Underground - Cable - Sub duct - Inner duct - B plate/ simplex - Cable labelling material - Draw rope • Tools ▪ Overhead - Cable pulley - Swivel - Cable gripper - Shackle-D - Hand tools - Ladder - Tensioning hoist ▪ Underground - Rodding cane - Rope - Cable roller - Shackle-D - Hand tools					
2. Barricade working area	i. Related OSHA requirements on • Traffic control zone	i. Identify confinement area ii. Arrange safe working	*Attitude:* i. Responsible in barricading	12	Lecture	i. Confinement area explained according to

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	• Telecommunication manhole • Building • On pole ii. Confinement area requirements such as:- • Advanced warning area • Transition area • Buffer space • Work area iii. Safe working environment arrangements such as:- • Sign board • Safety cone • Blinker • Baton light • Flagman • Warning tape	environment (safety equipment)	working area <u>*Safety:*</u> i. Adhere to safety precautions and procedures	30	Demonstration & Observation	OSHA requirements ii. Safety equipment arranged
3. Inspect duct way availability for underground installation	i. Procedure in opening telecommunication manhole ii. Manhole condition checking such as:- • Gas ▪ Explosive/ flammable - Petrol-Methane ▪ Suffocation - Carbon dioxide	i. Open telecommunication manhole ii. Check manhole condition iii. Execute fresh air blowing into the manhole iv. Drain out water from the manhole v. Check duct way space Carry out duct space	<u>*Attitude:*</u> i. Knowledgeable in inspecting duct way availability for underground installation <u>*Safety:*</u> Adhere to safety precautions and procedures	22 48	Lecture Demonstration & Observation	i. Manhole condition checked ii. Fresh air blown into the manhole iii. Water drained out from the manhole iv. Duct way space checked v. Duct space rodding carried out

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	- Carbon monoxide ▪ Poisonous - Hydrogen sulphide • Water iii. Purpose of fresh air blowing into the manhole iv. Purpose of draining out water from the manhole v. Duct way space checking • Duct way availability • Duct way clarity vi. Purpose of duct space rodding	rodding				
4. Perform underground installation cable pulling	i. Underground installation cable pulling procedure • Draw rope pulling ▪ Blowing technique ▪ Rodding technique • Duct way cleaning • Sub duct pulling • Fibre cable pulling ii. Function of cable roller iii. Method of fibre cable pulling • Unidirectional pulling • Bidirectional pulling • Intermediate pulling iv. Figure 8 technique for	i. Carry out draw rope pulling ii. Position cable roller on manhole iii. Carry out sub duct pulling iv. Carry out fibre cable pulling v. Perform Figure 8 technique for long cable pulling vi. Label installed fibre optic cable vii. Perform wiring in manhole viii. Update installation checklist	*Attitude:* i. Meticulous and responsible in performing underground installation cable pulling *Safety:* i. Adhere to safety precautions and procedures	46 110	Lecture Demonstration & Observation	i. Draw rope pulled ii. Cable roller positioned on manhole iii. Sub duct pulled iv. Fibre cable pulled v. Figure 8 technique for long cable pulling explained vi. Installed fibre optic cable labelled vii. Wiring performed in

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	long cable pulling v. Importance of fibre optic cable labelling vi. Purpose of wiring fibre optic cable in manhole vii. Updating of underground installation checklist such as:- • Types of cable • Length of cable • Installation of accessories • Labelling • Wiring					manhole viii. Installation checklist updated
5. Perform overhead installation fibre optic cable pulling	i. Physical checking on poles condition and stability such as:- • Rusk • Upright or leaning • Soil condition ii. Overhead installation cable pulling procedure • Pole clamp installation • Support hook and Integral Barrel (IB) clamp installation • Perform grip installation iii. Function of cable pulley iv. Dead end and dead in cable termination • Technique of termination	i. Check pole condition and stability ii. Install pole clamp for every pole iii. Position cable pulley on pole iv. Carry out fibre cable pulling v. Install support hook and IB clamp for selected pole vi. Install perform grip to hold cable on pole vii. Terminate dead end and dead in cable Update overhead installation checklist	*Attitude:* i. Meticulous in performing overhead installation fibre optic cable pulling *Safety:* i. Adhere to safety precautions and procedures	40 96	Lecture Demonstration & Observation	i. Pole condition and stability checked ii. Pole clamp installed for every pole iii. Cable pulley positioned on pole iv. Fibre cable pulled v. Support hook and IB clamp installed for selected pole vi. Perform grip installed vii. Dead end and dead in cable terminated

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	• Point of termination • Purpose of termination v. Updating of overhead installation checklist such as:- • Types of cable • Length of cable • Installation of accessories • Labelling					viii. Overhead installation checklist updated

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information. 01.02 Document information procedures or processes. 01.03 Utilise basic IT applications. 01.04 Analyse information. 01.08 Utilise spreadsheet applications to locate and process information. 01.10 Apply a variety of mathematical techniques. 01.11 Apply thinking skills and creativity. 02.01 Interpret and follow manuals, instructions and SOP. 02.02 Follow telephone/telecommunication procedures. 02.03 Communicate clearly. 02.04 Prepare brief reports and checklist using standard forms. 02.05 Read/Interpret flowcharts and pictorial information. 02.06 Write memos and letters. 02.08 Prepare pictorial and graphic information. 02.09 Prepare flowcharts. 02.10 Prepare reports and instructions. 02.11 Convey information and ideas to people. 03.02 Demonstrate integrity and apply practical practices. 03.03 Accept responsibility for own work and work area. 03.05 Demonstrate safety skills. 03.06 Respond appropriately to people and situations. 03.14 Facilitate and coordinate teams and ideas. 03.15 Liaise to achieve identified outcomes. 03.16 Identify and assess client/customer needs. 04.01 Organise own work activities. 04.02 Set and revise own objectives and goals. 04.04 Apply problem solving strategies. 04.05 Demonstrate initiative and flexibility. 04.07 Negotiate acceptance and support for objectives and strategies. 05.01 Implement project/work plans. 06.02 Comply with and follow chain of command. 06.03 Identify and highlight problems. 06.04 Adapt competencies to new situations/systems. 06.05 Analyse technical systems.	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Multitasking and prioritising 5. Self-discipline 6. Teamwork 7. Learning skills 8. Leadership skills

Tools, Equipment and Materials (TEM)

ITEMS	RATIO (TEM : Trainees)
1. Cable	1:5
2. Cable labelling materials	1:1
3. Cable grip	1:5
4. Sub duct	1:5
5. Inner duct	1:5
6. B plate/simplex	1:5
7. Cable tagging materials	1:5
8. Draw rope	1:5
9. Cable pulley	1:5
10. Swivel	1:5
11. Cable gripper	1:5
12. Shackle-D	1:5
13. Pole clamp	1:5
14. Support hook	1:5
15. IB clamp	1:5
16. Perform grip	1:5
17. Hand tools	1:1
18. Ladder	1:5
19. Tensioning hoist	1:5
20. Rodding cane	1:5
21. Rope	1:5
22. Cable roller	1:5
23. Sign board	1:5
24. Safety cone	1:5
25. Blinker	1:5
26. Baton light	1:5
27. Flagman	1:5
28. Warning tape	1:5
29. Air blower	1:5
30. Water pump	1:5
31. Wiring materials	1:5
32. Manhole	3:10

33. Pole	3:10
34. Stationery	1:1
35. Installation checklist	1:1
36. Full body harness	1:5
37. Personal Protective Equipment (PPE)	1:1
38. OSP Installation Standard Operating Procedures (SOP) sample	1:1
39. Occupational Safety and Health Act (OSHA)	1:1

References

REFERENCES

1. Patric Argiro, CreateSpace Independent Publising Platform (2012), Fiber Optic Networks Outside Plant Construction and Project Management Techniquies: A Guide to Outside Plant Engineering, ISBN: 978-1475156034
2. Jim Hayes, Create Space Independent Publishing Platform (2010), The FOA Reference Guide to Outside Plant Fiber Optics, ISBN: 978-1450559676
3. Eric Pearson, Cengage Learning; 1 Edition (1996), The Complete Guide to Fiber Optic Cable System Installation, ISBN: 978-0827373181
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5. Bill Woodward, Emile B. Husson, Sybex, 1 Edition (2005), Fiber Optics Installer and Technician Guide, ISBN: 978-0782143904

CURRICULUM of COMPETENCY UNIT (CoCU)

Sub-Sector	TELECOMMUNICATION						
NOSS Title	FIBRE OPTIC INSTALLATION & MAINTENANCE - TELECOMMUNICATION						
Competency Unit Title	FIBRE OPTIC CABLE NETWORK INSIDE PLANT (ISP) INSTALLATION						
Learning Outcome	The person who is competent in this CU shall be able to ensure the ISP cables are installed properly without harming the fibres. Upon completion of this competency unit, trainees will be able to: - • Arrange fibre optic cable network Inside Plant (ISP) installation resources • Barricade working area • Inspect cable trunking and tray availability • Perform fibre optic cable pulling						
Competency Unit ID	EE-324-3:2013-C03	**Level**	3	**Training Duration**	270 Hours	**Credit Hours**	27

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
1. Arrange fibre optic cable network Inside Plant (ISP) installation resources	i. Fibre optic cable network ISP installation process flow ii. Types of OSP installation resources such as:- • Manpower • Materials ▪ Cable ▪ Cable labelling materials ▪ Micro duct ▪ Cable tie ▪ Inner duct ▪ Draw rope ▪ Cable tray ▪ Cable trunking	i. Identify types of ISP installation resources ii. Identify resource logistics requirements	*Attitude:* i. Knowledgeable and resourceful in arranging fibre optic cable network ISP installation resources	10 24	Lecture Demonstration & Observation	i. Types of ISP installation resources listed and described ii. Resource logistics requirements explained

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	▪ Under floor trunking ▪ Cable ladder • Tools ▪ Swivel ▪ Cable gripper ▪ Hand tools ▪ Ladder ▪ Internal rodding cane ▪ Rope					
2. Barricade working area	i. Related OSHA requirements on • Traffic control zone • Telecommunication Manhole/pole • Building ii. Confinement area requirements such as:- • Advanced warning area • Transition area • Buffer space • Work area iii. Safe working environment arrangement such as:- • Sign board • Safety cone • Warning tape	i. Identify confinement area ii. Arrange safe working environment (safety equipment) according to OSHA requirements	*Attitude:* i. Responsible in barricading working area *Safety:* i. Adhere to safety precautions and procedures	10 24	Lecture Demonstration & Observation	i. Confinement area explained according to OSHA requirements ii. Safety equipment arranged

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
3. Inspect cable trunking and tray availability	i. Procedure in opening indoor cable trunking and junction box ii. Cable trunking and tray space checking • Trunking space availability • Trunking space clarity iii. Purpose of under floor trunking rodding	i. Open indoor cable trunking ii. Check cable trunking and tray space iii. Open junction box Execute under floor trunking rodding	*Attitude:* i. Knowledgeable in inspecting cable trunking and tray availability *Safety:* i. Adhere to safety precautions and procedures	24 56	Lecture Demonstration & Observation	i. Cable trunking and tray space checked ii. Under floor trunking rodding executed
4. Perform fibre optic cable pulling	i. ISP installation cable pulling procedure • Draw rope pulling • Micro duct pulling • Fibre cable pulling ii. Importance of fibre optic cable labelling iii. Purpose of wiring fibre optic in cable tray iv. Updating of ISP installation checklist such as:- • Types of cable • Length of cable • Installation of accessories • Labelling • Wiring	i. Carry out draw rope pulling ii. Pull fibre optic micro-duct iii. Pull fibre optic cable iv. Label installed fibre optic cable v. Apply wiring technique in cable tray vi. Update ISP installation checklist	*Attitude:* i. Meticulous and responsible in performing fibre optic cable pulling *Safety:* i. Adhere to safety precautions and procedures	36 86	Lecture Demonstration & Observation	i. Draw rope pulled ii. Fibre optic micro-duct pulled iii. Fibre optic cable pulled iv. Installed fibre optic cable labelled v. Wiring technique applied in cable tray vi. ISP installation checklist updated

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information. 01.02 Document information procedures or processes. 01.03 Utilise basic IT applications. 01.04 Analyse information. 01.08 Utilise spreadsheet applications to locate and process information. 01.10 Apply a variety of mathematical techniques. 01.11 Apply thinking skills and creativity. 02.01 Interpret and follow manuals, instructions and SOP. 02.02 Follow telephone/telecommunication procedures. 02.03 Communicate clearly. 02.04 Prepare brief reports and checklist using standard forms. 02.05 Read/Interpret flowcharts and pictorial information. 02.06 Write memos and letters. 02.08 Prepare pictorial and graphic information. 02.09 Prepare flowcharts. 02.10 Prepare reports and instructions. 02.11 Convey information and ideas to people. 03.02 Demonstrate integrity and apply practical practices. 03.03 Accept responsibility for own work and work area. 03.05 Demonstrate safety skills. 03.06 Respond appropriately to people and situations. 03.14 Facilitate and coordinate teams and ideas. 03.15 Liaise to achieve identified outcomes. 03.16 Identify and assess client/customer needs. 04.01 Organise own work activities. 04.02 Set and revise own objectives and goals. 04.04 Apply problem solving strategies. 04.05 Demonstrate initiative and flexibility. 04.07 Negotiate acceptance and support for objectives and strategies. 05.01 Implement project/work plans. 06.02 Comply with and follow chain of command. 06.03 Identify and highlight problems. 06.04 Adapt competencies to new situations/systems. 06.05 Analyse technical systems.	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Multitasking and prioritising 5. Self-discipline 6. Teamwork 7. Learning skills 8. Leadership skills

Tools, Equipment and Materials (TEM)

ITEMS	RATIO (TEM : Trainees)
1. Cable	1:5
2. Cable labelling materials	1:1
3. Micro duct	1:5
4. Cable tie	1:5
5. Inner duct	1:5
6. Draw rope	1:5
7. Cable tray	1:5
8. Cable trunking	1:5
9. Under floor trunking	1:5
10. Cable ladder	1:5
11. Swivel	1:5
12. Cable gripper	1:5
13. Hand tools	1:1
14. Ladder	1:5
15. Internal rodding cane	1:5
16. Rope	1:5
17. Sign board	1:5
18. Safety cone	1:5
19. Warning tape	1:5
20. Wiring materials	1:5
21. Stationery	1:1
22. Installation checklist	1:1
23. Full body harness	1:5
24. Personal Protective Equipment (PPE)	1:1
25. OSP Installation Standard Operating Procedures (SOP) sample	1:1
26. Occupational Safety and Health Act (OSHA)	1:1

References

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1. Eric Pearson, Cengage Learning; 1 Edition (1996), The Complete Guide to Fiber Optic Cable System Installation, ISBN: 978-0827373181 2. Bob Chomycz, Mc Graw-Hill Professional, 1 Edition (2000), Fiber Optic Installer's Field Manual, ISBN: 978-0071356046 3. Bill Woodward, Emile B. Husson, Sybex, 1 Edition (2005), Fiber Optics Installer and Technician Guide, ISBN: 978-0782143904

CURRICULUM of COMPETENCY UNIT (CoCU)

Sub-Sector	TELECOMMUNICATION						
NOSS Title	FIBRE OPTIC INSTALLATION & MAINTENANCE - TELECOMMUNICATION						
Competency Unit Title	FIBRE OPTIC CABLE NETWORK JOINTING						
Learning Outcome	The person who is competent in this CU shall be able to joint two fibres together to form a continuous optical waveguide. Upon completion of this competency unit, trainees will be able to: - • Arrange fibre optic cable network jointing resources • Barricade working area • Set fibre optic cable for jointing • Perform fibre optic cable splicing						
Competency Unit ID	EE-324-3:2013-C04	**Level**	3	**Training Duration**	270 Hours	**Credit Hours**	27

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
1. Arrange fibre optic cable network jointing resources	i. Fibre optic cable network jointing process flow ii. Splicing area condition requirements such as:- • Clean • Dry • Free from dust iii. Types of fibre optic network jointing • Straight joint • Multi joint iv. Types of jointing resources • Manpower	i. Determine type of fibre optic network jointing ii. Identify types of jointing resources iii. Identify resource logistics requirements	*Attitude:* i. Knowledgeable and resourceful in arranging fibre optic cable network jointing resources	8 18	Lecture Demonstration & Observation	i. Type of fibre optic network jointing listed ii. Types of jointing resources listed and describe iii. Resources logistics requirements explained

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	• Materials ▪ Fibre optic cable - Slotted cable - Loose tube cable - External drop fibre - Internal drop fibre - Internal fibre cable ▪ Jointing closure ▪ Fibre Termination Box (FTB) ▪ Protection sleeve ▪ Single entry kits ▪ Fibre termination box ▪ Mounting kits ▪ Fibre tray ▪ Alcohol ▪ Spirit ▪ Cotton waste/lint free cloth ▪ PVC tape • Tools ▪ Splicing machine - Cleavers - Stripper ▪ Hand tools set					

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
2. Barricade working area	i. Related OSHA requirements on • Traffic control zone • Telecommunication Manhole/pole • Building ii. Confinement area requirements such as:- • Advanced warning area • Transition area • Buffer space • Work area iii. Safe working environment arrangements such as:- • Sign board • Safety cone • Blinker • Baton light • Flagman • Warning tape	i. Identify confinement area ii. Arrange safe working environment (safety equipment) according to OSHA requirements	*Attitude:* i. Responsible in barricading working area *Safety:* i. Adhere to safety precautions and procedures	12 28	Lecture Demonstration & Observation	i. Confinement area explained according to OSHA requirements ii. Safety equipment arranged
3. Set fibre optic cable for jointing	i. Fibre optic cable setting • Length • Marking • Cable in and out ii. Purpose of removing fibre jacket iii. Function of spirit in cable buffer cleaning iv. Procedure of fixing cables into cable closure	i. Confirm cables to be jointed ii. Remove fibre jacket iii. Clean cable buffer iv. Fix cables into cable closure v. Remove buffer tube	*Attitude:* i. Knowledgeable and meticulous in preparing fibre optic cable for jointing *Safety:* Adhere to safety precautions and procedures	24 58	Lecture Demonstration & Observation	i. Cables to be jointed determined ii. Cable set for jointing iii. Fibre jacket removed iv. Cable buffer cleaned v. Cables fixed into cable closure

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	v. Purpose of removing buffer tube					vi. Buffer tube removed
4. Perform fibre optic cable splicing	i. Function of protection sleeve ii. Fibre coating striping • Length • Quality iii. Function of alcohol in cleaning fibre core iv. Fibre core cleaving • Length • Angle • Perfectness v. Fibre core setting into splicing machine vi. Observation of splice point for :- • Crack • Separation • Bubble • Too thick • Too thin vii. Purpose of heating protecting sleeve viii. Managing fibre core into splicing tray such as:- • Bending radius • Neatness • Spliced fibre core arrangement • Sleeve numbering ix. Method of mounting joint closure	i. Fix protection sleeve into fibre core ii. Strip fibre coating iii. Clean fibre core using alcohol iv. Cleave fibre core using cleaver v. Set fibre core into splicing machine vi. Splice fibre core using splicing machine vii. Heat protection sleeve viii. Manage fibre core into splicing tray Mount joint closure	*Attitude:* i. Knowledgeable and meticulous in performing fibre optic cable splicing *Safety:* i. Adhere to safety precautions and procedures	36 86	Lecture Demonstration & Observation	i. Protection sleeve fixed into fibre core ii. Fibre coating stripped iii. Fibre core cleaned using alcohol iv. Fibre core cleaved v. Fibre core set into splicing machine vi. Fibre core spliced vii. Protection sleeve heated viii. Fibre core managed into splicing tray ix. Joint closure mounted

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	• Mechanical closure • Heat shrink tube x. Method of terminating fibre optic cable • Mechanical splice • Fusion splice					

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information. 01.02 Document information procedures or processes. 01.03 Utilise basic IT applications. 01.04 Analyse information. 01.08 Utilise spreadsheet applications to locate and process information. 01.10 Apply a variety of mathematical techniques. 01.11 Apply thinking skills and creativity. 02.01 Interpret and follow manuals, instructions and SOP. 02.02 Follow telephone/telecommunication procedures. 02.03 Communicate clearly. 02.04 Prepare brief reports and checklist using standard forms. 02.05 Read/Interpret flowcharts and pictorial information. 02.06 Write memos and letters. 02.08 Prepare pictorial and graphic information. 02.09 Prepare flowcharts. 02.10 Prepare reports and instructions. 02.11 Convey information and ideas to people. 03.02 Demonstrate integrity and apply practical practices. 03.03 Accept responsibility for own work and work area. 03.05 Demonstrate safety skills. 03.06 Respond appropriately to people and situations. 03.14 Facilitate and coordinate teams and ideas. 03.15 Liaise to achieve identified outcomes. 03.16 Identify and assess client/customer needs. 04.01 Organise own work activities. 04.02 Set and revise own objectives and goals. 04.04 Apply problem solving strategies. 04.05 Demonstrate initiative and flexibility. 04.07 Negotiate acceptance and support for objectives and strategies. 05.01 Implement project/work plans. 06.02 Comply with and follow chain of command. 06.03 Identify and highlight problems. 06.04 Adapt competencies to new situations/systems. 06.05 Analyse technical systems.	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Multitasking and prioritising 5. Self-discipline 6. Teamwork 7. Learning skills 8. Leadership skills

Tools, Equipment and Materials (TEM)

ITEMS	RATIO (TEM : Trainees)
1. Cable	1:1
2. Jointing closure	1:5
3. Fibre Termination Box (FTB)	1:5
4. Protection sleeve	1:1
5. Single entry kits	1:1
6. Mounting kits	1:5
7. Pig tail	1:5
8. Fibre tray	1:5
9. Alcohol	1:5
10. Spirit	1:5
11. Cotton waste/lint free cloth	1:1
12. PVC tape	1:1
13. Splicing machine (Cleavers, Stripper)	1:5
14. Hand tools set	1:1
15. Manhole	3:10
16. Pole	3:10
17. Stationery	1:1
18. Installation checklist	1:1
19. Full body harness	1:5
20. Personal Protective Equipment (PPE)	1:1
21. Jointing Standard Operating Procedures (SOP) sample	1:1
22. Occupational Safety and Health Act (OSHA)	1:1

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1. Calvin M. Miller, Dekker (1986), Optical Fiber Splices and Connectors: Theory and Methods, ISBN: 978-0824775209 2. Carl A. Villarruel, SPIE-the International Society for Optical Engineering (1986), Fiber Optic Coupler, Connectors, and Splice Technology, ISBN: 978-0892525140 3. Eric Pearson, Cengage Learning; 1 Edition (1996), The Complete Guide to Fiber Optic Cable System Installation, ISBN: 978-0827373181 4. Bob Chomycz, Mc Graw-Hill Professional, 1 Edition (2000), Fiber Optic Installer's Field Manual, ISBN: 978-0071356046 5. Bill Woodward, Emile B. Husson, Sybex, 1 Edition (2005), Fiber Optics Installer and Technician Guide, ISBN: 978-0782143904

CURRICULUM of COMPETENCY UNIT (CoCU)

Sub-Sector	TELECOMMUNICATION						
NOSS Title	FIBRE OPTIC INSTALLATION & MAINTENANCE - TELECOMMUNICATION						
Competency Unit Title	FIBRE OPTIC CABLE NETWORK TESTING & COMMISSIONING						
Learning Outcome	The person who is competent in this CU shall be able to conduct several tests in ensuring the fibre optic cables are in good quality before handing over to the service provider/client. Upon completion of this competency unit, trainees will be able to: - • Prepare testing instrument • Perform cable loss test • Perform end to end test • Perform Insertion Loss (IL) and Optical Return Loss (ORL) bi-directional test • Report fibre optic testing activities to superior • Perform fibre optic installation commissioning						
Competency Unit ID	EE-324-3:2013-C05	**Level**	3	**Training Duration**	270 Hours	**Credit Hours**	27

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
1. Prepare testing instrument	i. Fibre optic cable network testing and commissioning process flow ii. Cable information for testing such as:- • Cable types • Cable coding • Cable length • Cable core number • Cable wavelength • Splice point	i. Determine type of test ii. Confirm fibre core to be tested iii. Determine type and function of testing instrument	*Attitude:* i. Knowledgeable and resourceful in preparing testing instrument	12 28	Lecture Demonstration & Observation	i. Type of test listed ii. Types and functions of testing instrument explained

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	▪ Numbers of joint ▪ Numbers of connection iii. Types of test such as:- • Cable loss test • End to End Test • IL and ORL Test Bi directional for high speed broadband iv. Types and functions of testing instruments • Optical Time Domain Reflectometer (OTDR) • Light source • Power meter • Optical Loss Test Set (OLTS)					
2. Perform cable loss test	i. OTDR instrument setting ii. Types of patch codes • Subscriber Connector (SC) • Fixed Connector (FC) • E2000 • Lucent Connector (LC) iii. Cable loss test results such as:- • Optical Return loss (ORL)	i. Set OTDR instrument ii. Connect OTDR instrument to fibre core using patch cord iii. Conduct cable loss testing iv. Record cable loss test results	*Attitude:* i. Knowledgeable and detail in performing cable loss test *Safety:* Adhere to safety precautions and procedures	18 44	Lecture Demonstration & Observation	i. OTDR instrument set ii. OTDR instrument connected to fibre core using patch cord iii. Cable loss testing conducted iv. Cable loss test results recorded

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	• Fibre length • Splice loss					
3. Perform end to end test	i. Definition of starting point and ending point ii. Light source and power meter setting and calibration iii. Purpose of instrument calibration iv. Procedure of end to end testing • Placing of light source at starting point • Placing of power meter at ending point • Connecting of power meter to cable end using patch cord • Connecting of light source to cable in using patch cord v. End to end testing results such as:- • Cable continuity • Core reversal • Core loss (dB)	i. Determine starting point and ending point ii. Set and calibrate light source and power meter iii. Place light source at starting point iv. Place power meter at ending point v. Connect power meter to cable ending point using patch cord vi. Connect light source to cable starting point in using patch cord vii. Conduct end to end test viii. Record end to end test results	*Attitude:* i. Knowledgeable and detail in performing end to end testing *Safety:* i. Adhere to safety precautions and procedures	20 46	Lecture Demonstration & Observation	i. Starting point and ending point distinguished ii. Light source and power meter set and calibrated iii. Light source placed at starting point iv. Power meter placed at ending point v. Power meter connected to cable ending point using patch cord vi. Light source connected to cable starting point in using patch cord vii. End to end test conducted viii. End to end test results recorded
4. Perform Insertion Loss (IL) and Optical Return Loss (ORL) bi-	i. OLTS instrument setting and calibration ii. Procedure of IL and ORL bi-directional testing	i. Set and calibrate OLTS instrument ii. Connect OLTS instrument to ending point using patch	*Attitude:* i. Knowledgeable and detail in performing IL and ORL bi-	18	Lecture	i. OLTS instrument set and calibrated ii. OLTS instrument

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
directional test	• Connecting of OLTS instrument to ending point using patch cord • Connecting of OLTS instrument to starting point using patch cord iii. IL and ORL bi-directional test results such as:- • Micro bending loss • Connector loss • Splitter loss • Upstream and downstream loss	cord iii. Connect OLTS instrument to starting point using patch cord iv. Conduct IL and ORL Bi-directional test v. Record IL and ORL bi-directional test results	directional testing *Safety:* Adhere to safety precautions and procedures	44	Demonstration & Observation	connected to ending point using patch cord iii. OLTS instrument connected to starting point using patch cord iv. IL and ORL bi-directional test conducted v. IL and ORL bi-directional test results recorded
5. Report fibre optic testing activities to superior	i. Importance of tagging the tested cable ii. Tested cable tagging contents such as:- • Number of cores • Number of cables • Link name iii. Fibre optic testing result assessment • Specification fulfilment (according to service provider requirements) • Checklist details iv. Report writing skills v. Fibre optic fibre optic testing report contents	i. Tag tested cable ii. Assess fibre optic testing result iii. Recommend rectification to superior base on fibre optic test result iv. Prepare fibre optic testing report v. Fibre optic testing report submitted to superior	*Attitude:* i. Meticulous and detailed in preparing fibre optic testing report ii. Adhere to report submission deadline	4 8	Lecture Demonstration & Observation	i. Tested cable tagged ii. Fibre optic testing result assessed iii. Fibre optic testing report prepared and submitted to superior

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	• Cable loss test results • End to End Test results • IL and ORL bi-directional test results • Rectification recommendation					
6. Perform fibre optic installation commissioning	i. Fibre optic installation commissioning details: • Venue • Date • Time • Participant ii. Fibre optic installation verification with service provider/client such as: • Cable route • Cable tagging • Cable arrangement • Cable test result • Installation error rectification, if necessary iii. Technical document preparation for installation commissioning such as:- • Hand over note • Final drawing - Straight Line	i. Set commissioning details ii. Verify fibre optic installation with service provider/client iii. Rectify installation errors, if necessary iv. Prepare technical documents for installation commissioning	*Attitude:* i. Knowledgeable and detailed in performing fibre optic installation commissioning *Safety:* i. Adhere to safety precautions and procedures	8 20	Lecture Demonstration & Observation	i. Commissioning details set ii. Fibre optic installation verified with service provider/ client iii. Installation errors rectified iv. Technical documents prepared for installation commissioning

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	Drawing (SLD) - Map drawing • Test results					

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information. 01.02 Document information procedures or processes. 01.03 Utilise basic IT applications. 01.04 Analyse information. 01.08 Utilise spreadsheet applications to locate and process information. 01.10 Apply a variety of mathematical techniques. 01.11 Apply thinking skills and creativity. 02.01 Interpret and follow manuals, instructions and SOP. 02.02 Follow telephone/telecommunication procedures. 02.03 Communicate clearly. 02.04 Prepare brief reports and checklist using standard forms. 02.05 Read/Interpret flowcharts and pictorial information. 02.06 Write memos and letters. 02.08 Prepare pictorial and graphic information. 02.09 Prepare flowcharts. 02.10 Prepare reports and instructions. 02.11 Convey information and ideas to people. 03.02 Demonstrate integrity and apply practical practices. 03.03 Accept responsibility for own work and work area. 03.05 Demonstrate safety skills. 03.06 Respond appropriately to people and situations. 03.14 Facilitate and coordinate teams and ideas. 03.15 Liaise to achieve identified outcomes. 03.16 Identify and assess client/customer needs. 04.01 Organise own work activities. 04.02 Set and revise own objectives and goals. 04.04 Apply problem solving strategies. 04.05 Demonstrate initiative and flexibility. 04.07 Negotiate acceptance and support for objectives and strategies. 05.01 Implement project/work plans. 06.02 Comply with and follow chain of command. 06.03 Identify and highlight problems. 06.04 Adapt competencies to new situations/systems. 06.05 Analyse technical systems.	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Multitasking and prioritising 5. Self-discipline 6. Teamwork 7. Learning skills 8. Leadership skills

Tools, Equipment and Materials (TEM)

ITEMS	RATIO (TEM : Trainees)
1. Cable	1:5
2. Optical Time Domain Reflectometer (OTDR)	1:5
3. Light source	1:5
4. Power meter	1:5
5. Optical Loss Test Set (OLTS)	1:5
6. Sign board	1:5
7. Safety cone	1:5
8. Blinker	1:5
9. Baton light	1:5
10. Flagman	1:5
11. Warning tape	1:5
12. Patch code	1:5
13. Cable loss test results	1:1
14. End to End testing results	1:1
15. IL and ORL Test Bi directional results	1:1
16. Cable tagging materials	1:1
17. Fibre network set	1:25
18. Stationery	1:1
19. Computer	1:5
20. Printer	1:10
21. Fibre optic testing report format	1:1
22. Commissioning technical documents (Hand over note, Final drawing, Testing result)	1:1
23. Full body harness	1:5
24. Personal Protective Equipment (PPE)	1:1
25. Testing and commissioning Standard Operating Procedures (SOP) sample	1:1
26. Occupational Safety and Health Act (OSHA)	1:1

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1. Hewlett Packard, Prentice Hall; 1 Edition (October 18, 1997), Fiber Optic Test and Measurement, ISBN: 978-0135343302
2. Eric R. Pearson, Create Space Independent Publishing Platform (October 11, 2011), Mastering The OTDR: Trace Acquisition and Interpretation, ISBN: 978-1466429291
3. Patric Argiro, CreateSpace Independent Publising Platform (2012), Fiber Optic Networks Outside Plant Construction and Project Management Techniquies: A Guide to Outside Plant Engineering, ISBN: 978-1475156034
4. Jim Hayes, Create Space Independent Publishing Platform (2010), The FOA Reference Guide to Outside Plant Fiber Optics, ISBN: 978-1450559676
5. Calvin M. Miller, Dekker (1986), Optical Fiber Splices and Connectors: Theory and Methods, ISBN: 978-0824775209
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7. Eric Pearson, Cengage Learning; 1 Edition (1996), The Complete Guide to Fiber Optic Cable System Installation, ISBN: 978-0827373181
8. Bob Chomycz, Mc Graw-Hill Professional, 1 Edition (2000), Fiber Optic Installer's Field Manual, ISBN: 978-0071356046
9. Bill Woodward, Emile B. Husson, Sybex, 1 Edition (2005), Fiber Optics Installer and Technician Guide, ISBN: 978-0782143904

CURRICULUM of COMPETENCY UNIT (CoCU)

Sub-Sector	TELECOMMUNICATION						
NOSS Title	FIBRE OPTIC INSTALLATION & MAINTENANCE - TELECOMMUNICATION						
Competency Unit Title	FIBRE OPTIC CABLE NETWORK MAINTENANCE						
Learning Outcome	The person who is competent in this CU shall be able to maintain fibre optic cables as per prior agreed time schedule and rectify any faults or immediate breakdowns of fibre optic cables upon the detection or occurrence of a failure. Upon completion of this competency unit, trainees will be able to: - • Arrange fibre optic cable network maintenance resources • Perform fibre optic cable preventive maintenance • Perform fibre optic cable corrective maintenance • Report fibre optic maintenance activities to superior						
Competency Unit ID	EE-324-3:2013-C06	**Level**	3	**Training Duration**	180 Hours	**Credit Hours**	18

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
1. Arrange fibre optic cable network maintenance resources	i. Fibre optic cable network maintenance process flow ii. Types of fibre optic cable network maintenance:- • Preventive maintenance • Corrective maintenance iii. Maintenance location area iv. Types of faultiness such as: • Fibre cable	i. Determine type of fibre optic cable network maintenance according to the job order ii. Determine maintenance location area iii. Determine type of faultiness iv. Identify type of maintenance resources	*Attitude:* i. Knowledgeable and resourceful in arranging fibre optic cable network maintenance resources	10 24	Lecture Demonstration & Observation	i. Types of fibre optic cable network maintenance explained ii. Types of faultiness listed iii. Types of maintenance resources listed and described

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	break/damage • Fibre contamination • Faulty connector • Ageing • Faulty equipment v. Types of faulty causes such as:- • Vandalism • Natural disaster • Rodent • Accident vi. Basic knowledge of active equipment such as:- • Types and functions ▪ Modem ▪ Network element ▪ Broadband unit ▪ Equipment Monitoring System (EMS) • Symptom of faulty ▪ Network element offline alarm in Equipment Monitoring System (EMS) ▪ Service failure ▪ Power and environmental alarm ▪ Loss Of Signal (LOS) alarm at Passive Optical Network (PON)					

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	port ▪ Card faulty alarm • Causes of faultiness ▪ Power failure ▪ Lightning ▪ High temperature ▪ Rectifier failure ▪ Humidity • Faulty procedure vii. Types of maintenance resources • Manpower • Materials ▪ Cable ▪ Cable labelling materials ▪ Cable grip ▪ Sub duct ▪ Inner duct ▪ B plate/simplex ▪ Cable tagging materials ▪ Draw rope ▪ Pole clamp ▪ Support hook ▪ Integral Barrel (IB) clamp ▪ Perform grip ▪ Jointing closure ▪ Protection sleeve ▪ Single entry kits • Tools ▪ Ladder					

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	▪ Tensioning hoist ▪ Rodding cane ▪ Rope ▪ Cable roller ▪ Cable pulley ▪ Swivel ▪ Cable gripper ▪ Shackle-D ▪ Splicing machine - Cleavers - Stripper ▪ Hand tools set ▪ OTDR ▪ OLTS ▪ Live fibre detector ▪ Power meter ▪ Light source ▪ Visible light source					
2. Perform fibre optic cable preventive maintenance	i. Related OSHA requirements on • Traffic control zone • Telecommunication Manhole • Building • On pole ii. Preventive maintenance schedule interpretation iii. Preventive maintenance procedures iv. Updating of preventive maintenance checklist:- • Location of	i. Interpret preventive maintenance schedule ii. Conduct preventive maintenance iii. Update preventive maintenance checklist	*Attitude:* i. Responsible in performing fibre optic cable preventive maintenance *Safety:* i. Adhere to safety precautions and procedures	12 26	Lecture Demonstration & Observation	i. Related OSHA requirements explained ii. Preventive maintenance schedule interpreted iii. Preventive maintenance conducted iv. Preventive maintenance checklist updated

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	maintenance • Physical check ▪ Pole condition ▪ Cable condition ▪ Termination condition ▪ Manhole condition • Regularity of maintenance • Replacement of obsolete materials • Remarks and comments					
3. Perform fibre optic cable corrective maintenance	i. Methods of troubleshooting faulty cable • Physical checking • Instrumental checking ii. Faulty cable rectification procedure iii. Rectified cable testing • Cable distance • Cable continuity • Cable loss iv. Importance of updating cable labelling and cable inventory record v. Recording of corrective maintenance activities such as:- • Location of maintenance	i. Troubleshoot faulty cable ii. Rectify faulty cable iii. Test rectified cable iv. Update cable labelling v. Update cable inventory record Record corrective maintenance activities	*Attitude:* i. Responsible and proactive in performing fibre optic cable corrective maintenance *Safety:* i. Adhere to safety precautions and procedures	28 64	Lecture Demonstration & Observation	i. Faulty cable checked ii. Faulty cable rectified iii. Rectified cable tested iv. Cable labelling updated v. Cable inventory record updated vi. Corrective maintenance activities recorded

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	• Physical check ▪ Pole condition ▪ Cable condition ▪ Termination condition ▪ Manhole condition • Types of faultiness • Replacement of faulty materials • Remarks and comments					
4. Report fibre optic maintenance activities to superior	i. Report writing skills ii. Fibre optic maintenance report contents • Works maintenance activities • Test results • Supporting evidence - Before and after maintenance picture	i. Determine fibre optic maintenance report format and contents ii. Prepare fibre optic maintenance report Submit fibre optic maintenance report to superior	*Attitude:* i. Meticulous in preparing fibre optic cable network project pre installation report ii. Adhere to report submission deadline	4 12	Lecture Demonstration & Observation	i. Fibre optic maintenance report format drafted ii. Fibre optic maintenance report prepared and submitted to superior

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information. 01.02 Document information procedures or processes. 01.03 Utilise basic IT applications. 01.04 Analyse information. 01.08 Utilise spreadsheet applications to locate and process information. 01.10 Apply a variety of mathematical techniques. 01.11 Apply thinking skills and creativity. 02.01 Interpret and follow manuals, instructions and SOP. 02.02 Follow telephone/telecommunication procedures. 02.03 Communicate clearly. 02.04 Prepare brief reports and checklist using standard forms. 02.05 Read/Interpret flowcharts and pictorial information. 02.06 Write memos and letters. 02.08 Prepare pictorial and graphic information. 02.09 Prepare flowcharts. 02.10 Prepare reports and instructions. 02.11 Convey information and ideas to people. 03.02 Demonstrate integrity and apply practical practices. 03.03 Accept responsibility for own work and work area. 03.05 Demonstrate safety skills. 03.06 Respond appropriately to people and situations. 03.14 Facilitate and coordinate teams and ideas. 03.15 Liaise to achieve identified outcomes. 03.16 Identify and assess client/customer needs. 04.01 Organise own work activities. 04.02 Set and revise own objectives and goals. 04.04 Apply problem solving strategies. 04.05 Demonstrate initiative and flexibility. 04.07 Negotiate acceptance and support for objectives and strategies. 05.01 Implement project/work plans. 06.02 Comply with and follow chain of command. 06.03 Identify and highlight problems. 06.04 Adapt competencies to new situations/systems. 06.05 Analyse technical systems.	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Multitasking and prioritising 5. Self-discipline 6. Teamwork 7. Learning skills 8. Leadership skills

Tools, Equipment and Materials (TEM)

ITEMS	RATIO (TEM : Trainees)
1. Cable	1:5
2. Cable labelling materials	1:1
3. Cable grip	1:5
4. Sub duct	1:5
5. Inner duct	1:5
6. B plate/simplex	1:5
7. Cable tagging materials	1:1
8. Draw rope	1:5
9. Cable pulley	1:5
10. Swivel	1:5
11. Cable gripper	1:5
12. Shackle-D	1:5
13. Pole clamp	1:5
14. Support hook	1:5
15. IB clamp	1:5
16. Perform grip	1:5
17. Jointing closure	1:5
18. Fibre Termination Box (FTB)	1:5
19. Protection sleeve	1:1
20. Single entry kits	1:5
21. Mounting kits	1:5
22. Fibre tray	1:5
23. Alcohol	1:5
24. Spirit	1:5
25. Cotton waste/lint free cloth	1:1
26. PVC tape	1:1
27. Splicing machine (Cleavers, Stripper)	1:5
28. Hand tools	1:1
29. Ladder	1:5
30. Tensioning hoist	1:5

31. Rodding cane	1:5
32. Rope	1:5
33. Cable roller	1:5
34. Optical Time Domain Reflectometer (OTDR)	1:5
35. Light source	1:5
36. Power meter	1:5
37. Optical Loss Test Set (OLTS)	1:5
38. Patch code	1:5
39. Adapter	1:5
40. Pig tail	1:5
41. Fibre optic cleaning material tools set	1:5
42. Sign board	1:5
43. Safety cone	1:5
44. Blinker	1:5
45. Baton light	1:5
46. Flagman	1:5
47. Warning tape	1:5
48. Air blower	1:5
49. Water pump	1:5
50. Wiring materials	1:5
51. Manhole	3:10
52. Pole	3:10
53. Stationery	1:1
54. Installation checklist	1:1
55. Full body harness	1:5
56. Personal Protective Equipment (PPE)	1:1
57. OSP Installation Standard Operating Procedures (SOP) sample	1:1
58. Occupational Safety and Health Act (OSHA)	1:1

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1. Hewlett Packard, Prentice Hall; 1 Edition (October 18, 1997), Fiber Optic Test and Measurement, ISBN: 978-0135343302
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CURRICULUM of COMPETENCY UNIT (CoCU)

Sub-Sector	TELECOMMUNICATION						
NOSS Title	FIBRE OPTIC INSTALLATION & MAINTENANCE - TELECOMMUNICATION						
Competency Unit Title	FIBRE OPTIC CABLE NETWORK INSTALLATION & MAINTENANCE SUPERVISION						
Learning Outcome	The person who is competent in this CU shall be able to monitor all installation and maintenance activities at site in ensuring work progress runs smoothly within the given time frame. Upon completion of this competency unit, trainees will be able to: - • Monitor fibre optic installation work progress • Monitor safe working environment practices by subordinate • Monitor subordinates' performance • Control materials, tools and instrument movement • Prepare daily progress report						
Competency Unit ID	EE-324-3:2013-C07	**Level**	3	**Training Duration**	180 Hours	**Credit Hours**	18

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
1. Monitor fibre optic installation work progress	i. Project briefing to the subordinates such as:- • Scope of work • Critical issues ii. Project timeline and schedule such as:- • Definition • Purpose • Cycle time iii. Purpose of compliance to Standard Operating Procedure (SOP)	i. Conduct project briefing to the subordinates ii. Ensure project timeline and schedule compliance iii. Ensure Standard Operating Procedure compliance by subordinate	*Attitude:* i. Professional and firm in monitoring fibre optic installation work progress *Safety:* i. Adhere to safety precautions and procedures	14 32	Lecture Demonstration & Observation	i. Project briefing conducted to the subordinates ii. Project timeline and schedule compliance enforced iii. Standard Operating Procedure compliance enforced

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
2. Monitor safe working environment practices by subordinate	i. Related Occupational Safety and Health Act (OSHA) requirements on safety compliance ii. Basic knowledge on hazard and risk iii. Safety requirement instruction such as: • Personal Protecting Equipment (PPE) • Full body harness • Safe working practices • Ethics • Personal gas detector iv. Importance of ensuring safe working environment practices by subordinate	i. Brief safe working environment practices to subordinate ii. Instruct subordinate to follow safety requirements iii. Ensure safe working environment practices by subordinate	*Attitude:* i. Professional and firm in monitoring safe working environment practices by subordinate *Safety:* Adhere to safety precautions and procedures	14 32	Lecture Demonstration & Observation	i. Safe working environment practices briefed to subordinate ii. Subordinate instructed to follow safety requirements iii. Safe working environment practices by subordinate enforced
3. Monitor subordinates' performance	i. Subordinates' performance evaluation method • Observation • Interview • Peers feedback ii. Subordinates' performance evaluation • Periodically • Criteria ▪ Quality ▪ Productivity ▪ Discipline ▪ Competency	i. Observe subordinates' performance ii. Evaluate subordinates' performance Report subordinates' performance to superior	*Attitude:* i. Fair and professional in monitoring subordinates' performance	8 20	Lecture Demonstration & Observation	i. Subordinates' performance observed ii. Subordinates' performance evaluated iii. Subordinates' performance reported to superior

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	• Recommendation ▪ Confirmation ▪ Promotion ▪ Training ▪ Refresher course ▪ Motivation ▪ Termination iii. Subordinates' performance report • Appraisal form • Submission procedure					
4. Control materials, tools and instrument movement	i. Materials, tools, and instruments tracking ii. Master list of tools and instrument iii. Types of materials, tools, and instrument movement • New • Transfer • Disposal iv. Tools and instrument calibration • Calibration schedule • Accredited party	i. Determine type of materials, tools and instruments used ii. Record movement of materials, tools, and instruments iii. Execute material settlement Coordinate tool and instrument calibration according to calibration schedule	*Attitude:* i. Responsible in controlling materials, tools and equipment movement ii. Follow equipment and tools calibration schedule *Safety:* i. Adhere to safety precautions and procedures	10 26	Lecture Demonstration & Observation	i. Types of materials, tools and instruments listed ii. Movement of materials, tools, and instruments recorded iii. Material settlement executed iv. Tool and instrument calibration coordinated according to calibration schedule

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
5. Prepare daily progress report	i. Report writing skills ii. Daily progress report format iii. Daily progress report contents: • Site location • Weather • Working time • Manpower strength • Work activities • Reviews/comments	i. Identify daily progress report format and contents ii. Write daily progress report Submit daily progress report to superior	*Attitude:* i. Detailed in preparing daily progress report ii. Adhere to report submission deadline	8 16	Lecture Demonstration & Observation	i. Daily progress report format drafted ii. Daily progress report written and submitted to superior

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information. 01.02 Document information procedures or processes. 01.03 Utilise basic IT applications. 01.04 Analyse information. 01.07 Utilise database applications to locate a process information. 01.08 Utilise spreadsheet applications to locate and process information. 01.11 Apply thinking skills and creativity. 02.01 Interpret and follow manuals, instructions and SOP. 02.02 Follow telephone/telecommunication procedures. 02.03 Communicate clearly. 02.04 Prepare brief reports and checklist using standard forms. 02.05 Read/Interpret flowcharts and pictorial information. 02.06 Write memos and letters. 02.10 Prepare reports and instructions. 02.11 Convey information and ideas to people. 03.01 Apply cultural requirement to the workplace. 03.02 Demonstrate integrity and apply practical practices. 03.03 Accept responsibility for own work and work area. 03.04 Seek and act constructively upon feedback about work performance. 03.05 Demonstrate safety skills. 03.06 Respond appropriately to people and situations. 03.07 Resolve interpersonal conflicts. 03.08 Develop and maintain a cooperation within work group. 03.09 Manage and improve performance of individuals. 03.10 Provide consultations and counselling. 03.11 Monitor and evaluate performance of human resources. 03.12 Provide coaching/on-the-job training. 03.13 Develop and maintain team harmony and resolve conflicts. 03.14 Facilitate and coordinate teams and ideas. 03.15 Liaise to achieve identified outcomes. 03.16 Identify and assess client/customer needs. 03.17 Identify staff training needs and facilitate access to training. 04.01 Organise own work activities.	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Multitasking and prioritising 5. Self-discipline 6. Teamwork 7. Learning skills 8. Leadership skills

04.02 Set and revise own objectives and goals. 04.03 Organise and maintain own workplace. 04.04 Apply problem solving strategies. 04.05 Demonstrate initiative and flexibility. 04.06 Allocate work. 04.07 Negotiate acceptance and support for objectives and strategies. 05.01 Implement project/work plans. 05.02 Inspect and monitor work done and/or in progress. 06.01 Understand systems. 06.02 Comply with and follow chain of command. 06.03 Identify and highlight problems. 06.04 Adapt competencies to new situations/systems.	

Tools, Equipment and Materials (TEM)

ITEMS	RATIO (TEM : Trainees)
1. Stationery	1:1
2. Organisation chart	1:1
3. Project timeline and schedule	1:1
4. Attendance record	1:1
5. Appraisal form	1:1
6. Subordinates' performance report	1:1
7. Materials, tools and device movement record	1:1
8. Tools and device master list	1:1
9. Tools and device calibration schedule	1:1
10. Daily progress report format	1:1
11. Computer	1:5
12. Printer	1:10
13. Occupational Safety and Health Act (OSHA)	1:1
14. Standard Operating Procedure (SOP) sample	1:1

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SUMMARY OF TRAINING DURATION FOR FIBRE OPTIC INSTALLATION & MAINTENANCE - TELECOMMUNICATION

NO. ID	COMPETENCY UNIT TITLE	WORK ACTIVITIES	RELATED KNOWLEDGE (A)	RELATED SKILLS (B)	HOURS (A) + (B)	TOTAL (HRS)
1	FIBRE OPTIC CABLE NETWORK PROJECT PRE INSTALLATION	Interpret fibre optic cable network installation job order	6	13	19	**180**
		Conduct site survey	22	50	72	
		Apply authority and service provider way leave	10	24	34	
		Prepare installation material requisition	14	32	46	
		Report fibre optic cable network project pre installation activities to superior	3	6	9	
2	FIBRE OPTIC CABLE NETWORK OUTSIDE PLANT (OSP) INSTALLATION	Arrange fibre optic cable network Outside Plant (OSP) installation resources	14	32	46	**450**
		Barricade working area	12	30	42	
		Inspect duct way availability for underground installation	22	48	70	
		Perform underground installation cable pulling	46	110	156	
		Perform overhead installation fibre optic cable pulling	40	96	136	
3	FIBRE OPTIC CABLE NETWORK INSIDE PLANT (ISP) INSTALLATION	Arrange fibre optic cable network Inside Plant (ISP) installation resources	10	24	34	**270**
		Barricade working area	10	24	34	
		Inspect cable trunking and tray availability	24	56	80	
		Perform fibre optic cable pulling	36	86	122	
4	FIBRE OPTIC CABLE NETWORK JOINTING	Arrange fibre optic cable network jointing resources	8	18	26	**270**
		Barricade working area	12	28	40	
		Set fibre optic cable for jointing	24	58	82	
		Perform fibre optic cable splicing	36	86	122	
5	FIBRE OPTIC CABLE NETWORK TESTING & COMMISSIONING	Prepare testing instrument	12	28	40	**270**
		Perform cable loss test	18	44	62	
		Perform end to end test	20	46	66	
		Perform Insertion Loss (IL) and Optical Return Loss (ORL) bi-directional test	18	44	62	
		Report fibre optic testing activities to superior	4	8	12	
		Perform fibre optic installation commissioning	8	20	28	
6	FIBRE OPTIC CABLE NETWORK MAINTENANCE	Arrange fibre optic cable network maintenance resources	10	24	34	**180**
		Perform fibre optic cable preventive maintenance	12	26	38	
		Perform fibre optic cable corrective maintenance	28	64	92	
		Report fibre optic maintenance activities to superior	4	12	16	
7	FIBRE OPTIC CABLE NETWORK INSTALLATION & MAINTENANCE SUPERVISION	Monitor fibre optic installation work progress	14	32	46	**180**
		Monitor safe working environment practices by subordinate	14	32	46	
		Monitor subordinates' performance	8	20	28	
		Control materials, tools and instrument movement	10	26	36	

		Prepare daily progress report	8	16	24	
TOTAL HOURS (Core Competencies)			537	1263	1800	**1800**
TOTAL HOURS (+ Elective Competency)			537	1263	1800	**1800**