



Republic of Rwanda
Ministry of Education



RTB | RWANDA
TVET BOARD

TIMBER AND POLES DRYING

WOTTD501

DRY TIMBER AND POLES

Competence

RQF Level: 5

Learning Hours



Credits: 7

Sector: Agriculture and Food Processing

Trade: Wood Technology

Module Type: Specific

Curriculum: AFPWOT5001- TVET Certificate 5 in Wood Technology

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Purpose statement	This module describes employable and practicable skills, knowledge and right attitudes required by the student to Select timber drying methods, prepare timber drying place, and perform timber drying. The contents provided in this course are packages reserved for a student pursuing TVET certificate V in wood technology. Graduates at this level will have knowledge and skills for work in a defined context and/or further Learning.					
Learning assumed to be in place	<ul style="list-style-type: none"> ● WOTMH301 -Operate wood working machine and use of hand tools ● WOTWP301-Demonstrate knowledge of basic wood properties ● WOTJC301- construct wood joints ● WOTKO401-Operate a wood kiln ● WOTRM301- construct wooden roof 					
Delivery modality	Training delivery		100%	Assessment		Total 100%
	Theoretical content		30%	Formative assessment		30%
	Practical work:		70%			50%
	● Group project and presentation	20%				
	● Individual project /Work	50%	Summative Assessment		50%	

Elements of Competence and Performance Criteria

Elements of competence	Performance criteria
1. Prepare timber and poles drying site	1.1. Weather conditions are properly assessed as per weather prediction
	1.2. Drying methods are correctly selected according to the weather conditions, timeline and financial cost
	1.3. Ground compactness is well assessed according to the type of soil, weight supported and environmental standards
	1.4. Drying site access points are correctly created according to the safety procedures
	1.5. Drying shed is well constructed according to the weather conditions
	1.6. Safety and health measures for timber and poles site are properly applied based on health instructions.
2. Apply drying techniques	2.1. Incoming timber and poles are properly received and graded as per quality standards
	2.2. Instruments and equipment for drying are well selected in accordance with timber and poles drying standards
	2.3. Runners, supporting beams & piling sticks are effectively prepared and set as per timber and poles dimensions
	2.4. Initial moisture content is properly checked as per timber and poles drying standards
	2.5. Stacks and bundles are well arranged and labeled according to dimensions / species
	2.6. Prevention of timber and poles Bowing defect for top layer is effectively conducted as per holding down weighting materials
	2.7. Drying process is properly operationalized as per timber and poles drying standards.
3. Monitor drying process	3.1. Regular check of moisture content /water movement is properly monitored as per timber and poles drying standards
	3.2. Drying factors and seasoning defects are well inspected as per timber and poles drying standards
	3.3. Corrective measures against drying defects are effectively applied as per timber and poles drying standards
	3.4. The final moisture content is correctly determined as per timber and poles drying standards
	3.5. Dried timber and poles are attentively cooled down as per timber and poles drying standards
	3.6. Records of drying results are clearly maintained as per standard operating procedures
4. store dried timber and poles	4.1. Dried timber and poles are effectively offloaded accordingly as per standard operating procedures
	4.2. Timber and poles splits are effectively prevented by fixing plate according to the quality standard
	4.3. Stacking of dried timber and poles is properly conducted according to their quality and storage facility
	4.4. Dried timber and poles are properly stored and labeled according to quality and

Knowledge, Skills, and Attitude

Knowledge	Skills	Attitude
<ul style="list-style-type: none"> ✓ Demonstrate arithmetic, algebra, geometry ✓ Perform basics of first aid ✓ Identify basic properties of wood ✓ Memorize basics of building and construction skills ✓ Provide basics of maintenance ✓ Implement basics of physics ✓ Implement basics of environmental protection ✓ Use wood working tools ✓ Operate woodworking machines 	<ul style="list-style-type: none"> ✓ Apply assembling/disassembling ✓ Apply communication skills ✓ Apply computer skills ✓ Apply precised cutting skills ✓ Apply design skills ✓ Apply operation monitoring skills ✓ Apply quality control analysis skills ✓ Apply time management skills ✓ Apply leadership skills ✓ Apply networking skills 	<ul style="list-style-type: none"> ✓ Maintain accountability ✓ Adapt to every situation ✓ Pay attention to details ✓ Ensure cooperativeness ✓ Present integrity ✓ Ensure flexibility ✓ Implement ethics ✓ Have creativity ✓ Be proactive ✓ Initiate new idea ✓ Implement reliability ✓ Be self-control ✓ Manage stress ✓ Ensure environmental friendly. ✓ Apply communication skills ✓ Have decision making

Course content

Learning outcomes

At the end of the module the learner will be able to:

1. Prepare timber and poles drying site
2. Apply drying techniques
3. Monitor drying process
4. Store dried timber and poles

Learning outcome 1: Prepare timber and poles drying site

Learning hours: 15

Indicative content

● Assessing weather conditions

- ✓ Environmental factors
- ✓ Interpretation of basic meteorological data

● Selection of drying method

- ✓ Air (natural) drying
 - ✚ Advantages of air drying
 - ✚ Disadvantages of air drying
- ✓ Kiln (artificial) drying
 - ✚ Advantages of kiln drying
 - ✚ Disadvantages of kiln drying

● Selection of timber and poles drying site

- ✓ Accessibility
- ✓ Types of soil
- ✓ Topography
 - ✚ Drainage
 - ✚ Soil slopes and levelness

- ✓ Ground compactness

- **Construction of drying shed**

- ✓ Creation of drying site access point
- ✓ Factors influencing the construction of drying shed
 - ✚ Location
 - ✚ Size
 - ✚ Airflow
 - ✚ Stacking pattern
 - ✚ Orientation
 - ✚ Drying time
- ✓ Interpretation of shed design
- ✓ Selection of tools, materials and equipment
- ✓ Shed construction procedures

- **Health and safety measures during timber and poles drying**

- ✓ Safety measures
- ✓ Hazards in timber and poles drying
- ✓ Risk control measures associated with timber and poles drying

resources required for the learning outcome

Equipment	Safety equipment, compactor, chain saw,theodolite
Materials	Pallets, spacers, plastic sheets, fencing , fuel, baseline
Tools	Wheel barrow, Tape measure, Machete, Axe, Steel tape, Pegs, Hoe, Shovels, Map, spade, pick axe, spirit level, hosepipe,

Facilitation techniques	<ul style="list-style-type: none"> ● The teacher presents different techniques of preparing timber and poles drying site to students ● The teacher forms inclusive and manageable groups ● The teacher asks the respective groups to discuss on the factors to consider while preparing drying site ● The students are tasked to assess weather and environment conditions for timber and poles drying ● The teacher demonstrates shed construction procedures ● The students are tasked to construct sheds based on the design ● The teacher provided assistance to the groups ● The teacher asks each group to present their work and he/she provides feedback to close the session. ● The students are tasked to clean the site, dispose the waste and take back tools, materials and equipment to the workshop ● The teacher collects feedback from groups and provide the expert view
Formative assessment methods/(CAT)	Written assessment, Performance assessment

Learning outcome 2: Apply drying techniques	Learning hours: 30
Indicative content	
<ul style="list-style-type: none"> ● Receiving and grading incoming timber and poles for drying <ul style="list-style-type: none"> ✓ Preparation of the timber yard ✓ Factors considered during sorting and grading for timbers and poles <ul style="list-style-type: none"> ✚ Timber defects ✚ Source ✚ Species ✚ Moisture content level ✚ Appearance ✚ Sizes ✓ Timber grading standards ● Selection of instrument and equipment <ul style="list-style-type: none"> ✓ Instrument <ul style="list-style-type: none"> ✚ Moisture meter 	

- ✚ Hygrometers

- ✚ Dry bulb Thermometer

- ✓ Drying Equipment

- **Preparation of runners, supporting beams and piling sticks**

- ✓ Factors to consider during preparation of runners, supporting beams and piling sticks

- ✚ Standard height of runners from the ground level

- ✚ Dimension of timber and poles

- ✚ Moisture content of timber and poles

- ✓ Factors affecting the strength of supporting beam

- ✓ Criteria considered for preparing runners and supporting beams

- **Checking the initial moisture content**

- ✓ Moisture content types on timber and poles

- ✚ Free water

- ✚ Bound water

- ✓ Factors influence the acceptance of wood moisture content

- ✚ The wood's final use.

- ✚ The average relative humidity

- ✓ Methods of initial moisture content measurement

- ✚ Moisture Meter Testing

- ✚ Oven Dry Testing

- **Stacking timber, bundling poles and labeling stacks and bundles**

- ✓ Stacking and bundling methods

- ✚ Horizontal

- ✚ Vertical

- ✓ Timber and poles stacking standards

- ✚ Maximum height

- ✚ Width

- ✚ Pathways

- ✓ Criteria of labeling stacks and bundles

- **Operating timber and poles kiln drying process**

- ✓ Heating

- ✓ Humidity control
- ✓ Cooling
- ✓ Conditioning

Resources required for the indicative content

Equipment	Chain saw, Safety equipment, Moisture meter and accessories like Moisture meter pin, Moisture meter batteries, Kiln, Weighing Scale, Forklift
Materials	Field data recording sheet, Chalk, Marker, Labels
Tools	Hand saw, Hydrometer, Tape measure, Ladder, moisture meter, Ratchet struck
Facilitation techniques	<ul style="list-style-type: none"> ● The teacher presents different drying techniques ● The teacher checks the availability of the materials used during drying process ● The teacher asks students to join they remain groups used in previous session ● Students are tasked to select tools, instrument and equipment to be use ● Students are tasked to checking the initial moisture content ● Students are tasked to stack timber by respecting stack dimensions ● Teacher guides students to the process of labeling the stacks and bundles ● Teacher assists and provide necessary support to students while performing their tasks ● The students are tasked to clean the site, dispose the waste and take back tools, materials and equipment to the workshop ● Teacher collects feedback from groups and provide the expert view
Formative assessment methods/(CAT)	Written assessment, Performance assessment

Learning outcome 3: Monitor drying process	Learning hours: 15
Indicative content	
<ul style="list-style-type: none"> ● Regular checking of moisture content and water movement <ul style="list-style-type: none"> ✓ Moisture content range ✓ Drying rate ✓ Environment condition ● Factors affecting drying and seasoning defects 	

- ✓ Identification of seasoning/drying defects
- ✓ Factors that affecting the drying time of timber and poles
- ✓ Corrective measures against drying defects
- **Determining the final moisture content**
- **Process of cooling down dried timber and poles**
 - ✓ Gradual cooling
 - ✓ Continuous monitoring of temperature
- **Maintaining drying process records**
 - ✓ Key elements of drying records
 - ✚ Drying method
 - ✚ Initial moisture content
 - ✚ Final moisture content
 - ✚ Timber and poles seasoning defects
 - ✚ Drying duration
 - ✚ Specifications of dried timber and poles
 - ✓ Drying records filing




Resources required for the indicative content

Equipment	Computer, Weighing Scale, Moisture meter
Materials	Papers, Pens, Moisture meter pin,
Tools	Operation software, Flash disk, Stapler, fixing tools, Setting out tools, field data recording sheet
Facilitation techniques	<ul style="list-style-type: none"> ● Teacher ensures the monitoring of drying process ● Teacher asks students to join the remain groups used in previous session ● Students are tasked to inspecting the factors affecting drying and seasoning defects ● Students are tasked to applying the corrective measures against drying defects ● Students asked to maintaining records of drying results ● Teacher assists and provide necessary support to students while performing their tasks ● The students are tasked to clean the site, dispose the waste and take back tools, materials and equipment to the workshop ● Teacher collects feedback from groups and provide the expert view

Formative assessment methods/(CAT)	Written assessment, Performance assessment

Learning outcome 4: Store dried timber and poles	Learning hours: 10
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Indicative content

- **Method of Offloading dried timber and poles**
 - ✓ Manual handling
 - ✓ Mechanical handling
- **Storing of dried timber and poles**
 - ✓ Characteristics of good storage for dried timber and poles
 - ✓ Methods used to store dried timber and poles
 -  Bundling
 -  Shelving
 -  Hanging

Resources required for the indicative content

Equipment	Logger machines, Safety equipment, Forklift
Materials	Supporting beams, Pilings sticks/spacers, Nails, Binding wires, Screws Bolts & nuts, Ropes
Tools	Tape measure, Try square, crew driver, Ladder

Facilitation techniques	<ul style="list-style-type: none"> ● The teacher presents different methods of Offloading dried timber and poles to students ● The teacher asks students to join remain groups used in previous session ● Students are tasked to store dried timber or poles ● Teacher assists and provide necessary support to students while performing their tasks ● The students are tasked to clean the site, dispose the waste and take back tools, materials and equipment to the workshop ● Teacher collects feedback from groups and provide the expert view
Formative assessment methods/(CAT)	Written assessment, Performance assessment

Integrated/Summative assessment (For specific module)

Integrated situation

In NYAMAGABE District, there is a project of making student’s desks from timber. This project will be implemented by Nyamagabe ICPC, by using timbers sawn in Nyungwe buffer zone. With the aim of producing high quality furniture, the ICPC will first of all dry timbers, using possible methods depending available resources. However, the management of AGAKIRIRO, has conducted an investigation among workers, and found that there is a gap of lacking a person who can perform timber drying operations. So, the ICPC, calls you to be tested in order to perform timber drying of 20 timbers, and once you succeed, you will be hired as a permanent employee. The following information will help you in your test: The needed timber must have moisture content of 13%. Drying site is located in KITABI sector, where high rainfall occurs the needed timbers must be free from drying defects. The tools and equipment’s are available in NYAMAGABE ICPC

You’ve been assigned the following tasks:

- Prepare timber drying site
- Apply drying techniques
- Monitor drying process

Task must be accomplished in 8 hours

Notice: this integrated situation will be adapted in reference with available resources

Resources

Tools	hammer, Pencil, Spirit level, Tape measure, try square, marking knives, Saws, Hand drills, chisels, rollers, drying racks and curing facilities, Putty knives, Scrapers, Sanding blocks.
Equipment	Stickers, spacers, racks, shelves, straps or ropes, pest control equipment, forklifts or pallet jerks, moisture meter, Camera or Smart phone, GPS Receiver, Weighing Scale, Digital Calipers, Laser Distance Meter, Measuring Wheel
Materials/ Consumables	Timber, Screws, paper, nails, timber, hoe, Brushes, notebook

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
1.Prepare timber and poles drying site (30%)	1.1. Selection of drying method	Drying method are selected			2
	1.2. Assessing weather conditions	Environment factors are assessed			2
		Economic factors are assessed			2
	1.3. Assessing ground compaction	Leveling of ground are assessed			2
		Tools, equipment and materials are well assessed based on compaction method			2
	1.4. Constructing drying shed	Accessibilities are considered			2
		Shed size are measured			2
		Environment are controlled			2
	1.5. Creating drying site access point	Locations are considered			2
		Safety and environment are considered			2

		Grading and drainage are considered			1
	1.6. Applying Health and safety measures for timber and poles drying	Health and safety measures are applied			3
		Ways of disposing waste are applied			3
		Tools and equipment are gathered after their use			3
2. Apply drying techniques (45%)	2.1. Receiving and grading incoming timber and poles for drying	Strength are tasted			3
		Dimensions are checked			3
		Grading standards are considered			3
	2.2. Selection of instrument and equipment	Instrument are selected			3
		Equipment are selected based on drying techniques			3
	2.3. Preparation of rising blocks, supporting beams and piling sticks	Supporting beam and sticks are prepared			5
		Sticks dimensions are considered			5
	2.4 Checking of initial moisture content	Initial moisture content is checked			5
	2.5 Stacking timber, bundling poles and labeling stacks and bundles	Timbers are stacked			5
		Stacks are labeling			5
Stacks dimensions are taken				5	
3. Monitor drying process (25%)	3.1 Regular checking of moisture content and water movement	Initial moisture content and water movement are checked			5
	3.2 Factors affecting drying and seasoning defects	Internal factors are inspected			5
		External factors are inspected			5
		Drying rate are inspected			5
		Methods of preventing drying defect are applied			5
Total marks					100
Percentage Weightage					100%
Minimum Passing line % (Aggregate): 70%					

References

- Elustondo, D., & Avramidis, S. (2005). Industrial evaluation of re-dry strategy for softwood lumber. *Maderas. Ciencia y tecnología*, 7(2), 65-78.
- Hillis, W. E. (1984). High temperature and chemical effects on wood stability: Part 1: General considerations. *Wood Science and Technology*, 18(4), 281-293.
- Kern, S., Halwachs, M., Kampichler, G., Pfeifer, C., Pröll, T., & Hofbauer, H. (2012). Rotary kiln pyrolysis of straw and fermentation residues in a 3 MW pilot plant—Influence of pyrolysis temperature on pyrolysis product performance. *Journal of Analytical and Applied Pyrolysis*, 97, 1-10
- Kim, M. H., Jeong, I. T., Park, S. B., & Kim, J. W. (2019). Analysis of environmental impact of activated carbon production from wood waste. *Environmental Engineering Research*, 24(1), 117-126
- Kumar, S., & Kishankumar, V. S. (2016). Thermal energy storage for a solar wood drying kiln: estimation of energy requirement. *Journal of the Indian Academy of Wood Science*, 13, 33-37.
- Millar, S., & Western Dry Kiln Association. (2004). Problems in kiln drying treated shakes and shingles.
- Rice, R. W., & Shepard, R. K. (1993). Moisture content variation in white pine lumber dried at seven northeastern mills. *Forest products journal*, 43(11, 12), 77.
- Simpson, W. T. (1983). Drying wood: a review-part II. *Drying technology*, 2(3), 353-368.
- Simpson, W. T., & Wang, X. (2001). RELATIONSHIP BETWEEN LONGITUDINAL STRESS WAVE TRANSIT TIME AND MOISTURE CONTENT OF LUMBER DURING KILN-DRYING. *Forest Products Journal*, 51(10).
- Solo-Gabriele, H., & Townsend, T. (1999). Disposal practices and management alternatives for CCA treated wood waste. *Waste management & research*, 17(5), 378-389.