****

**REPUBLIC OF KENYA**

**COMPETENCY BASED MODULAR CURRICULUM**

**FOR**

**PLUMBING**

**KNQF LEVEL 3**

**PROGRAMME ISCED CODE**: **0732 254 A**

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**FOREWORD**

The provision of quality education and training is fundamental to the Government’s overall strategy for social and economic development. Quality education and training contribute to the achievement of Kenya’s development blueprint and sustainable development goals.

Reforms in the education sector are necessary to achieve Kenya Vision 2030 and meet the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution, and this resulted in the formulation of the Policy Framework for Reforming Education and Training in Kenya (Sessional Paper No. 14 of 2012). A key feature of this policy is the radical change in the design and delivery of TVET training. This policy document requires that training in TVET be competency-based, curriculum development be industry-led, certification be based on demonstration of competence, and the mode of delivery allow for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that this curriculum has been developed. For trainees to build their skills on foundational hands-on activities of the occupation, units of learning are grouped in modules. This has eliminated duplication of content and streamlined exemptions based on skills acquired as a trainee progresses in the up-skilling process, while at the same time allowing trainees to be employable in the shortest time possible through the acquisition of part qualifications.

It is my conviction that this curriculum will play a great role in developing competent human resources for the construction Sector’s growth and development.

**PRINCIPAL SECRETARY**

**STATE DEPARTMENT FOR TVET**

**MINISTRY OF EDUCATION**

**PREFACE**

Kenya Vision 2030 aims to transform Kenya into a newly industrializing middle-income country, providing high-quality life to all its citizens by the year 2030. Kenya intends to create globally competitive and adaptive human resource base to meet the requirements of a rapidly industrializing economy through lifelong education and training. TVET has a responsibility to facilitate the process of inculcating knowledge, skills, and worker behaviour necessary for catapulting the nation to a globally competitive country, hence the paradigm shift to embrace Competency-Based Education and Training (CBET).

TVET Act, CAP 210A and Sessional Paper No. 1 of 2019 on Reforming Education and Training in Kenya for Sustainable Development emphasized the need to reform curriculum development, assessment, and certification. This called for a shift to CBET to address the mismatch between skills acquired through training and skills needed by industry, as well as increase the global competitiveness of the Kenyan labour force.

This curriculum has been developed in adherence to the Kenya National Qualifications Framework and CBETA standards and guidelines. The curriculum is designed and organized into Units of Learning with Learning Outcomes, suggested delivery methods, learning resources, and methods of assessing the trainee’s achievement. In addition, the units of learning have been grouped in modules to concretize the skills acquisition process and streamline upskilling.

I am grateful to all expert trainers and everyone who played a role in translating the Occupational Standards into this competency-based modular curriculum.

**ACKNOWLEDGMENT**

This curriculum has been designed for competency-based training and has independent units of learning that allow the trainee flexibility in entry and exit. In developing the curriculum, significant involvement and support were received from expert trainers, institutions and organizations.

I recognize with appreciation the role of the Construction National Sector Skills Committee (NSSC) in ensuring that competencies required by the industry are addressed in the curriculum. I also thank all stakeholders in the Construction sector for their valuable input and everyone who participated in developing this curriculum.

I am convinced that this curriculum will go a long way in ensuring that individuals aspiring to work in the Construction Sector acquire competencies to perform their work more efficiently and effectively.

**COUNCIL SECRETARY/CEO**

**QAI**

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# ABBREVIATIONS AND ACRONYMS

PPE Personal Protective Equipment

CCTV Closed-Circuit Television (surveillance)

BS British Standards

ICT Information Computer Technology

IEE International Electrical Engineering

BQS Bill of Quantities

CAD Computer Aided Design

CGA County Government Approvals

DTP Desktop Publishing

EHS Environment, health and safety

EMS Environmental Management System

IFCE The International Federation of Consulting Engineers

HRD Human Resources Development

ICT Information Computer Technology

JBC Joint building council

KCSE Kenya Certificate of Secondary Education

KEBS Kenya Bureau of Standards

KNQA Kenya National Qualification Authority

NCA National Construction Authority

NEMA National Environment Management Authority

NOS National Occupational Standards

PPE Personal Protective Equipment

QA Quality Assurance

QC Quality Control

TES Teach Elite’s Shop

TVET Technical and vocational education and training

BRC British reinforcement concrete

ASTM American society for testing and materials

PPR Polypropylene pipes

DPM Damp proof membrane

DPC Damp proof course

IEE Institute of electrical engineers

GI Galvanized iron

PTFE Thread seal

# KEY TO ISCED UNIT CODE



# COURSE OVERVIEW

Plumbing Level 3 qualification consists of competencies that an individual must have to perform plumbing works. It includes installation of domestic water supply, sanitary appliances and domestic drainage systems.

**Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit of Learning Code** | **Unit of Learning Title** | **Duration**  **in**  **Hours** | **Credit Factor** |
| 0732 251 01A | Water supply system I | 100 | 10.0 |
| 0732 251 02A | Sanitary appliance installation I | 100 | 10.0 |
| 0732 251 03A | Drainage system installation I | 100 | 10.0 |
|  | Industrial Attachment | 240 | 24.0 |
| **Total** | | **540** | **54.0** |
| **GRAND TOTAL** |  | **540** | **54.0** |

**Entry Requirements**

An individual entering this course should have any of the following minimum requirements:

1. Kenya Certificate of Primary Education (KCPE)

**Or**

1. Equivalent qualifications as determined by TVETA.

**Trainer Qualification**

Qualifications of a trainer for this course include:

1. Possession of at least higher diploma in water of plumbing or in related trade area;
2. License by TVETA; and

**Industry Training**

An individual enrolled in this course will be required to undergo Industry training for a minimum period of 240 hours in plumbing sector. The industrial training may be taken after completion of all units for those pursuing the full qualification or be distributed equally in each unit for those pursuing part qualification. In the case of dual training model, industrial training shall be as guided by the dual training policy.

**Assessment**

The course shall be assessed formatively and summatively:

1. During formative assessment all performance criteria shall be assessed based on performance criteria weighting.
2. Number of formative assessments shall minimally be equal to the number of elements in a unit of competency
3. Assessment of basic and common competencies shall be integrated in the core units
4. Theoretical assessment shall be integrated in practical assessment and conducted orally in both formative and summative assessments.
5. Theoretical and practical weight shall be 10:90 respectively for each unit of learning.
6. Formative and summative assessments shall be weighted at 60% and 40% respectively in the overall unit of learning score
7. Assessment performance rating for each unit of competency shall be as follows:

|  |  |
| --- | --- |
| **MARKS** | **COMPETENCE RATING** |
| 80 -100 | Attained Mastery |
| 65 - 79 | Proficient |
| 50 - 64 | Competent |
| 49 and below | Not Yet Competent |
| Y | Assessment Malpractice/irregularities |

Assessment for Recognition of Prior Learning (RPL) may lead to award of part and/or full qualification.

**Certification**

A candidate will be issued with a Certificate of Competency upon demonstration of competence in a core Unit of Competency. To be issued with Kenya National TVET Certificate in Plumbing Level 3, the candidate must demonstrate competence in all the Units of Competency as given in the qualification pack. A Statement of Attainment certificate may be issued upon demonstration of competence in certifiable element within a unit.

These certificates will be issued by QAI

# UNITS OF LEARNING

## WATER SUPPLY SYSTEMS I

**ISCED UNIT CODE: 0732 251 01A**

**Duration: 100 hours**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: **Install Water Supply System I.**

**UNIT DESCRIPTION**

This unit specifies the competencies required to install water supply system. It involves preparing pipe installation materials, performing domestic pipework and maintaining domestic pipework. It applies in the construction industry.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| S/No | **Learning Outcomes** | **Duration (Hours)** |
|  | Prepare and quantify pipe installation materials | 10 |
|  | Sketch simple plumbing drawing and symbols | 25 |
|  | Perform domestic pipework | 50 |
|  | Maintain domestic pipework | 15 |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Prepare and quantify pipe installation materials | * 1. Safety Measures      1. Safe handling of plumbing tools and equipment      2. Personal protective equipment      3. Workshop SOP’s, rules and regulations.   2. Pipe installation materials      1. Pipes         1. PPR-Polypropylene random pipes         2. HDPE-High density polyethylene pipes         3. Galvanized iron (G.I) pipes         4. Chlorinated polyvinyl chloride (CPVC)         5. Unplasticized polyvinyl chloride (UPVC)      2. Caulking supplies      3. Various types of pipe support      4. Sandpapers      5. Threading oil      6. Thread tape   3. Preparation of pipes      1. Pipe bending      2. Cold bending      3. Heat bending      4. Pipe cutting      5. Pipe jointing      6. Pipe threading      7. Pipe welding   4. Quantify Materials and supplies      1. Measurements      2. Fittings      3. Supplies      4. Material Schedule      5. Estimation and costing | * Practical * Projects * Observation * Portfolio of evidence * Written assessment * Oral assessment |
| 1. Sketch simple plumbing drawing and symbols | 1. Working drawings    * 1. Pictorial      2. Line drawing      3. Freehand sketching   Scale drawings   * 1. Interpretation ofworking pipework drawings   2. Measurements and Symbols      1. Isometric pipework drawings      2. Interpret working drawings. | * Practical * Projects * Observation * Portfolio of evidence * Written assessment * Oral assessment |
| 1. Perform domestic pipework | * 1. Assemble Piping tools and equipment      1. Pipe wrench      2. Pipe cutter      3. Hacksaw      4. Pipe threading machine      5. diestock      6. Pipe vice      7. Files      8. Screwdrivers      9. Drill with various sizes of bits      10. Mallet      11. Ballpein hammer      12. Cold chisel      13. PPR welding machine / Heat Fusion      14. Pipe bender      15. Pipes layout.      16. Terms and concepts      17. Setting out of the pipes   2. Setting out of pipe lay out based on working drawings   3. Pipes mounted based on drawing specifications   4. Installation of Storage and auxiliary fittings.      1. Tanks      2. Cisterns,      3. Hot water storage      4. Tee      5. Unions      6. Elbows      7. Adapters      8. Nipples      9. Valves      10. Tank connectors   5. Pipework functionality tests      1. Water test      2. Air test      3. Pressure test   6. Housekeeping | * Practical * Projects * Observation * Portfolio of evidence * Written assessment * Oral assessment |
| 4 Maintain domestic pipework | * 1. Pipework repair materials.      1. Epoxy Putty      2. Pipe Repair Tape (e.g., silicone tape)      3. Repair Clamps (metal or stainless steel)      4. Slip Couplings or Repair Couplings      5. PVC or CPVC Cement and Primer      6. Pipe Patch Kits      7. Replacement Fittings and Sealants   2. SOP’s for pipework maintenance.   3. Tools and equipment assembling      1. Pipe Cutter      2. Adjustable Wrench      3. Pipe Wrench      4. Tubing Cutter      5. Hacksaw      6. Pipe Reamer/Deburring Tool      7. Plumber’s Tape (Thread Seal Tape)      8. Propane Torch      9. Screwdrivers      10. Pliers      11. Measuring Tape      12. Plumber’s Snake or Auger      13. Safety Gear (gloves, goggles, masks)   4. Pipework faults repair   5. Housekeeping | * Practical * Projects * Observation * Portfolio of evidence * Written assessment * Oral assessment |

**Suggested Methods of Delivery**

* Practical
* Direct Instruction
* Discussion
* Demonstration
* Trade projects
* Site visits

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **s/no.** | **Category** | **Resource Description/ Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
|  | **Training Materials** | Plumbing Principles and Practices Textbooks/online | 25 | 1:1 |
|  | Domestic Water Supply Installation Guides/online | 25 | 1:1 |
|  | Technical Manuals (manufacturer’s guides) | 25 | 1:1 |
|  | Plumbing Level 3 Workbooks | 25 | 1:1 |
|  | Sample Blueprints for Water Supply Layout | 25 | 1:1 |
|  | Learning facilities and Infrastructure | Theory room (10m\*8m) | 1 | 1:25 |
|  | Workshop (18m\*12m) | 1 | 1:25 |
|  | **Tools** | Pipe Cutter and Tubing Cutter | 25 | 1:1 |
|  | Adjustable Wrench and Pipe Wrench | 25 | 1:1 |
|  | Deburring Tool | 25 | 1:1 |
|  | Screwdrivers and Pliers Set | 25 | 1:1 |
|  | Measuring Tape | 25 | 1:1 |
|  | Pipe Reamer | 25 | 1:1 |
|  | Hacksaw | 25 | 1:1 |
|  | Mallet | 25 | 1:1 |
|  | Ballpein hammer | 25 | 1:1 |
|  | Cold chisel | 25 | 1:1 |
|  | Diestock | 5 | 1:5 |
|  | Pipe vice | 5 | 1:5 |
|  | **Equipment** | Pipe Bending Machine | 5 | 1:5 |
|  | Pressure Testing Kit | 5 | 1:5 |
|  | Water Pump Model | 1 | 1:25 (demonstration only) |
|  | Pipe threading machine | 5 | 1:5 |
|  | Drill with various sizes of bits | 5 | 1:5 |
|  | PPR welding machine / Heat Fusion/ Propane Torch (for supervised use) | 5 | 1:5 |
|  | **Materials** | PVC, PEX, Copper, Galvanized Steel Pipes | 25 pieces | 1:1 |
|  | Fittings (Elbows, Tees, Reducers, Couplings, Tank connectors) | 25 pieces | 1:1 |
|  | Valves (Gate, Ball, Check) | 25 pieces | 1:1 |
|  | Thread Seal Tape and Pipe Joint Compound | 25 pieces | 1:1 |
|  | Pipe Insulation Material | 25 pieces | 1:1 |
|  | **PPE’s** | Gloves, Goggles, Ear Protection, Masks | 25 pieces | 1:1 |

## SANITARY APPLIANCES INSTALLATION I

**ISCED UNIT CODE: 0732 251 02A**

**UNIT DURATION:** 100Hours

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Install Sanitary Appliances I.

**UNIT DESCRIPTION**

This unit specifies the competencies required to install sanitary appliances. It involves preparing materials for sanitary appliances, sketching simple sanitary appliances drawings and symbols, fixing sanitary appliances and maintaining sanitary appliances. It applies in the construction industry.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| S/No | **Learning Outcomes** | **Duration (Hours)** |
|  | Prepare materials for sanitary appliances | 15 |
|  | Sketch simple sanitary appliances drawing and symbols | 10 |
|  | Fix sanitary appliances | 50 |
|  | Maintain sanitary appliances | 25 |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Prepare materials for sanitary appliances | * 1. Safety Measures      1. Hardhat/ Helmet      2. Safety gloves      3. Dustcoat / overall      4. Safety shoes / boots      5. Safety goggles/ face mask.   2. Sanitary appliances installation materials/accessories      1. Screws      2. Adhesives      3. Cement      4. Sand      5. Pipes      6. Traps      7. Caulking material      8. Pipe fittings      9. Magic bends   3. Selection of Sanitary appliances      1. Wash hand basin      2. Water closet      3. Bath tub      4. Urinal      5. Kitchen sink      6. Shower head      7. Faucets   4. Assembly of Sanitary appliances | * Practical * Projects * Observation * Portfolio of evidence * Written assessment * Oral assessment |
| 1. Sketch simple sanitary appliances drawings and symbols.   . | * 1. Working drawings      1. Pictorial      2. Line drawing      3. Freehand sketching      4. Scale drawings   2. Working sanitary drawings interpreted as per work requirements Symbols   3. Measurements and symbols of sanitary drawings interpretedas per work requirements. | * Practical * Projects * Observation * Portfolio of evidence * Written assessment   Oral assessment |
| 1. Fix sanitary appliances | * 1. Sanitary appliances installation tools and equipment      1. Adjustable Wrench      2. Pipe Wrench      3. Basin Wrench      4. Screwdrivers (Flathead and Phillips)      5. Hacksaw      6. Pipe Cutter      7. Plumber’s Tape (Thread Seal Tape)      8. Silicone Sealant and Caulking Gun      9. Plumber’s Putty      10. Tape Measure      11. Spirit Level      12. Drill and Drill Bits      13. Hole Saw Kit      14. Bucket and Sponge      15. Pliers      16. Teflon Tape      17. Allen Keys (Hex Wrench Set)      18. Rubber Mallet      19. Ball hammer      20. Pipe Bender (for copper pipes)   2. Setting out Sanitary appliances      1. Positioning      2. Marking   3. Install Sanitary appliances      1. Mount Sanitary appliances      2. Connecting the Water Supply to Drainage Connection      3. Sealing   4. Functionality tests for Sanitary appliances      1. Water Supply Check      2. Flush Test (Toilets and Urinals)      3. Drainage Test (Sinks, Basins, and Showers)      4. Leak Test      5. Water Pressure Test      6. Temperature Control Check (if applicable)      7. Overflow Prevention Test (for sinks and tubs) | * Practical * Projects * Observation * Portfolio of evidence * Written assessment * Oral assessment |
| 1. Maintain sanitary appliances | * 1. Types of Sanitary appliances repair materials      1. Plumber's Putty      2. Silicone Sealant      3. Thread Seal Tape (Teflon Tape)      4. Replacement Washers and O-rings      5. Screws and Bolts      6. Pipes (PVC, PEX, Copper)      7. Fittings (Elbows, Tees, Couplings)      8. Valves (Ball, Gate, Check)      9. Flexible Water Supply Hoses      10. Drain Cleaning Chemicals or Solutions      11. Wax Rings (for toilets)      12. Replacement Parts for Faucets and Fixtures      13. Pipe Insulation Material      14. Adapters and Connectors      15. Duct Tape (for temporary fixes)      16. Plumber’s Snake (Auger)      17. Drain Clog Remover (enzyme-based or chemical)      18. Toilet Auger/plunger (for clearing toilet clogs)   2. SOP’s for sanitary appliances maintenance.   3. Types of Tools and equipment **to** Maintain sanitary appliances      1. Adjustable Wrench      2. Pipe Wrench      3. Basin Wrench      4. Screwdrivers (Flathead and Phillips)      5. Hacksaw      6. Pipe Cutter      7. Plumber's Snake (Auger)      8. Toilet Auger/plunger      9. Drill and Drill Bits      10. Measuring Tape      11. Duct Tape      12. Silicone Caulking Gun      13. Pliers      14. Level      15. Bucket      16. Drain Cleaning Chemicals      17. Safety Gear (gloves, goggles)   4. Repair of sanitary appliances faults      1. Leaking Faucet      2. Clogged Sink or Drain      3. Running Toilet      4. Low Water Pressure      5. Weak Flush or Clogged Toilet      6. Broken or Cracked Sink      7. Faulty Water Heater      8. Leak at Joints or Connections      9. Slow Draining Bathtub or Shower      10. Faulty Showerhead (leaking or low flow)      11. Overflowing Urinal      12. Bad odours from Drains      13. Corroded Pipes or Fittings      14. Non-functioning Bidet      15. Incorrectly Mounted Fixtures   5. Housekeeping      1. Care and maintenance      2. Storage | * Practical * Projects * Observation * Portfolio of evidence * Written assessment * Oral assessment |

**Suggested Methods of Delivery**

* Practical
* Direct Instruction
* Discussion
* Demonstration
* Trade projects
* Site visits

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category** | **Resource Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
|  | Training Materials | Plumbing Principles and Practices Textbook/Online | 25 | 1:1 |
|  | Domestic Water Supply Installation Guide | 25 | 1:1 |
|  | Technical Manuals (manufacturer’s guides) | 25 | 1:1 |
|  | Plumbing Workbook | 25 | 1:1 |
|  | Sample Blueprints for Water Supply Layout | 25 | 1:1 |
|  | Learning facilities and Infrastructure | Theory room (10m\*8m) | 1 | 1:25 |
|  | Workshop (18m\*12m) | 1 | 1:25 |
|  | Tools | Pipe Cutter | 25 | 1:1 |
|  | Adjustable Wrench | 25 | 1:1 |
|  | Hacksaw | 25 | 1:1 |
|  | Basin Wrench | 25 | 1:1 |
|  | Screwdrivers Set (Flathead and Phillips) | 25 pieces | 1:1 |
|  | Measuring Tape | 25 | 1:1 |
|  | Plumber’s Snake (Auger) | 10 | 1:3 |
|  | Equipment | Pipe Bending Machine | 5 | 1:5 |
|  | PPR machine / Heat Fusion | 5 | 1:5 |
|  | Pressure Testing Kit | 5 | 1:5 |
|  | Drill with various sizes of bits | 5 | 1:5 |
|  | Sanitary appliances | Wash hand basin | 5 | 1:5 |
|  | Water closet | 5 | 1:5 |
|  | Bath tub | 5 | 1:5 |
|  | Urinal | 5 | 1:5 |
|  | Kitchen sink | 5 | 1:5 |
|  | Shower head | 5 | 1:5 |
|  | Materials | PVC, PEX, Copper Pipes | 25 pieces | 1:1 |
|  | Fittings (Elbows, Tees, Couplings) | 25 pieces | 1:1 |
|  | Valves (Gate, Ball, Check) | 25 pieces | 1:1 |
|  | Thread Seal Tape and Pipe Joint Compound | 25 | 1:1 |
|  | Pipe Insulation Material | 25 pieces | 1:1 |
|  | Screws (assorted) | sufficient | sufficient |
|  | Adhesives | sufficient | sufficient |
|  | Cement | sufficient | sufficient |
|  | Sand | sufficient | sufficient |
|  | Traps | sufficient | sufficient |
|  | Caulking material | sufficient | sufficient |
|  | Safety Gear | Gloves, Goggles, Ear Protection, Masks | 25 pieces | 1:1 |
|  | Equipment | Water Pump Model (demonstration use) | 1 | 1:25 (demonstration only) |

## DRAINAGE SYSTEM INSTALLATION I

**ISCED UNIT CODE: 0732 251 03A**

**UNIT DURATION:** 100 Hours

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: **Install drainage system I.**

**UNIT DESCRIPTION**

This unit specifies the competencies required by plumber to install domestic drainage systems. It involves Installing above ground drainage system, installing below ground drainage system, interpreting simple domestic drainage system drawings and maintaining drainage systems. It applies in the construction industry.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| S/No | **Learning Outcomes** | **Duration (Hours)** |
|  | Install above ground drainage system | 30 |
|  | Install below ground drainage system | 30 |
|  | Interpret simple domestic drainage system drawings | 20 |
|  | Maintaining drainage systems | 20 |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Install above ground drainage system | * 1. Safety Measures and Personal protective equipment      1. Hardhat/ Helmet      2. Safety gloves      3. Dustcoat / overall      4. Safety shoes / boots      5. Safety goggles/ face mask      6. Workshop SOP’s, rules and regulations.   2. Types of above ground drainage materials /accessories preparations      1. Waste pipes      2. Fittings      3. Bends      4. Tees      5. Couplings      6. Adapters      7. Cross tee      8. Pitcher tee      9. Inspection tee      10. Hangers and Supports      11. Pipe Hangers      12. Brackets      13. Clamps      14. Clips   1.2.2 Drainage Fixtures   * + 1. Sinks (Kitchen, Bathroom)     2. W/C pan     3. Cistern     4. Bathtubs     5. Showers     6. Floor Drains     7. Seals and Gaskets     8. Rubber Gaskets     9. Silicone Sealants     10. Gratings and Traps     11. Drain Grates     12. P-traps     13. Vent Pipes     14. Accessories     15. Cleanouts     16. Rodders   1. Types of Drainage tools and equipment      1. Hacksaw      2. Trowel      3. Tape measure      4. Spirit level/ laser level      5. Steel float      6. Wooden float      7. Drilling machine      8. Screw drivers      9. Power extension cable      10. Mason hammer      11. Builders square      12. Plumbing snake      13. Toilet plunger      14. Sump/water pump      15. Drainage Grates and Frames   2. Setting out drainage pipework      1. Positioning      2. Marking   3. Installation of drainage pipework.      1. Install hangers and supports      2. Cut pipes to length      3. Assemble pipe fittings      4. Fix pipes      5. Check alignment and slope      6. Seal joints and connections      7. Install drainage fixtures   4. Drainage systems functionality test      1. Visual Inspection      2. Water Flow Test      3. Pressure Test      4. Air Test      5. Backflow Test      6. Sump Pump Test      7. Drainage Fixture Test      8. Flow Rate Measurement      9. Check for Odors   5. Housekeeping      1. Care and maintenance      2. Storage | * Practical * Oral assessment * Observation * Portfolio of evidence * Written assessment |
| 1. Install below ground drainage system | * 1. Personal protective equipment      1. Hardhat/ Helmet      2. Safety gloves      3. Dustcoat / overall      4. Safety shoes / boots      5. Safety goggles/ face mask      6. Workshop SOP’s, rules and regulations.   2. Types of below ground drainage materials /accessories      1. Waste pipes      2. Fittings      3. Bends      4. Tees      5. Couplings      6. Adapters      7. Cross tee      8. Pitcher tee      9. Inspection tee      10. Hangers and Supports      11. Pipe Hangers      12. Brackets      13. Clamps      14. Clips      15. Drainage Fixtures   3. Types of drainage tools and equipment      1. Hacksaw      2. Trowel      3. Tape measure      4. Spirit level/ laser level      5. Steel float      6. Wooden float      7. Drilling machine      8. Screw drivers      9. Power extension cable      10. Mason hammer      11. Builders square      12. Plumbing snake      13. Toilet plunger      14. Sump/water pump      15. Drainage Grates and Frames   4. Preparation of Drainage trenches      1. Mark the Drainage Line      2. Excavate the Trench      3. Prepare the Trench Bottom      4. Setting out the drainage pipes   5. Installation of drainage pipework.      1. Set the Pipe      2. Install hangers and supports      3. Cut pipes to length      4. Assemble pipe fittings      5. Fix pipes      6. Check alignment and slope      7. Seal joints and connections      8. Install drainage fixtures   6. Construction of Drainage access points      1. Cleanouts      2. Inspection Chambers (Manholes)      3. Septic tanks      4. Bio digester      5. Access Wells      6. Catch Basins      7. Drains      8. Sump Pumps      9. Vent Pipes      10. Cleanout Fittings      11. Downspout Outlets      12. Traps   7. Drainage systems functionality tests      1. Visual Inspection      2. Water Flow Test      3. Pressure Test      4. Air Test      5. Backflow Test      6. Sump Pump Test      7. Drainage Fixture Test      8. Flow Rate Measurement      9. Check for Odors   8. Housekeeping      1. Care and maintenance      2. Storage | * Practical * Oral assessment * Observation * Portfolio of evidence * Written assessment |
| 1. Interpret ssimple domestic drainage system drawing | * 1. Working drawings      1. Pictorial      2. Line drawing      3. Freehand sketching      4. Scale drawings   2. Measurements   3. Symbols   4. Isometric pipework drawings   5. Interpreted working drawings. | * Practical * Oral assessment * Observation * Portfolio of evidence * Written assessment |
| 1. Maintain drainage systems | * 1. Domestic drainage repair materials      1. PVC Pipes and Fittings      2. PVC Cement      3. Plumber’s Putty      4. Teflon Tape      5. Rubber Gaskets and Washers      6. Drain Auger (Plumber’s Snake)      7. Liquid Drain Cleaner      8. Pipe Insulation (foam or rubber)      9. Replacement Grates and Covers      10. Repair Clamps and Sleeves      11. Silicone Caulk      12. Hand Tools (pipe wrench, pliers, screwdrivers, hacksaw)      13. SOP’s for drainage systems maintenance.   2. Notice for maintenance operations   3. Tools and equipment      1. Pipe Wrenches      2. Drain Auger (Plumber’s Snake)      3. Plumber's Plunger      4. Hacksaw      5. PVC Pipe Cutter      6. Channel Lock Pliers      7. Adjustable Wrench      8. Pipe Inspection Camera      9. Hand Trowel      10. Pipe Locator Tool      11. Shovel      12. Level      13. Drain Cleaning Machine (Electric Auger)      14. Heat Gun      15. Wet/Dry Vacuum      16. Measuring Tape      17. Safety Equipment (gloves, goggles, and mask)      18. Bucket      19. Teflon Tape      20. Pipe Sealant   4. Drainage pipework faults/ Blockages      1. Leaks      2. Corrosion      3. Root Intrusion      4. Pipe Misalignment      5. Bellied (Sagging) Pipes      6. Joint Failure      7. Cracks or Fractures      8. Backflow      9. Clogged Vent Pipes      10. Blockage      11. Pipe burst      12. Loss of trap seals   5. Housekeeping      1. Care and maintenance      2. Storage | * Practical * Oral assessment * Observation * Portfolio of evidence * Written assessment |

**Suggested Methods of Delivery**

* Practical
* Direct Instruction
* Discussion
* Demonstration
* Trade projects
* Site visit

**Recommended resources for 25 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category** | **Resource Description/Specifications** | **Quantity** | **Recommended Ratio (Item : Trainee)** |
|  | Training Materials | Plumbing Principles and Practices Textbook | 25 | 1 : 1 |
|  | Domestic Water Supply Installation Guide | 25 | 1 : 1 |
|  | Technical Manuals (manufacturer’s guides) | 25 | 1 : 1 |
|  | Plumbing Workbook | 25 | 1 : 1 |
|  | Sample Blueprints for Water Supply Layout | 25 | 1 : 1 |
|  | Learning facilities and Infrastructure | Theory room (10m\*8m) | 1 | 1:25 |
|  | Workshop (18m\*12m) | 1 | 1:25 |
|  | Tools | Pipe Cutter | 25 | 1 : 1 |
|  | Adjustable Wrench | 25 | 1 : 1 |
|  | Basin Wrench | 25 | 1 : 1 |
|  | Hacksaw | 25 | 1 : 1 |
|  | Trowel | 25 | 1 : 1 |
|  | Screwdrivers Set (Flathead and Phillips) | 25 pieces | 1 : 1 |
|  | Measuring Tape | 25 | 1 : 1 |
|  | Plumber’s Snake (Auger) | 10 | 1 : 3 |
|  | Spirit level | 25 | 1 : 1 |
|  | Steel/ Wooden float | 25 | 1 : 1 |
|  | Mason hammer | 25 | 1 : 1 |
|  | Drilling machine | 5 | 1:5 |
|  | Builders square | 25 | 1 : 1 |
|  | Power extension cable | 5 | 1 : 5 |
|  | Equipment | Pipe Bending Machine | 5 | 1 : 5 |
|  | Pressure Testing Kit | 5 | 1 : 5 |
|  | Drilling machine | 5 | 1 : 5 |
|  | Materials | PVC, PEX, Copper Pipes (1/2” and 3/4” diameter) | 25 pieces | 1 : 1 |
|  | Fittings (Elbows, Tees, Couplings) | 25 pieces | 1 : 1 |
|  | Valves (Gate, Ball, Check) | 25 pieces | 1 : 1 |
|  | Thread Seal Tape, adhesives and Pipe Joint Compound | 25 | 1 : 1 |
|  | Pipe Insulation Material | 25 pieces | 1 : 1 |
|  | Screws (assorted) | sufficient | sufficient |
|  | Adhesives | sufficient | sufficient |
|  | Cement | sufficient | sufficient |
|  | Sand | sufficient | sufficient |
|  | Traps | sufficient | sufficient |
|  | Caulking material | sufficient | sufficient |
|  | Wall plugs | 25 pieces | 1 : 1 |
|  | Clips | 25 pieces | 1 : 1 |
|  | PPE’s | Gloves, Goggles, Ear Protection, Masks, Safety shoes / boots | 25 pieces | 1 : 1 |
|  | Equipment | Water Pump Model (demonstration use) | 1 | 1 : 25 (demonstration only) |