

# **Agricultural Machinery and Equipment Operation**

## **Level II**



**Based on March 2022, Version II Occupational  
Standard**

**Module Title: - Operating Walking Tractor**

**LG Code: AGR AMO2 M03 LO (1-6) LG (12-17)**

**TTLM Code: AGR AMO2 TTLM 0523v1**

**May, 2023**

**Addis Ababa, Ethiopia**

## Table of Contents

Introduction to the Module .....	1
LO#1- Identify systems, components and controls of walking tractor .....	2
Instruction sheet 1 .....	2
Information Sheet 1 .....	3
Self-check 1 .....	10
LO #2- Prepare walking tractor for operation.....	11
Instruction sheet 2 .....	11
Information Sheet 2 .....	12
Self-check 2 .....	20
Operation sheet 2 .....	22
Lap test 2.....	24
LO #3- Operate walking tractor .....	25
Instruction sheet 3 .....	25
Information Sheet 3 .....	27
Self-check 3 .....	55
Operation sheet 3 .....	58
Lap test-3 .....	62
LO #4- Select, fit and remove attachments.....	63
Instruction sheet 4 .....	63
Information Sheet 4 .....	64
Self-check 4 .....	84
Operation Sheet -4.....	86
Lap test-4 .....	98
LO #5- Undertake agricultural work using walking tractor.....	99
Instruction sheet 5 .....	99
Information Sheet 5 .....	101
Self-check 5 .....	121
Operation Sheet -5.....	123
Lap test-5 .....	129

LO #6- Complete walking tractor operation .....	130
Instruction sheet 6 .....	130
Information Sheet 6 .....	132
Self-check 6 .....	140
Operation Sheet -6.....	142
Lap test-6 .....	145
Reference Material .....	146

## Introduction to the Module

The two-wheel tractor or power tiller or walking tractor is a single axle (a tractor with one axle), self-powered and self-propelled tractor, which can pull and power various farm implements such as a trailer, cultivator or harrow, water pump, harvester, thresher, a plough and planters. The direction of travel and its control for field operation is performed by the operator walking behind it or sitting on a seat of the implement hitched to it.

Page 1 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

**LG#12**

## **LO#1- Identify systems, components and controls of walking tractor**

### **Instruction sheet 1**

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Introduction to the module
- Following workplace information sources regarding walking tractor driving and operations
- Identifying systems, components and their functions
- Performing operational requirements of walking tractor controls and functions

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Follow workplace information sources regarding walking tractor driving and operations
- Identify systems, components and their functions
- Perform operational requirements of tractor controls and functions

### **Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks

Page 2 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

## Information Sheet 1

### 1.1. Workplace information sources regarding walking tractor driving and operations

#### 1.1.1 Information Needs

Information about regulatory issues, industry trends and your competition is crucial to the development of your small business. Begin by identifying your business's information needs. Then, seek out good information sources. By using them properly, you can prevent legal problems and identify new opportunities for your small business.

Before searching for information sources, identify the information that you need. During your workday, keep a record of the types of information you use to perform your job and the topics of any Internet searches that you perform. Survey your employees about their information needs, and ask them how they find their information. You will likely identify several areas in which your business relies on your ability to develop accurate sources of information.

#### 1.1.2 Types of workplace information

- Verbal or written and graphical instructions, signage, work schedules/plans/specifications, work bulletins, memos, Material Safety Data Sheets (MSDS), diagrams and sketches
- Safe work procedures related to inspection, servicing and maintenance of battery storage system
- Regulatory/legislative requirements pertaining to farm machinery industry, including International design rules
- Engineer's design specifications and instructions
- Organization work specifications and requirements
- Instructions issued by authorized enterprise or external persons
- International and National standards
- Fault reporting and may include site specific instructions, written instructions, plans or instructions related to job/task, telephones and pagers

Page 3 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

## 1.2. Identifying systems, components and their functions

### 1.2.1 Main components of walking tractor and uses

**Engine:** The engine is the heart of an automobile. It is a device that converts the chemical energy of fuel into mechanical energy which is used to drive the vehicle ... Engine is the source of power. All the power tillers are fitted with an I.C. engine. At present, most of the power tillers are fitted with diesel engine.

**Main Clutch system:** Power goes from the engine to the main clutch.

Clutch can be of following two types:

- (a) Friction clutch or
- (b) V-belt tension clutch

Friction clutch is generally used for bigger power tiller. Usually it is a dry type multiple disc clutch. V-belt tension clutch is used for small power tillers.

The main functions of clutch in a power tiller are:

- (i) To transmit engine power to transmission gears and
- (ii) To make power transmission gradual and smooth

**Transmission gears system:** Transmission box consists of gears, shafts and bearings. The main clutch is a lever on the handle. The lever can be shifted to on or off position while operating in the field. When the lever is shifted to on position, the power from the engine is transmitted through the main clutch to the various parts of the power tiller. When the lever is shifted to off position the power from the engine is cut-off from the rest of the transmission

**Steering clutch:** The tractor has two steering clutch levers mounted under the handles. Depressing the clutch lever will limit power transmitted to the wheel on the same side. So, steering the tractor to the left will require pressing of the left clutch lever. Depressing both levers at the same time will stop the tractor.

**Brake:** All power tillers have some braking arrangement for stopping the movement. Most of the power tillers use inner side expansion type brake.

Page 4 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

**Rotary Unit:** Power tiller has a rotary unit for field operation.

**Rotary unit is of two types:**

- i. Centre drive type (transmission at the center)
- ii. Side drive type (transmission at one side)

**Wheel:** The component to move as well as cultivate the land to be plowed.

**Handle knob:** Used to manually control tractor

**Clutch lever:** Engages and disengages power transmission

**Accelerator:** Controls flow rate of fuel into combustion chamber

**Muffler (silencer):** Reduces the noise emitted by the exhaust of the internal combustion engine.

**Engine:** Converts fuel into motion so tractor can move

**Tension pulley:** Drives the tractor belt system.

**Bumper:** Absorbs impact of a minor collision

**Support stand:** To balance the tractor when not in use

**Tires:** Provides traction

**Air cleaner:** Removes solid particles from the air that goes to the engine

**Decompression lever:** Eases the start of the internal combustion engine

**Cranking handle:** Converts circular motion to reciprocating motion.

**Gear lever:** Used to change gears

**Handbrake:** When pulled, resists tractor from getting into motion

**Ignition:** Makes the tractor run smoothly

**Fuel tank:** Safe container for the flammable fuel

**Water tank:** Stores water

Page 5 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



### Different names of walking tractor:

- Power tiller
- Hand tractor
- Two wheel tractor
- “walk-behind tractor
- Iron-ox
- walking tractor
- Mechanical ox
- Ox-machine
- Pedestrian tractor
- Single-axle tractor
- In Asia, tut-tut

#### 1.2.2. Types of walking tractor

**1) Mini Tiller Type:** The mini tiller type is the smallest two-wheeled tractor. This type has a fairly simple component, which are various types of rotary blades mounted on the tractor drive shaft. The rotary knife is used to replace the tractor wheel.

In addition, the mini tiller type has a drag-stake that is attached to the rear hook-up point of the machine. In general, this type is used for gardening in the yard and is rarely used for professional farming purposes.

**2) Traction Type:** The second type is the traction type. Traction type two-wheeled tractors are used for pulling plowshares or as a transportation of other agricultural tools. Compared to the mini tiller, the traction type machine has a larger capacity, which is 4 to 6 PS. Traction type two-wheeled tractors do not have a rotary soil cultivator so they are often referred to as power cultivators.

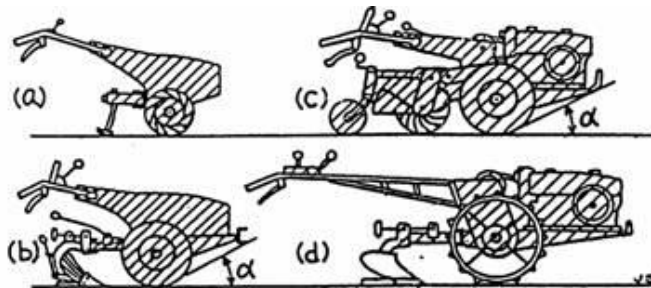
**3) Motion Type:** The third type of two-wheeled tractors is the motion type. In contrast to the traction type which does not have a rotary device, the motion type is equipped with a rotary soil

Page 6 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

processing device. A motorized two-wheeled tractor will cultivate the soil and mechanically transmit the tractor's power to the farm equipment installed behind it.

**4) Thai Type:** Unlike the previous type, the Thai type is a two-wheeled tractor that has a simple structure by relying on a diesel motor and water cooling. The installed control rod is longer and heavier than the traction type tractor. The power generated by the Thai type is much greater

a. Mini tiller type,    b. Traction type,    c. Motion type,    d. Thai type



**Figure1:2: Types of walking tractor**

**Source:** [https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcTubFma-W2-](https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcTubFma-W2-2iCrcXK7Z_x9WVltXh8cVrNPg&usqp=CAU)

[2iCrcXK7Z\\_x9WVltXh8cVrNPg&usqp=CAU](https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcTubFma-W2-2iCrcXK7Z_x9WVltXh8cVrNPg&usqp=CAU) Figure

### 1.3. Operational requirements of tractor controls and functions

#### 1.3.1. Walking tractor control parts

These are about how to run the system. Logging, startup/shutdown controls, monitoring, resource consumption, back up, availability

#### 1. Fuel Valve

The fuel valve opens and closes the connection between the fuel in the tank and the carburettor. The fuel valve must always be ON for the engine to keep running. After using the hand tractor, turn the fuel valve to the OFF position.

Page 7 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

## 2. Choke Lever

The choke lever is responsible for opening and closing the choke valve on the carburettor. When the choke lever is completed, you can start the engine when it is cold. Conversely, when the choke lever is open, you can start the engine again when it is already warm. When you begin the hand tractor for the first time, the choke lever must be in the closed position. Meanwhile, if the engine is already warm, it can move the choke lever to the open position.

## 3. Engine Switch

The engine switch component is responsible for controlling the ignition system. If the switch is in the OFF position, the engine is stopped. Conversely, when the engine switch is in the ON position, the machine is in the operating place.

## 4. Starter Handle

The starters handle functions to operate the recoil starter to crank the engine. Ensure this component is always in optimal condition, especially when using the hand tractor. If the starter handle has problems, the engine will be difficult to start.

## 5. Throttle Lever

The engine speed will control using the throttle lever. Each throttle lever movement will make the engine speed faster or slower. The rate itself is managed by adjusting the throttle. The tiller component will rotate at the highest speed at the full throttle position. The engine speed will decrease when you move the throttle lever to the idle place.

## 6. Main Clutch Lever

The clutch lever component is responsible for pressing and releasing the tiller's transmission. Therefore, the performance of the clutch lever will affect the throttle lever. If the clutch is inoperable, it cannot control the engine speed according to the needs

Page 8 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

## **7. Transmission Lever**

The transmission lever works to adjust the speed and torque of the hand tractor engine. Its primary function is to convert the engine rotation into the wheel rotation needed to perform agricultural work. This transmission lever has several positions: neutral, forward, reverse, and speed controller. When operating the hand tractor, you must adjust the transmission lever according to your needs. For example, when planting, the transmission lever must be in the neutral position, while when pulling agricultural equipment, the transmission lever must be in the forward position.

## **8. Hitch Bar/Resistance Bar**

This hitch bar component works to control the depth when tilling the soil. This component can make it easier for you to overcome challenging soil conditions. The height of the hitch bar depends on the type of soil till. Generally, the hitch bar must be adjusted to the tiller and slightly tilted towards the back.

## **9. Hitch Box**

The hitch box on the hand tractor functions as a place to connect the agricultural equipment. This component is part of the tractor system that pulls agricultural equipment such as plows, cultivators, or trailers. You can also use the hitch box component to change the direction of the tractor's movement so that it can perform various agricultural tasks. Proper use of the hitch box can make the tractor more efficient, especially in completing agricultural work and increasing farmers' productivity.

**10. Clutch:** The pedal on the left is the clutch

**11. Brakes:** Two of the pedals on the right are the brakes

**12. Throttle:** The pedal furthest to the right is the foot throttle

Page 9 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

Self-check 1	Written test
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Name..... ID.....Date.....

Time started: \_\_\_\_\_ Time finished: \_\_\_\_\_

**Directions: Answer all the questions listed below**

**Test I: Choose the best answer (2 point)**

- 1) Which one of the following is source of power in operating walking tractor
  - a) Steering clutch
  - b) Engine
  - c) Brake
  - d) Transmission gears
- 2) From the following which one is not control function of walking tractor?
  - a) Clutch
  - b) brakes
  - c) fuel valve
  - d) Throttle Lever
  - e) none
3. One of the following is not part of two wheel tractor
  - a) Ignition
  - b) Fuel tank
  - c) Water tank
  - d) weed
- 4) Part of walking tractor used for stopping movement
  - a) Brake
  - b) Rotary Unit
  - c) Steering clutch
  - d) all
- 5) Which one is used to drives the tractor belt system
  - a) Air cleaner
  - b) Engine
  - c) Tires
  - d) Tension pulley

**Test II: short answer questions**

- 1) Write important of workplace information
- 2) List types of two wheel/walking tractors
- 3) List and discuss tractor control parts and their function
- 4) Explain types and function of Main Clutch system
- 5) List types of workplace information

Page 10 of 153	Ministry of Labor and Skills	Agricultural Machinery and Equipment Operation	Version 1
	Author/Copyright	Level -II	May, 2023

**LG #13**

**LO #2- Prepare walking tractor for operation**

**Instruction sheet 2**

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Occupational Health and Safety (OHS) hazards
- Using, maintaining and storing suitable Personal Protective Equipment
- Compliance documentation relevant to conducting tractor operations
- Conducting routine checks of tractors
- Checking tractor controls and functions for serviceability and reporting any faults
- Working instructions and safety requirements

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Identify occupational Health and Safety (OHS) hazards
- Use, maintain and store suitable PPE
- Interpret Compliance documentation relevant to conducting tractor operations
- Conduct routine checks of tractors
- Check tractor controls and functions for serviceability and reporting any faults
- Confirm work instructions and safety requirements

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

Page 11 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

## Information Sheet 2

### 2.1. Occupational health and safety (OHS) hazards

#### 2.1.1. Types of OHS hazards

- Sharp cutting tooling and instruments
- Torn or improper use personal protective equipment
- Worn out repair tools
- Servicing while engine is running
- Working under machines not secured
- Unprotected moveable parts
- Electricity and water and toxic substances,
- Damaged packing material or containers,
- Broken or damaged equipment,
- Flammable materials and fire hazards,
- Lifting practices,
- Stumps and logs in the soil or covered by debris
- Spillages, waste and debris especially on floors
- Uneven/ unstable terrain, trees,
- Overhead and underground power lines,
- Bridges, buildings, excavations, traffic, embankments

#### 2.1.2. Effect of (OHS) hazards



The consequences of workplace hazards could be trauma, even posttraumatic stress disorder (PTSD), loss of dignity, anxiety, depression, suicide attempt, and decreased self-esteem, lack of trust in people, premature aging, losing autonomy, injuries, absenteeism, and physical and musculoskeletal injuries

Page 12 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

## 2.2. Using, maintaining and storing suitable personal protective equipment




Personal protective equipment, commonly referred to as "PPE", is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards.

**Table 1.1: Personal protective equipment**

No	Name of PPE	By picture	Uses
1	Earmuffs or plugs		Earmuffs are clothing accessories or personal protective equipment designed to cover a person's ears for hearing protection or warmth.
2	Goggles/ Eye glass		It is a close-fitting protective glass with side shields. It protects eye from dust particles, fumes and harmful chemicals. Safety glasses should be worn during spraying chemicals.





2	Apron/overall		It is a loose-fitting garment worn over ordinary clothes. It can have long or short sleeves. It is used to protect skin against harmful substances such as pesticides.
3	Hardhats		Hard hats must be worn by electricians, construction workers, and any other workers when there is a danger of objects falling from above.
4	Masks and respirators		It is an apparatus worn over the face to cover the nostrils. It used to prevent the inhalation of dust. It can also protect against dust. It has a filter so when worn on face you are able to breathe clean air.

5	Gloves		Gloves- Are covering for hands. There are separate parts for each finger and thumb. Gloves are necessary to protect the skin from exposure to toxic materials
6	Foot wears		The PPE that covers the feet, ankles and the lower legs. It is water proof that is the feet are protected from getting wet. Checks should be taken to be ensuring there are no holes in them. The feet are also protected when using sharp tools.
7	Fire extinguishers		Fire extinguishers apply an agent that will cool burning heat, smother fuel or remove oxygen so the fire cannot continue to burn.

## **2.3. Compliance documentation relevant to conducting tractor operations**

### **2.3.1. Meaning and important of compliance documentation**

means and include any documentation required to determine that the Interconnecting Customer is in compliance with requirements of the Tariff, including the applications, exhibits and agreements attached thereto, and such documentation includes, as applicable: final as-built one-line diagrams, photos, witness test results, local wiring inspection approval, completed Certificate of Completion, certified relay test results, printout of inverter settings, insurance certificates, P-rate agreement, Exhibit H (retail customer agreement), landowner agreement, easements for system modifications, and, if the Facility is net metering, a completed Schedule Z, a net metering cap allocation from the System of Assurance, and, for a Facility that is included in the public net metering cap, certification from the Department that the Host Customer and all off-takers qualify as a municipality or other governmental entity.

### **2.3.2. Types of compliance documentation include:**

- Legislative, organisation and site requirements and procedures
- Manufacturer's guidelines and specifications
- Codes of practice
- Employment and workplace relations legislation

## **2.4. Conducting routine checks of walking tractors**

### **2.4.1. Walking tractor Daily Inspection Pre Checklist**

- Engine oil
- Coolant level
- Fuel level
- Hydraulic fluid level
- Tires and wheels.
- Batteries. Securely held down. Connections are clean.
- Electrolyte level.

Page 16 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

- Tracks and rollers
- Rear hitch
- Oil level and condition
- Fan belts
- Glass and mirrors
- Start lever
- Supply lever

## **2.5. Checking tractor controls and functions for serviceability and reporting any faults**

### **What is checked during an equipment inspection?**

Heavy equipment inspections combine data collection and analysis with hands-on testing and examination for a thorough look at the equipment's condition. A complete inspection is an important preventive way to make sure equipment is safe for use and that all systems are working properly.

### **What do inspectors look for?**

Heavy equipment inspectors check all the components of a piece of equipment, emphasizing safety. A technician can not only test for safety, but can also consider ways to increase equipment productivity and efficiency. Once you're certain of safety, it is up to you what you want to accomplish with your equipment. Our inspections are tailored to meet your specific needs. In general, equipment inspectors will check the following components using both diagnostic tools and an expert eye:

Page 17 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

### **2.5.1 Walking tractor control checklist:**

- Fuel Valve
- Choke Lever
- Engine Switch
- Starter Handle
- Throttle Lever
- Main Clutch Lever
- Transmission Lever
- Hydraulic system
- Steering system
- Hitch Bar/Resistance Bar
- Hitch Box
- Clutch
- Brakes
- Throttle

## **2.6. Work instructions and safety requirements**

Read and understand the owner's manual and labels affixed to the product. Learn its application and limitations as well as the specific potential hazards. Retain these instructions for future reference. The operator is responsible for following the warnings & instructions in this manual and on the product.

### **2.6.1. General safety instructions**

- Stay alert
- Users
- Inspect your machine
- Dressing properly
- Avoiding electrical shock

Page 18 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

- Always switching the machine off
- Electrical safety
- Keeping bystanders and children away
- Do not overreach
- Avoiding injury from unexpected accident
- Do not force tool
- Never leaving machine running unattended
- Inspecting
- Maintaining your machine with care
- Protecting the environment
- Storing idle equipment

### **Safety requirements**

- Protective clothing and equipment, use of tools and equipment, workplace environment and safety, handling of materials, use of fire fighting equipment, use of First Aid equipment, hazard control and hazardous materials and substances
- Safe operating procedures to recognise hazards and prevent risks associated with underground and overhead power lines, other machines, personnel, restricted access barriers, traffic control, working at heights, working in proximity to others, worksite visitors and the public
- Emergency procedures, including: emergency shutdown and stopping, extinguishing fires, organisational First Aid requirements and evacuation

Page 19 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

Self-check 2	Written test
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Name..... ID.....Date.....

Time started: \_\_\_\_\_ Time finished: \_\_\_\_\_

**Directions: Answer all the questions listed below**

**Test I: Choose the best answer (2 point)**

- 1) The types of PPE use to covering hands
  - a) Masks and respirators
  - b) Hardhats
  - c) Gloves
  - d) Foot wears
- 2) From the following which one are tractor operation Safety requirements
  - a) Protective clothing and equipment
  - b) Safe operating procedures
  - c) Safely shutdown and stopping
  - d) None
3. One of the following is types of compliance documentation?
  - a) Manufacturer's guidelines and specifications
  - b) Employment and workplace relations legislation
  - c) Codes of practice
  - d) All
- 4) Which one of the following are OHS hazards?
  - a) Unprotected moveable parts
  - b) Damaged packing material
  - c) Broken or damaged equipment
  - d) All

Page 20 of 153	Ministry of Labor and Skills	Agricultural Machinery and Equipment Operation	Version 1
	Author/Copyright	Level -II	May, 2023

5) What tractor control which operator check

- a) Fuel Valve                      c) Throttle Lever
- b) Engine Switch                d) Main Clutch Lever

### Test II: Short Answer Questions

- 1) Write the consequences of workplace hazards
- 2) Write Meaning and important of Compliance Documentation
- 3) What is checked during an equipment inspection?
- 4) Write two wheel tractor operation Safety requirements
- 5) Write uses of Fire extinguishers

Page 21 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



## Operation sheet 2

### 2.1 Techniques/Methods of using PPE properly

#### A. Tools and equipment

- Goggles/ Eye glass
- Earmuffs or plugs
- Apron/overall
- Hardhats
- Masks and respirators
- Foot wears
- Gloves
- Tool box

#### B. Techniques/Methods

- Wear all PPE
- Ask participants to list the safety precautions needed which are essential while operating walking tractor.
- Ask participants to demonstrate how to protect themselves while operating equipment safely.
- Ask participants to observe safety posters
- Ask participants to list the safety measures they need to adopt to avoid injury while operating
- Use questions and answers to determine comprehension.
- Summarize the session by emphasizing on the need to develop the habit of safety from the start, and never want to work without them. Also, to properly use and care.

Page 22 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

## **2.2 Techniques/Methods of applying safety precaution working with walking tractor**

### **A. Tools and equipment**

- PPE
- Tool box
- Safety posters
- PC/TV or LCD for video show
- Common maintenance tools and equipment

### **B. Techniques/Methods**

- Explain that the session's objective is to improve awareness of safe work practices while using walking tractor and its ancillary equipment on farm and on road.
- Ask the participants to state/identify and make oral presentation on the most dangerous jobs in Ethiopia.
- What will happen to your family and your lifestyle if you get injured and can't work? What will you lose if you get injured?
- Sources of hazards in walking tractor (starting, handling and using hand tools, portable power tools and machines).
- Safe work practices pertaining to tools and equipment.
- Basic safety rules in working with walking tractor.
- Summarize the session by emphasizing on the need to follow basic safety rules and develop the habit of using safety equipment from the start, and never want to work without them.

Page 23 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

Lap test 2	Performance test
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Name..... ID..... Date.....

Time started: \_\_\_\_\_ Time finished: \_\_\_\_\_

**Instructions:** Given necessary templates, tools and materials you are required to perform the following tasks within 5 hour. The project is expected from each student to do it.

Task-1 Use PPE and properly

Task-2 Apply safety precaution in working with walking tractor

Page 24 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

**LG #14**

**LO #3- Operate walking tractor**

**Instruction sheet 3**

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics

- Operating principles and operating methods
- Recognizing and avoiding risks to self, others and the environment
- Pre-start, start-up, park and shutdown procedures
- Demonstrating correct use of clutch
- Smooth efficient gear changing and gear selection
- Operating walking tractor according to low risk operating procedure
- Effects of adverse weather, soil and difficult terrain conditions on tractor operation
- Operating walking tractor with attached implement and trailer
- Parking tractor safely
- Environmental impacts associated with tractor operation

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Operating principles and operating methods
- Recognize and avoid risks to self, others and the environment
- Carry out Pre-start, start-up, park and shutdown procedures
- Demonstrate correct use of clutch
- Demonstrate Smooth efficient gear changing and gear selection
- Operate walking tractor according to low risk operating procedure
- Safely operate tractors in adverse weather, soil and difficult terrain conditions
- Operate tractor with attached implement and trailer

Page 25 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

- Park tractor safely
- Minimize environmental impacts associated with tractor operation

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5. Perform Operation Sheets
6. Do the “LAP test”

Page 26 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

## Information Sheet 3

### 3.1. Operating principles and operating methods

#### 3.1.1 Operating method of Walking Tractor

Walking Tractor operation requires skill to operate. Without proper training, operation of two-wheel tractor might be dangerous and will expose the user to an unnecessary injury. Thus, it is very important to know how to operate a Walking Tractor before attempting to do so. Before starting a Walking Tractor there are certain things to be checked. The following are the mandatory checks before starting the engine of the Walking Tractor

#### General principle of operating the walking tractor

- Operating the unit only on stable ground or footing to avoid potential slips and falls.
- Ability to safety features such as auto-clutches and shut-off switches, and do not secure levers and switches in the “on” position to simulate operator presence.
- Do not leaving the unit running unattended.
- Inspecting the area where the equipment will be used, and remove all stones, sticks, wires, or other debris.
- Keeping the hands and feet away from moving parts.
- Working slowly when tilling and avoid forcing the unit through the soil.
- Using the attachments only as they were designed to be operated.
- Awareness of bystanders in the event of thrown objects and keep a safe distance.
- Operating the equipment when fatigued or under the influence of drugs or alcohol impossible.
- Operating the equipment only with adequate visibility and light.
- Approach/operate a two-wheel tractor with loose clothing/scarf not recommended
- Taking special care near the running engine / turning belts
- Taking special care that feet do not slip from footrests/steering peddles into the rotavator’s blades.

Page 27 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

**If you not sure, do not apply the following events**

- Engaging the clutch from a starting position with one of the steering clutches disengaged.
- Driving the two-wheel tractor up or down a steep slope at high speed.
- “Coast” down a hill with clutch / gears disengaged (freewheeling).
- Disengaging two both steering clutches at the same time
- Driving the two -wheel tractor at high speed on a rough road (gears 4-6).
- Attempting to start the tractor from dead stop in gears higher than # 3.
- Driving across a steep slope
- Go down steep slopes in reverse to avoid tipping forward
- If not sure that the brake is appropriately always adjusted in good working order.

**3.2. Recognizing and avoiding risks to self, others and the environment**

**Safe starting and stopping**

Once you’re in the driving position and before you start the tractor, adjust the seat so that all controls can be operated comfortably and safely. Then:

- Start the tractor from the driving position and not from the ground
- Do not step down from a moving tractor
- Ensure the park brake is on and operating effectively before exiting
- Do not park a tractor on a steep slope
- Remove the starting key when the tractor is not in use.

**Operation procedure**

To recognize and avoid risks to self, others and the environment, we have to be applying the safety precaution, before you drive the tractor for the first time, read the manufacturer’s operating instructions and complete the necessary specialist training. If it’s been a while since you’ve driven the tractor, refreshes your knowledge.

- Using handlebar adjuster to set handlebar height
- Holding the handlebar and pull up the clutch lever.

Page 28 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

- Depressing the OPC lever and select the correct working speed using the gear lever.
- Ensure forward/reverse lever is in the correct position to move forward
- If the handlebars are positioned over the engine then this lever should be in the fully back position.
- If the handlebars are positioned over the implement then it should be in the fully forward position.
- Engaging drive to the working implement by using the PTO lever
- If the handlebars are positioned over the engine then pull the PTO lever towards you.
- If the handlebars are positioned over the implement then push the PTO lever away from you.
- Releasing clutch lever slowly and fully, keeping the red machine stop lever depressed as the machine will stop if released.
- Moving the throttle lever to the correct position for the implement you are operating - please refer to the Implement Manual.

### 3.3. Pre-start, start-up, park and shutdown procedures

#### 3.3.1. Pre-Start procedure

Option to start walking tractor

- Using starter battery/key
- Using mechanical crank handle/manually (the crank handle is supplied with the two-wheel tractor maintenance kit)

#### The following should be done before starting

- Using the dipstick provided, check the engine oil level. Top up with 10w/40 oil if necessary.
- Check water level and top up if necessary.
- Check fuel level. Only use diesel from a clean container. Never re-fuel when the engine is hot or running.

Page 29 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



- Check position of the fuel cut off valve and open if closed.
- Ensure the gear lever is in neutral position and the power take-off (PTO) lever is disengaged.
- Set throttle level to the start position.

### **Starting by Hand Crank**

- Connecting battery or turn on magneto.
- Transmission in neutral
- Secondly, making sure to put your tractor in neutral so when the tractor starts it cannot run you over
- Keeping clutch held in
- Turn the Key on.
- Safely Cranking the Tractor

### **3.3.2. Starting (startup) procedure**

Before operating your reversible two-wheel tractor read carefully and commits to memory the instructions given in the general safety precautions paragraph at the beginning of this manual.

### **Starting the engine**

See the engine Operating and Maintenance manual for all information regarding the engine.

- Disengage all control levers before starting the engine
- Open the fuel cock.
- Position the small starter lever.
  - The position of the starter, for starting with a cold engine, is shown on the appropriate plate.
  - When starting with a hot engine, the starter lever must be kept in in-gear position.
- Press down the engine stop lever
- Pull clutch lever fully up.

Page 30 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

- f. Lock the clutch lever in down position with locking device
- g. Turn throttle lever for 1/4 turn.
- h. Grip the pull-rope handle and pull firmly and quickly. When the engine starts, allow the rope to wind back onto the reel slowly.
- i. Turn the throttle lever to idle position, and allow the engine to warm up.

### 3.3.3. Steering system

There is no circular steering wheel in a walking tractor, like in a vehicle (car). Instead, the levers/clutches/in the right and left handles act as a steering wheel.

- To turn to the left, the left lever should be pulled.
- To turn to the right, the right lever should be pulled.

**Directional Reference:** All reference to left, right, front, or rear are given from the operator's position, where the operator is positioned and facing the direction of forward travel.

**Note that:** the steering might be different in driving steep slope while attaching a trailer with a full load. Please take a great care while driving downhill



**Figure 3:1 walking tractor steering clutch (left & right sides).**

Page 31 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

Source: <https://repository.cimmyt.org/xmlui/bitstream/handle/10883/22432/65930.pdf?sequence=1&isAllowed=y>

### 3.3.4. Forward driving

#### Forward driving:

- The gear was in the neutral position when the walking tractor is started, now you should select first or second gear depending on your desire.
- There are two options/low and high gear.
- To select high gear, pulling the lever upwards, for low gear push the lever down.
- Engaging the gear-shifting lever to 1st gear.
- Increasing the throttle gradually.
- Engaging the clutch/brake lever to its forward position.
- Now the walking tractor should start moving forward.
- If you want to shift the gear to 2nd, disengage the clutch/brake lever to its backward position and shift the gear to 2nd gear.

### 3.3.5. Reverse driving

With the help of tractor reverse drive controls, the workload of the driver can be eased significantly. According to a study, the reverse drive controls clearly decreased working postures where the back or the neck are twisted. The e faster turning also made the work more rapid when compared with mowing done in a normal forward with a tractor equipped with a front mower – trailed mowing machine combination with a corresponding operating width. The e faster working speed also means shorter exposure time. In reverse driving, a slightly wider operating width was achieved near the headland than in driving forward. By combining automatic steering with reverse drive, the operating width can be utilized even more efficiently. In reverse drive, there is slightly less body vibration than with the comparison work machinery. Th e benefi ts of the reverse drive controls are especially evident when working for a long stretches.

Page 32 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

### **3.4. Demonstrating corrects use of clutch**

#### **3.4.1 Symptoms of a Worn or Bad Clutch**

The most common symptom of a worn clutch is a slipping clutch during acceleration. You may also notice that the clutch pedal engages higher up than usual. You can also notice any strange clutch pedal behaviors like a stiff or soft pedal. Clutches wear out over time, and can be expensive to replace. Learn how to tell if your car's clutch is worn, and find out what it costs to replace a bad clutch.

- **Signs of a bad or worn clutch:**

- ✓ Slipping Clutch
- ✓ Clutch takes higher up than usually
- ✓ Clutch Feels Soft While Pressing
- ✓ Trouble Shifting Gears
- ✓ Noise When Pressing the Clutch
- ✓ Clutch Pedal Feels Stiff
- ✓ Clutch Pedal Stays on the Floor

### **3.5. Smooth efficient gear changing and gear selection**

#### **3.5.1. Gear shifting lever**

An agricultural tractor has gear selection levers including operating knobs for manual operation by a tractor driver seated on a seat. The levers are moveable forwards and backwards of the tractor to gear selection positions predefined by the gear selection mechanism of the tractor. In a narrow tractor, such as an orchard tractor, the driver space is limited and there is contention between the driver space and the path to be followed by the gear selection levers of the tractor. In order to avoid this contention, each gear selection lever is coupled, at the end remote from the hand operated end, to a control linkage in the form of an articulated link.

Page 33 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

### 3.5.2. Gear selection

When selecting a gear the workload and environment of the gear set should be considered. Power, velocity and torque consistency and output peaks of the gear drive so the gear meets mechanical requirements. Heavier gears can be harder to stop or reverse

Gears are rotating mechanical devices employing 'teeth' in order to transmit torque between separate axes. Two or more cooperating gears are called a transmission and can produce a mechanical advantage by changing speed, torque or rotation direction.

Gears use teeth, also called cogs, to engage and transmit rotational motion each other. One gear has the movement supplied to it by the turn of its shaft and is known as the drive. Interlocked teeth pressure the corresponding gear to turn in a ratio. If the drive turns a larger gear then torque is improved; if the drive turns a small gear, the rotational speed is increased. A gear does not necessarily always turn another gear, like in the instance of a rack.

## 3.6. Operating walking tractor according to low risk operating procedure

### 3.6.1 The way to reduce risk of tractor accidents

**i) Physically and mentally fit:** There are numerous human factors involved in fatal tractor-related accidents. Certain factors like poor judgment, poor attitude, insufficient knowledge or training, fatigue, haste, stress, depression, intoxication, or showing off can cause a fatal tractor overturn accident. Each operator should be physically and mentally fit when operating a tractor. An operator who is sleepy, tired or not feeling well may not be able to react in time to avoid an accident. Your tractor does what you make it do.

**ii) Properly trained:** A person who does not know how to operate a tractor safely in potentially hazardous situations can be injured or killed by exercising poor judgment. Make sure all persons permitted to operate tractors have been thoroughly trained. A good place to start training is with the operator's manual. Review the operator's manual, if possible with the tractor in front of you.

Page 34 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

**iii) Familiar with operator's manual:** Read and follow procedures as outlined in the operator's manual. By being familiar with the operating features of a tractor, the operator will develop confidence when the tractor is driven under adverse conditions. Learn the location and purpose of all of the gauges and controls as well as other indicators. Knowing where the controls are by memory can allow you to react more quickly in an emergency situation.

**iv) Using tractor for intended purposes:** The tractor has many uses around the farm, however, improper use can result in an accident. For example, using the tractor to round up the cattle is dangerous because the operator may encounter rough, uneven ground and make sharp turns at high speeds.

**v) Checking tractor before operating:** A pre-operational check of the tractor will assure you that it is in safe operating condition. Check the tires for proper inflation and defects, windows for visibility, seat position, seat belts, brakes for adjustment, steering response, rear view mirrors, slow-moving vehicle emblem, reflectors, and running lights for day or night time operation.

**i) Batteries: handling with care:** Occasionally it may be necessary to handle, adjust or change the battery on your tractor. Batteries contain sulfuric acid which can cause considerable harm if it comes into contact with your skin. They can also produce mixtures of hydrogen gas and oxygen which can explode if contacted with heat or sparks.

**vii) Hydraulic systems and safety:** Working with or on hydraulic equipment can be dangerous. Some of the hazards cannot even be seen readily. Hydraulic systems are under tremendous pressure and this is where the unseen danger lies.

### 3.7. Effects of adverse weather, soil and difficult terrain conditions on tractor operation

#### 3.7.1. Effects of adverse weather

People are often not surprised when private passenger vehicle drivers make mistakes, but paid drivers are often viewed as professionals who should meet higher safety and performance standards. Driving safely during all kinds of weather, traffic, and road conditions is expected.

Page 35 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

### **Safe when weather conditions make driving challenging**

- Vehicle inspection
- Planning ahead
- Safe speed and space
- Rain
- Snow
- Ice/freezing rain
- Fog and smoke
- Wind

### **3.7.2. Effect of soil physical properties**

Prior to the determination of the various performance indicators, some soil physical characteristics such as:

- Moisture contents
- Bulk density,
- Soil structure,
- Texture,
- Porosity are that influences machinery performances, were determined using the method adopted by Duma et al. (2019).

### **3.7.3. Tips for Operating a Tractor on Tough Terrain**

Whether you're encountering steep hills or trails packed with rocks and logs, there are some specific precautions you should take when navigating your tractor through tough terrain. Here are eight tips to stay safe and work effectively.

- Utilize safety features
- Ballast for balance
- Remove obstacles and debris
- Operate up and down

Page 36 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

- Keep the loader low
- Slow and steady
- Know your weight and dimensions
- Consult the operator's manual

### **3.8. Operating walking tractor with attached implement and trailer**

Walking tractor or walking tractor are which can pull and power various farm implements such as a trailer, cultivator or harrow, a plough, or various seeders and harvesters. The operator usually walks behind it or rides the implement being towed. Similar terms are mistakenly applied to the household rotary tiller or power tiller; although these may be wheeled and/or self-propelled, they are not tailored for towing implements. A two-wheeled tractor specializes in pulling any of numerous types of implements, whereas rotary tillers specialize in soil tillage with their dedicated digging tools.




#### **3.8.1. Type's attachments**

- Mouldboard plough
- Disc plough
- Rotary tiller
- Planter
- Harvester
- Sheller and Thresher,
- Reaper
- Centrifugal pump
- Generator
- Trailer
- Grain Mill

Page 37 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023






**Table 3:1 Attachment types and their uses**



No	Name	Attachment by figure	Uses
1	Mould board Plough		Suitable for ploughing virgin land which is not tilled for long period. <ul style="list-style-type: none"> <li>• Tills the soil which has deep roots, unwanted plants, shrubs and weeds.</li> <li>• Best for land preparation</li> </ul>
2	Disc Harrow		It is secondary tillage implement used to break down and more pulverized the soil
3	Water Pump		<b>Domestic Water Pump</b> – To pump water from irrigation canals, rivers and wells, etc., <b>Self-Priming Pump</b> – Self priming pump with tanker can be fitted for cleaning septic tanks, clogged drainage, community wells etc.,
4	Rotary tiller		Used primarily for seedbed preparation, Soil is discharged to the right side, enabling the operator to easily build raised planting beds with multiple passes. The rotary plow is particularly effective for

			<p>breaking new ground and power composting cover crops. <b>Features:</b></p> <ul style="list-style-type: none"> <li>• Break new ground, power compost cover crops, build raised beds, and create drainage ditches, power hill, and more.</li> </ul>
5	Planter or seeder		Planting or seeding crops or grain
6	Pesticide sprayer		<p>Pesticide application at planting stage and post planting</p> <p>The sprayer is used for spraying pesticides and insecticides to avoid pests in following areas:</p> <ol style="list-style-type: none"> <li>1) Coconut</li> <li>2) Chiku</li> <li>3) Pomegranate</li> <li>4) Grapes</li> <li>5) Guava</li> <li>6) Banana</li> <li>7) Papaya</li> <li>8) Mango</li> </ol>
7	Reaper		<p>A reaper attachment is used for cutting of crops at harvest time. Key Benefits</p> <ul style="list-style-type: none"> <li>• Reaper fitted with the tiller is the best replacement for manual reaping.</li> <li>• Saves labor &amp; time for</li> </ul>

			<p>cutting the crops.</p> <ul style="list-style-type: none"> <li>• Very easy to operate the reaper fitted with the tiller.</li> <li>• The cut crops are carried to one side of the tiller operator by a conveyor belt.</li> </ul>
9	Cultivator		<p>Five types cultivator can be easily attached with Power tiller with help of Hitch bracket. Five tine Cultivator fitments is commonly used as a secondary tillage equipment mostly in dry lands for loosening the soil, removal of crop roots, weeds and for Inter cultivation in orchards etc. A little moisture in the field increases the tilling efficiency.</p>
10	Grain mill		<p>Milling transforms grain into flour for food preparation. The main crops that are milled are maize, rice, sorghum, teff and millet, using hammer or plate mills. Although demand may be highest during the harvest season, grain milling is required throughout the year as many households keep a stock of grain</p>



11	Seed Cum Fertilizer Drill		<p>This is an exclusive attachment fitted to the Tiller after removing rotary assembly.</p> <ul style="list-style-type: none"> <li>• It is used for sowing seeds and spreading of fertilizer in a row.</li> <li>• It consists of separate boxes for seed and fertilizer, a shoe type furrower and a spliced ground wheel.</li> <li>• It is suitable for sowing seed of Wheat, Soya Bean, Bengal Gram etc.,</li> </ul>
12	Ridger (Furrower)		<p>Ridger cuts and turns the soil in two opposite direction for making ridges. The Ridger is used for making ridges for row crops such as Sugarcane, Potato, chilies, tobacco, banana etc. as well as for opening furrows for water flow.</p> <ul style="list-style-type: none"> <li>• The ridger should be used when the soil is slightly moist and used only after tilling the land once or twice.</li> <li>• The Ridger is fitted on the Rotary assembly with the help of a special bolt &amp; nut.</li> </ul>
13	Thresher		<p>Ideal replacement for manual method of threshing.</p> <ul style="list-style-type: none"> <li>• Post threshing the grains can be collected in a tray / bag.</li> <li>• Grains come out cleaned after passing through a sieve and fan.</li> <li>• Threshers are fitted with pneumatic tires for easy transportation.</li> <li>• A platform is provided for a person to stand and feed.</li> </ul>

			<ul style="list-style-type: none"> <li>• Blowers are made available on request for very fine cleaning.</li> </ul>
14	Trailer		<p>Trailer of 1.5 tons capacity can be fitted for transport of goods. Type of Trailers:</p> <ul style="list-style-type: none"> <li>• Standard</li> <li>• Mechanical Tipping</li> <li>• Hydraulic Tipping</li> <li>• Garbage trailer for collection of Garbage &amp; Transportation</li> <li>• Water tanker of capacity 1000 liters can also be fitted to</li> <li>• Power Tiller for carrying drinking water</li> </ul>
	Power Tiller Operated Generator		<p>It can be used as a generator when off season like a prime mover. The Generator can be used as:</p> <ul style="list-style-type: none"> <li>• Submersible Pump sets</li> <li>• Water Pump</li> <li>• Domestic Requirements</li> </ul> <p>Generator Capacity-7.5 kVA Average Fuel Consumption-1.5 to 1.75 liters / hr.</p>

**Source:** -Bisrat Getnet, Dereje Alemu, Seyoum Woldeesenbet, Teshome Bullo, Frédéric Baudron. November 2019 Edition

### 3.8.2. Mold board Plough operating system

#### Operation principle

Also called the walking tractor, iron buffalo, steel buffalo or hand tractor, two wheel tractors are used in many rice producing countries. These tractors have a forward mounted engine which is counter-balanced by the equipment attached behind the two drive wheels. The operator walks behind the tractor. Two wheel tractors are normally powered by 6-12 kW gasoline or diesel engines and are fitted with either rubber tires or steel cage wheels. Rubber tires are commonly used for dry land plowing and transportation. Cage wheels are necessary for all wet workings. Most makes of two wheel tractors incorporate an independent drive clutch as well as individual steering clutches or brakes. Three forward and one reverse working gear are most common. Two wheel tractors are used for land preparation. This includes plowing, land leveling, transportation and pumping water. The attachments used with two wheel tractors are the moldboard plough, the disc plough, harrows and rotavator's.



**Figure 3:2 Two wheel mold Plough operating**

**Source:** <https://i.ytimg.com/vi/9vKoiPR8bb0/hqdefault.jpg>

#### Operating Steps:

**1. Preparation for starting:** check whether the diesel engine is normal, if the cooling water in diesel engine is enough, the lubricating oil in Oil Pan's height and quality, the tightness of V-belt, should be adjust if the belt it too loose. And complement the tire pressure if it's too low.

Page 43 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1 May, 2023
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**2. Diesel engine start:** Pull the clutch brake handle to "off", put the gear lever in neutral position, turn the handle of accelerate graph to start position. Open reduced pressure handle with left hand, grip starting handle with right handle, shake diesel crankshaft. After diesel engine start, recheck if the oil pressure indicator valve rises up. Let the diesel engine running for a while, until the water temperature rise to 40-60 degree.

**3. Tractor Start:** After Tractor warm up, Pull the clutch brake handle to "off", push the gear lever to right gears, and put the clutch brake handle from "off" to "on". Drive the tractor slowly, according to traction loads modulating the throttle.

**4. Shift Gears:** Before gear shift, pull the clutch brake handle to "off", put the gear lever to right gears. Push left is low gear, pull right is high gear. Unit with the clutch, tractor will be running at suitable speed.

**5. Steering:** Steering of walking tractor is controlled by left and right steering handle. When tractor steering, reduce throttle and running speed, push right steering handle turn right, left steering handle turn left.

**6. Parking brake:** Walking tractor's brake handle and clutch handle is together, pull back the brake handle to stop the tractor. If connected with tractor, also need to step on the trailer brake.

### 3.8.3. Disc plough walking tractor operating

The machine is completely mounted with walking tractor, during operation, it is suitable for operation on the field with grasses, straw and stems of crops or plants, big soil resistance and with many stones and brickbat, etc. in the field. It is good at cutting the grasses and straw and free from stopped by the grasses, soil or stones, etc. It is efficient in the work it's good quality during operation. It is easy to adjust and strong.

Page 44 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

A small disc plough walking, also called a Disc tractor walking wheels, has a smooth and flat texture, and has a smooth texture even on the back of a tractor. Disc plough walking is a best tractor for kids, and it has more wheels than normal ones that are easy to drive. A disc plough walking is a great tractor for much soil, and one has to remain on the flat surface. One disc plough walking is a best tractor for children, but one is not enough for children. It can walk for a best traction, a disc plough walking tractor may be a good choice for smaller children.



**Figure 3:3 Disc Plough walking tractor operations**

**Source:** <https://encryptedtbn0.gstatic.com/images?q=tbn:ANd9GcSBHNsKqAlMAo4t7pJn3t62-OjZXKFx2EeuXzJs3AdEUGPNBetwfdWPCCo1VcjA0S8lls&usqp=CAU>

#### **3.8.4. Seeder operating system**

Seeder is designed to drill seeds, apply fertilizer, and cover the seeds firmly into the soil. It can be used for either strip and no-till depending on the number of blades fitted and the type of tillage required. The seed is dropped down along rows through plastic. In a single operation, it prepares and pulverizes the soil, along the row at which the seed is dropped at certain depth according to agronomic recommendation.

Page 45 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



### Operating principles

In general, this walking tractor attached seed drill works with power obtained from the rotation of sprocket assembled on the left side walking tractor axle wheel. As the tractor starts to move, the sprocket on the axle will start to rotate. The sprocket of the walking tractor and the sprocket at the seed drill seed metering shaft is connected through chain (The seed and fertilizer metering parts are connected by a chain-sprocket arrangement to the walking tractor wheel axle). As the tractor starts to move, the shaft of seed metering unit will rotate, which can internally rotate the fluted roller and hence the seed and fertilizer metered through fluted roller will be delivered to the seed outlet (the seed and fertilizer metering mechanism gets the power directly from axle through the chain and sprocket).



**Figure 3:4 Seeder operating systems**

**Source:** <https://encryptedtbn0.gstatic.com/images?q=tbn:ANd9GcRw5X0BFVPKSEaf1Mkhynnl-DGNk-h5pYrwiw&usqp=CAU>

### 3.8.5. Thresher/Sheller operating system

Threshing and shelling of crops are among the most important agricultural operations, but are also time consuming and labor-intensive. It is estimated that harvesting and threshing of crops consume about one third of the total requirement of the production process. The total labor requirements for harvesting/threshing of cereals/pulses vary from 120-200 man-hours per hectare.

Page 46 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

**Warning:** Thresher has an internal combustion gasoline/diesel engine. This engine contains hazardous chemicals, toxic fumes and hot surfaces that could cause harm or even death. The engine also contains a flammable chemical that could result in a fire or even an explosion. For the complete overview of all warnings and risks please read the engine manual before use.

**Warning:** Thresher contains moving parts that could cause serious harm or even death if anything is caught in the moving drum or in the belt system. While in operation, all guards should be in place and all adjustment bolts should be tightened properly.

**Warning:** While loading, the loader's hand should never come close to the opening at the end of the input. If the crop gets stuck on the input or output turn off the thresher and only proceed when it is completely stopped. It is recommended that anyone with long hair works on or with the thresher put up their hair or wear a hat in order to reduce that risk of their hair being caught in the belt or on the drum which could result in very serious injuries.

**Warning:** while threshing or shelling, there will be dirt and dust which will be blown by the threshing or shelling action. Therefore, it is strongly recommended that a person doing the threshing and shelling job should wear a dust mask or any other clean cloth to cover the mouth and nose to protect the breathing organs.



**Figure 6.5: Thresher/Sheller Operating system**

Source: [Two-wheel tractor operator manual Zimbabwe.pdf](#), [walking Tractor.pdf](#)

Page 47 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

### Operating principle

Ensure that all the security bolts on the concave are tightened down up and the concave is snug. Rotate the threshing drum by hand to make sure it moves freely and that there are no restrictions to rotation. Insert the belt to the pulley in the drum and on the engine. Make sure that the belt is aligned to avoid belt slipping. Start the engine with a rope or a cranking button (depending on the method of starting for different engines). Slide the engine with handle pulley up on the slide to tension the belt (remember to only tension the slack side of the belt) and make sure that the belt is seated properly in all pulleys and is not rubbing on anything. All setscrews on the pulley should be tightened and the nuts on the idler should be tightened by wrench. Caution: un-tightened pulley may fly and can cause serious fatal injuries.

After the engine is started, lower the speed to idle speed for 3-5 minutes for warming up. Now the engine has warmed up, gradually increase the speed (rpm) and insert the un-threshed material through the inlet of the thresher/Sheller. Check the outlet and take a sample to see whether the thresher/Sheller is working properly, i.e., there is no breakage and no un-threshed grain. If there is un-threshed /unshelled grain slowly increases the speed (rpm) and repeat until you get threshed grain. If there is breakage, reduce the speed so that the breakage will be avoided. Note: Breakage is not only due to higher speed, but it may due to over dried un-threshed harvest.

#### 3.8.6. Self-prime water pump operating system

The heart of most irrigation systems is a pump. To make an irrigation system as efficient as possible, the pump must be selected to match the requirements of the water source, the water piping system and the irrigation equipment. Pumps used for irrigation include centrifugal, deep well turbine, submersible and propeller pumps. Before selecting an irrigation pump, a careful and complete, inventory of the conditions under which the pump will operate must take place

Dawang brand is a portable walking tractor driven pump. It is small in size, light weight, good in performance, and easy to operate and maintain. It is also reliable and widely used for irrigation, drainage, mines, construction sites and daily water supply systems.

Page 48 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



**Figure 6.6: Self-prime water Pump Operating system**

**Source:**<https://image.made-in-china.com/2f0j00meUtGgncfOzd/Sprinkler-Set-Water-Pump-Irrigation-equipment.jpg>

### **Operating principle**

Some types of pumps are engineered to be automatically self-priming. Pumps of this nature feature close tolerance working parts that trap fluids in the pump's body, preventing them from returning from the discharge side of the pump to the suction side when the pump is not in operation. In these types of pumps, the constant presence of fluid in the pump's body allows the pump to better handle what are called "air pockets". Air pockets are an accumulation of air bubbles in the pump's working mechanism, which can impair proper pump operation.

### **3.8.7. Reaper harvester operating system**

#### **Parts of reaper harvester**

A front mounted vertical conveyor reaper is a common reaper to harvest wheat and barley crops. It can also be used for harvesting of soybean and other similar crops. Engine operated reaper can be operated with a two-wheel tractor engine. Width of cut is about 1.6 m in two-wheel tractor reaper. Two-wheel tractor front mounted vertical conveyor reaper can cover about 0.2 ha/hr

Page 49 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



**Figure 3:7 Parts of a Wheat Reaper Harvester**

**Source:** <https://image.made-in-china.com/155f0j00ulTphHNcCOzy/Tractor-Front-Link-Wheat-Cutting-Machine-Rice-Reaper-Beans-Straw-Harvester.jpg>

### **Operating principle of reaper**

A machine called vertical conveyor reaper-cum-windrower can cut the crop and lay it in the form of windrow for easy picking. It consists of a conventional cutter bar assembly, crop row dividers with star wheels, covers, pressure springs and vertical conveyor belts. Cutter bar is given reciprocating motion by crank wheel. Crop row dividers with star wheels enter the standing crop, help in lifting, gathering and guiding the crop towards the cutter bar.

After the crop is cut, held in a vertical position during its passage by means of pressure springs and star wheels vertically held crop is then delivered towards right side of the machine in a windrow perpendicular to the direction of movement of machine with the help of lugged conveyor belt. The gearbox and windrower is coupled to the drive shaft of the prime mover.

Page 50 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

### 3.8.8. Operating trailer with walking tractor

At the end of this module, operators, service providers, worreda extension experts or private mechanic and maintenance/repairs workshop owners will be able to use a trailer hitched to a two-wheel tractor. A trailer is a carriage that will be hitched to any tractor or a vehicle so that it can carry any type of load required. It is very critical to know the road conditions and the trailer load carrying limit. The trailer can transport a load of up to 1000 kg maximum

#### Necessary checks before hitching a trailer

- Check the tire pressure before hitching.
- Check all the wheel bolts, tighten and replace if there are missing bolts.
- Make a visual observation so that if any missing bolts and other body parts are in their place.
- After hitching the trailer, drive slowly with first gear and check whether the brakes are working properly. If they are working properly then load what you wanted to transport but do not exceed the limits. For example: Most two-wheel tractors having 12-15 HP can carry a trailer with 1000 kg but the only limiting factor for the trailer capacity is its brake drum diameter and size of the shoes. Therefore, strictly follow the carrying capacity of the trailer.
- Most of the time you can find the labeling at the back side of the trailer. Depending on the capacity load what you want but please secure it properly so that you will avoid dropping of staff from the trailer.

#### Never operate a two-wheeled tractor unless:

- You have been fully trained in their operation and maintenance, or:
- You have had years of experience operating and maintaining the particular model in question

Page 51 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



### Operating principle

Never exceed the maximum carrying capacity of the trailer. Trailer brakes are designed to halt the trailer with its maximum designated carrying capacity only. Always abide and observe all public traffic regulations while driving on the roads. Always observe speed limits on the roads. Use appropriate speed for difficult/crowded/high traffic conditions. Be sure that the brake of the trailer and the two-wheel tractor is appropriately always. Adjusted before starting to drive, Remember both brakes can be applied at the same time in emergency conditions. Never make a sudden turn at higher speeds. Never run the tractor in 5th and 6th gear unless the road is in very good condition. Never drive across a steep slope. Go down steep slopes in reverse to avoid tipping forward. Be sure that the brake is appropriately always adjusted in good working order. Never let children approach or ride on the tractor. Observe the road rules pertinent to two-wheeled tractor use



**Figure 3:8. Operating Trailer with walking Tractor**

**Source:** [https://upload.wikimedia.org/wikipedia/commons/thumb/d/de/2011\\_Dec\\_Bangladesh\\_014.JPG/440px-2011\\_Dec\\_Bangladesh\\_014.JPG](https://upload.wikimedia.org/wikipedia/commons/thumb/d/de/2011_Dec_Bangladesh_014.JPG/440px-2011_Dec_Bangladesh_014.JPG)

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Page 52 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

### **3.9. Parking walking tractor safely**

#### **Safe parking procedures prevent accidents**

The Professional Parking Association recommends the following common safety tips for parking:

##### **Before You Park:**

- Do Not Leave Valuables In Sight - (phones, pagers, purses, wallets, etc., invite theft)
- Putting valuables and packages in the trunk or out of sight before arriving at the parking facility.
- If you have the option, choose a parking spot that is well-lit.
- Do not hide a spare key in or on your tractor - it can be found.
- Reporting any suspicious activity immediately by calling 326-7096 or for emergencies dial 911.

##### **When parking, always:**

- Position the tractor parallel to the edge of the ditch, depression or slope.
- Set the hand or park brake before leaving the tractor.
- Turn off the tractor, whenever possible.
- In some situations, you may need to chock the wheels to prevent any movement.
- Set up safety cones to mark the work area.

##### **After You Park:**

- Walk with a confident and positive attitude.
- Don't Walk Alone At Night.

### **3.10. Environmental impacts associated with tractor operation**

The environment includes water, air, land and all plants and human beings and/or animals living there in and the inter-relationships which exist among these or any of them. Meaning, the environment consists of land, air, water and all the physical structures surrounding us.

Environmental pollution is any discharge of material or energy into water, land, or air that causes or may cause acute (short-term) or chronic (long-term) harmful to the Earth's ecological balance

Page 53 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1 May, 2023
----------------	--	---	------------------------



or that lowers the quality of life. Pollutants are the agents that may cause primary damage, with direct identifiable impact on the environment, or secondary damage which takes a very long time to see.

### 3.10.1 Types of environmental impact with operating agricultural tractor

**1. Noise pollution:** Sound is a common part of daily life and also agricultural mechanization that we hardly distinguish all of its effects. Many sounds that are unpleasant or unwanted are called noise. In summary, noise pollution is any loud sounds that are either harmful or annoying to humans and animals.

**2. Land pollution:** Land is often used as a recipient for treatment of wastes. Land also receives waste spills. Land pollution is the destroying of the earth's land surface through misuse of the soil by poor agricultural practices, dumping of waste, and indiscriminate disposal of wastes on the surface of the land.

**3. Air pollution:** It is the contamination of air by smoke and harmful gases, mainly oxides of carbon, sulfur, and nitrogen. Or the accumulation in the atmosphere, substances that are in sufficient concentrations that endanger human health or produce other measured effects on wildlife and humans. The pollutants may be that smelly odour we inhale.

**4. Water pollution:** Water pollution is the introduction of chemical, physical, or biological materials into fresh waters such as lakes, rivers, streams and ground waters that damage or contaminate the quality of the water we use and affects the organisms living in it. This process ranges from simple addition of dissolved or suspended solids to discharge of the most harmful toxic pollutants such as pesticides, heavy metals, and non-degradable chemical compound such as oils and fuels.

Page 54 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

Self-check 3	Written test
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Name..... ID.....Date.....

Time started: \_\_\_\_\_ Time finished: \_\_\_\_\_

**Directions: Answer all the questions listed below**

**Test I: Choose the best answer (2 point)**

- 1) Which one is different from the other?
  - a) Walking tractor
  - b) Power tiller
  - c) Two wheel tractor
  - d) None
- 2) What operator not check before operating walking tractor
  - a) Oil level
  - b) Fuel level
  - c) Water level
  - d) Plantation level
- 3) What operators do before checking the oil level?
  - a) Cleaning around the dipstick and filler tube
  - b) Moving the walking tractor to a level ground
  - c) Putting the dipstick in its place again
  - d) Pointing the oil level
- 4) Which one is Signs of a bad or worn clutch?
  - a) Slipping Clutch
  - b) Noise When Pressing the Clutch
  - c) Clutch Pedal Feels Stiff
  - d) Clutch takes higher up than usually

Page 55 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1 May, 2023
----------------	--	---	------------------------

- 5) The contamination of oxygen by smoke and harmful gases, mainly oxides of carbon, sulfur, and nitrogen is,
- Land pollution
  - Noise pollution
  - Water pollution
  - Air pollution
- 6) Which one is true about operation of walking tractor?
- Drive the two-wheel tractor up or down a steep slope at high speed.
  - Drive across a steep slope
  - Disengage two both steering clutches at different time
  - Drive the two -wheel tractor at high speed on a rough road
- 7) Which one is not the way to reduce risk of tractor accidents?
- Physically and mentally fit
  - Properly Trained
  - Familiar with operator's manual
  - Checking tractor before operating

## **Test II: Matching**

### **A**

- Mouldboard plough
- Disc plough
- Rotary tiller
- Ridger
- Planter
- Reaper
- Sheller and Thresher,
- Reaper
- Centrifugal pump
- Sprayer

### **B**

- Used for Planting or seeding
- Used for spraying pesticides and insecticides
- Used for making ridges for row crops
- Used to harvest the grain
- Used to separate grain from straw and chaff
- Used to pump water from irrigation canals, rivers
- Used to tills the soil which has deep roots
- Used to break down and more palverized the soil
- Used primarily for seedbed preparation
- Used primarily for seedbed preparation

Page 56 of 153	Ministry of Labor and Skills	Agricultural Machinery and Equipment Operation	Version 1
	Author/Copyright	Level -II	May, 2023

### Test III: Short Answer Questions

- 1) Write the operation should be done before starting
- 2) List the two options used to start two wheel tractors
- 3) Write two wheel tractor starting (startup) procedure
- 4) Write and perform Step in forward driving two wheel tractors
- 5) Write and perform stopping (shutdown) procedure of two wheel tractor

Page 57 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

## Operation sheet 3

### 3.1.Method of operating walking tractor

#### A. Tools and equipment

- PPE, PC/TV or LCD, flipchart and marker for showing video
- Walking tractor
- Tool kit
- Oil
- Fuel
- Coolant
- Hard copy of the operation manual

#### A. Methods

- Do not approach/operate a walking tractor with loose clothing/scarf/tie.
- Take special care near the running engine/turning belts.
- Never engage the clutch from a starting position with one of the steering clutches disengaged.
- Never drive the walking tractor up or down a steep slope at high speed.
- Never “coast” down a hill with clutch/gears disengaged (free-wheeling).
- Never disengage both of the steering clutches at the same time.
- Never drive the walking tractor at high speed on a rough road (gears 4-6).
- Never attempt to start the tractor from dead stop in gears higher than 3rd gear

### 3.2.Techniques/Methods of seeder operating

#### A. Tools and equipment

- PPE, PC/TV or LCD, flipchart, marker
- Walking tractor
- Seeder
- Seed
- Digital balance

Page 58 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

- Fertilizer (organic or inorganic)
- Meter (30-50 meters length)
- Tool box (spanner, wrenches etc.)
- Oil
- Fuel
- Water
- Hard copy of the operation manual
- Note book and pen

### **B. Techniques/Methods**

- Arrange participants in groups (2-4 people/group)
- Ask participants to observe the walking tractor seeder
- Ask participants to discuss in group on the general layout of the walking tractor:
- What are the main components of the walking tractor -attached seeder technology?
- Identify the metering units, metering system for seed and fertilizer used
- Explain what to calibrate and steps of calibration?
- Demonstrate the steps of calibration, adjust the seeder according to the desired rate, and measure the collected seeds and fertilizer with a digital balance.
- Compare each row with the desired/required rate.
- Repeat experimental/trial exercise at least three times
- Wrap-up discussion

## **3.3.Techniques/Methods of thresher operating system**

### **A. Tools and equipment**

- PPE, PC/TV or LCD, flipchart, marker
- Walking tractor
- Thresher/Sheller
- Harvested crop
- Tool box

Page 59 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

- Digital balance
- Oil
- Fuel
- Water
- Hard copy of the operation manual
- Note and pen

## B. Techniques/Methods

- Ensure that all the security bolts on the concave are tightened down up and the concave is snug.
- Rotate the threshing drum by hand to make sure it moves freely and that there are no restrictions to rotation.
- Insert the belt to the pulley in the drum and on the engine.
- Make sure that the belt is aligned to avoid belt slipping.
- Start the engine with a rope or a cranking button (depending on the method of starting for different engines).
- Slide the engine with handle pulley up on the slide to tension the belt (remember to only tension the slack side of the belt) and make sure that the belt is seated properly in all pulleys and is not rubbing on anything. All setscrews on the pulley should be tightened and the nuts on the idler should be tightened by wrench. Caution: un-tightened pulley may fly and can cause serious fatal injuries.
- After the engine is started, lower the speed to idle speed for 3-5 minutes for warming up.
- Now the engine has warmed up, gradually increase the speed (rpm) and insert the un-threshed material through the inlet of the thresher/Sheller.
- Check the outlet and take a sample to see whether the thresher/Sheller is working properly, i.e., there is no breakage and no un-threshed grain. If there is un-threshed /unshelled grain slowly increases the speed (rpm) and repeat until you get threshed grain. If there is breakage, reduce the speed so that the breakage will be avoided. Note:

Page 60 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

Breakage is not only due to higher speed, but it may be due to over dried un-threshed harvest.

### 3.4. Techniques/Methods of operating walking tractor with trailer

#### A. Tools and equipment

- PPE, PC/TV or LCD, flipchart, marker
- Walking tractor
- Trailer
- Tool box
- Oil
- Fuel
- Water
- Hard copy of the operation manual

#### B. Techniques/Methods

- Never exceed the maximum carrying capacity of the trailer. Trailer brakes are designed to
- Halt the trailer with its maximum designated carrying capacity only.
- Always abide and observe all public traffic regulations while driving on the roads.
- Always observe speed limits on the roads.
- Use appropriate speed for difficult/crowded/high traffic conditions.
- Be sure that the brake of the trailer and the two-wheel tractor is appropriately always
- Adjusted before starting to drive.
- Remember both brakes can be applied at the same time in emergency conditions.
- Never make a sudden turn at higher speeds.
- Never run the tractor in 5th and 6th gear unless the road is in very good condition
- Never drive across a steep slope.
- Go down steep slopes in reverse to avoid tipping forward.
- Be sure that the brake is appropriately always adjusted in good working order.

Page 61 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



Lap test-3	Performance Test
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Name..... ID..... Date.....

Time started: \_\_\_\_\_ Time finished: \_\_\_\_\_

**Instructions:** Given necessary templates, tools and materials you are required to perform the following tasks within 12 hour. The project is expected from each student to do it.

Task-1 Perform Operating walking tractor

Task-2 apply Planting operation properly

Task-3 Perform threshing operation of walking tractor

Task-4 Drive walking tractor with Trailer

Page 62 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

**LG #15**

**LO #4- Select, fit and remove attachments**

**Instruction sheet 4**

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Methods of fitting attachment
- Selecting attachment for the task
- Calculating and measuring distance, volumes and weights
- Attaching and calibrating equipment
- Adjusting and calibrating attachment
- Removing attachment

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Identify methods of fitting attachment
- Select attachment for the task
- Calculate and measure distance, volumes and weights
- Attach and calibrate equipment
- Adjust and calibrate attachment
- Remove attachment

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

Page 63 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

## Information Sheet 4

### 4.1 Methods of fitting attachment

#### 4.1.1. Attaching ancillary equipment to walking tractor

The walking tractor is a multi-purpose tractor, which can handle many tasks if appropriate ancillary equipment is attached properly. There are four ways to get a desired power/pull from the walking tractor

- 1) Through direct assembly to the drawbar
- 2) Through a pin to the drawbar
- 3) Through a v-belt on the pulley
- 4) Through a sprocket on the driving axle



**Figure 4:1. Method of fitting attachment to walking tractor**

Page 64 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1 May, 2023
----------------	--	---	------------------------

**Source:** <https://knowledgeplatform.hellotractor.com/wp-content/uploads/2020/02/EIAR-CIMMYT-operator-training-manual.pdf>

Please note: none of the attachments should be done at once. Depending on the operation, it is essential to make the decision to attach. For example, a walking tractor with a reaper harvester cannot be attached to a pump simultaneously. It is important to put the activity priority before making an attachment so that the downtime will be reduced.

#### 4.2 Selecting attachment for the task

Two wheel tractors are small, motorised farming machines used to cultivate soil for gardening and horticulture, usually on small plots of land. Two wheel tractors are often used to break up soil, like a rotary tiller. But compared with rotary tillers they are very versatile tools: whereas a rotary tiller has fixed cutters, a two wheel tractor can be fitted with various implements, making it a tool with numerous applications. These implements include rotors, ploughs, welders and rotary harrow for tilling; flail mowers, cutter bars and disc mowers for lawn and garden maintenance; and finally, mini-round balers and automatic seeder for agricultural management. In short, a good two wheel tractor can perform an endless number of jobs

#### Factors to consider for select attachment

To identify which two wheel tractor is best suited to your needs, it's worth considering four factors: the land surface area, the implements needed, your available budget and the available storage space.

**a) The land surface area:** the size of your land determines how powerful your machine needs.

**b) Implements needed:** the jobs that your two wheel tractor will perform, and therefore the tools that you need to install to do those jobs, determine the power output and weight that your two wheel tractor should have.

Page 65 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

**c) Available budget:** This is undoubtedly one of the first things that you should take into account, but you can be certain that the extensive range of number of two wheel tractors offers a solution for every budget. And most importantly, the product quality is outstanding at every price. Among the specifications of each model, you can find different configurations that may help you find a compromise between the two wheel tractor you need and the right price.

**d) Available storage space:** this is one of the most important factors, but also the most overlooked. Your two wheel tractor and accompanying implements should be stowed away in a protected shelter, which will prolong the lifespan of the vehicle and maintain its performance. All number of two wheel tractors are designed to occupy the smallest footprint possible and fold away to fit even the tiniest of spaces. You should therefore bear in mind that most of your storage space will be taken up by the modular implements, so choose them sparingly if you have limited space available.

### 4.3 Calculating and measuring distance, volumes and weights

#### 5.2.4 Determining seed drill calibration

##### i. Determining the nominal width (W) of seed drill

$$W = M \times S,$$

Where,

M = Number of furrow openers, and

S = Spacing between the openers, m

##### ii. Finding the length of the strip (L) having nominal width (W).

Suppose we have 1 ha of area

We know 1 ha = 100 m x 100 m = 10000 m<sup>2</sup>

$$L \times W = 10000$$

$$L = 10000/W, \text{ meter}$$

##### iii. Determining the number of revolutions (N) of the ground wheel of the seed drill required to cover the length of the strip (L)

$$L = P \times D \times N = 10000/W$$

Page 66 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

$N = 10000/P \times D \times W$  revolutions per minute

- iv. Jacking the seed drill so that the ground wheels turn freely. Make a mark on the drive wheel and a corresponding mark at a convenient place on the body of the drill to help in counting the revolutions of the ground wheel
- v. Filling the selected seed in the seed hopper or plastic bags. Place a container under each boot for collecting the seeds dropped from the hopper
- vi. Setting the seed rate control adjustment for maximum position and mark this position on the control for reference
- vii. Engaging the clutch and rotate the ground wheel for  $N = 10000/P \times D \times W$ , revolutions per minute
- viii. Weighing the quantity of seed collected in the container and record the observation.
- ix. Calculating the seed rate in kg/ha
- x. If the calculated seed rate is higher or lower than the desired rate of selected crop, repeat the process by adjusting the seed rate control adjustment till the desired seed rate is obtained.
  - (a) Measure the ground wheel diameter 'cm'
  - (b) Measure the number of furrow openers
  - (c) Measure distance between two openers 'cm'
  - (d) Perimeter of ground wheel  $P = \pi D$
  - (e) Width of implement  $W = 1.2$  m

Let us use Diameter  $D = 40$  cm

Give one revolution to the ground wheel

Area covered/revolution of ground wheel

$$= \pi DW$$

$$= 3.14 \times 1.2 \times 0.40$$

$$= 0.15072 \text{ m}^2$$

Recommended seed of wheat = 100 kg/ha.

$$10000 \text{ m}^2 - 100 \text{ Kg}$$

$$0.15072 \text{ m}^2 - \frac{100}{10000} \times 0.15072$$

$$10000$$

Page 67 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

= 0.005072 kg for a single revolution

If number of furrows to be sown simultaneously, say 6.

Seed to be dropped by each furrow opener per revolution of ground wheel

=  $\frac{0.005072}{6} = 2.512 \times 10^{-4}$  kg

6

As this is not measurable quantity

Calculate seed dropped in 200 revolutions

$2.512 \times 10^{-4}$  kg X 200 = 50.24 gm

Therefore, an operator needs to know how to calibrate a seeder before conducting planting/seeding operation

#### 4.4 Attaching and calibrating equipment

##### 4.4.1. Assembling seed drill

Before assembling the seed drill with walking tractor, make sure that you have selected a good working environment, wear recommended clothes and safety shoes. Check if all accessories and appropriate necessary assembling tools are readily available.

##### a) Assembling the sprocket to walking tractor axle

Once the above pre-assembling procedures are fulfilled, start assembling the sprocket which drives the shafts of the metering mechanisms for both seed and fertilizer to the left wheel side of the axle. A drive sprocket should be assembled in the left axle of the walking tractor. Loosen the two bolts connecting the two sprockets facing, align the sprocket key way, insert the sprocket facing, insert the bolts and tighten the bolt.

Page 68 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023





**Figure 4:2. Inserting the drive sprocket to the drive axle**

**Source:** <https://knowledgeplatform.hellotractor.com/wp-content/uploads/2020/02/EIAR-CIMMYT-operator-training-manual.pdf>

#### **b) Assembling furrow opener**

Assembling of furrow openers depending on the row spacing needed for the crop to be planted. For example, if the seed is wheat that should be seeded with row spacing of 20 cm, it is necessary to install six furrow openers with 20 cm spacing. If the seed to be planted is maize, you need to install only two furrow openers at 75cm row spacing and the rest furrow openers will not be installed.



**Figure 4:3. Assembling of furrow openers**

**Source:** <https://knowledgeplatform.hellotractor.com/wp-content/uploads/2020/02/EIAR-CIMMYT-operator-training-manual.pdf>

Page 69 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1 May, 2023
----------------	--	---	------------------------



#### c) Assembling rotary blade

After installing the furrow openers at recommended spacing, the next step is to install the rotary blades for ripping. We already set up the furrow openers at 20 cm spacing. Therefore, twenty-four blades will be installed in the rotavator's shaft radially and exactly in front of the furrow openers aligned in straight line. This is because the furrow openers will follow the ripped/pulverized soil/lines and the seed and fertilizer metered will fall in the opened furrow through plastic hose.



**Figure 4:4. Installed blades on the rotavator's shaft**

**Source:** <https://knowledgeplatform.hellotractor.com/wp-content/uploads/2020/02/EIAR-CIMMYT-operator-training-manual.pdf>

#### d) Assembling press wheel/Roller

Loosen the bolts on the left and right side of the press wheel and align the press wheel with working depth adjustment lever. Insert bolt and tighten properly

Page 70 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



**Figure 4:5. Assembling press wheel/roller**

**Source:** <https://knowledgeplatform.hellotractor.com/wp-content/uploads/2020/02/EIAR-CIMMYT-operator-training-manual.pdf>

#### e) Mounting the seed drill to walking tractor

Before mounting the seeder, tilt the walking tractor so that its front side will touch the ground, to avoid leakage of gearbox oil when the cover is opened. There are four nuts in the drawbar pull plate of the walking tractor located on the gearbox. Loosen the nuts and remove the cover.

**Caution:** the walking tractor gearbox is filled with oil, so care should be taken to avoid oil leakage.



**Figure 4:6. Removing drawbar pull cover**

**Source:** <https://knowledgeplatform.hellotractor.com/wp-content/uploads/2020/02/EIAR-CIMMYT-operator-training-manual.pdf>

Page 71 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1 May, 2023
----------------	--	---	------------------------

Once the draw bar cover is removed, the next step is to mount the seeder seed drill. At least four persons are required to carry and mount seeder on walking tractor

- Two persons each on the left- and right-hand sides to carry and mount the planter.
- Carry the planter and align the gear on the front side of the seeder gearbox to the opened gearbox of the walking tractor.

One additional person is needed to tighten the nuts uniformly, while the four persons are aligning the seeder front gearbox to the walking tractor gearbox, .i.e. the right side and left side nuts need to be tightened almost simultaneously. Caution: Carry the seed drill properly until the bolt is tightened and the support lever on seed drill and with the tractor handle tighten to avoid fatal injury.



**Figure 4:7. Mounting the seeder to the drawbar pull/gearbox of the walking tractor**

**Source:** <https://knowledgeplatform.hellotractor.com/wp-content/uploads/2020/02/EIAR-CIMMYT-operator-training-manual.pdf>

As soon as you finish tightening the nuts, place the walking tractor on a normal horizontal position. Next tighten the mounting levers to the right and left sides of the walking to fix the seed drill rigidly so that when someone is trying to lift the planter while turning, it will facilitate safe turning and operation.

Page 72 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



**Figure 4:8. Mounting levers to attach the planter to walking steering column**

**Source:** <https://knowledgeplatform.hellotractor.com/wp-content/uploads/2020/02/EIAR-CIMMYT-operator-training-manual.pdf>

#### **f: Alignment of sprockets and chain**

Misalignment of the seed metering drive sprocket with the axle sprocket of the walking tractor will result in the chain to frequently come off the sprockets and drive to the seed box will cease. Moving the securing pin and sliding the sprocket on either the axle or the seed box shaft until the drive chain is completely aligned. Once we are sure that the sprocket and chain is perfectly aligned, we can easily make a groove on the axle and tighten the sprocket and axle with a bolt. Ensure that the drive chain sits evenly on the chain tensioner idler. After aligning the chain, replace the securing pins in the correct position

**Note:** Please ensure that the chain drive from the axle to the seed box is equally aligned and tight.

Page 73 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



**Figure 4:9. Alignment of sprockets and chain**

**Source:** <https://knowledgeplatform.hellotractor.com/wp-content/uploads/2020/02/EIAR-CIMMYT-operator-training-manual.pdf>

#### **4.4.2. Pump attachment methods**

##### **Installation steps**

**Step 1:** Removing the securing bolts and nuts from the base of the pump supporting

**Step 2:** Securing the pump support base with three bolts that you removed from the walking tractor below when viewed from the front top of the walking tractor

**Step 3:** Installing the pump on the pumping support by four bolts and nuts. Note that the pump pulley should be aligned with the engine pulley. Alignment of the two pulleys can easily be done by visual inspection and taking the pump support securing left and right slots. After ensuring that the two pulleys are aligned, tighten the nuts at a proper torque.

**Caution:** Note that bolts are placed up-side down as in the picture below.

**Step 4:** After the pump is installed properly, the next step is to remove the belts from the clutch to the walking tractor engine pulleys. This step involves tightening the engine belt tensioner and the engine base securing bolts as follows:

- First start by loosening the four engine base securing nuts. Caution: do not remove them yet, just loosen them until they are free from the base.

Page 74 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1 May, 2023
----------------	--	---	------------------------



- Next, loosen the first and second nuts on the tensioner stud and then loosen the inner nut and tighten the second nut clockwise so that the engine will be pushed away from you. As a result, the three-engine v-belts will be loosened enough to be removed from the crankshaft pulley and clutch pulleys respectively

**Step 5:** Now after loosening the belts, the next step is to remove all three v-belts starting from the outer most to the middle and the inner v-belt. While rotating the engine with the manual starting lever, using a long flat screw driver put in the inner side of the v-belt. Slowly remove the v-belts one by one starting from the engine pulley and finishing with the clutch pulley. After inserting the new v-belt into the pulleys, secure the engine v-belt. Caution: Please exercise caution while removing the v-belts, as you may hurt your hands in the process.

**Step 6:**

- Now all the necessary steps have been taken, what is left installing the discharge and suction pipes.
- Start with installing the suction pipe with tightening the reducer holder nut with your hand.
- Then inserting the suction pipe into the reducer. Caution: Tightening the reducer holder correctly is very crucial. If there is a leak, the pump will not work and will also lead to unnecessary and increased fuel consumption.
- Inserting strainer at the end of the suction pipe and tighten the clamp properly with a flat screw driver,
- Similarly, install the elbow with its holder in the discharge side of the pump, as shown in
- Now secure the blue discharge pipe on the elbow and tighten the clamp with a screwdriver. Caution: Unless you tighten the clamp properly, there will be water leakage as soon as the pump starts working.
- Finally, stretching the discharge pipe without any bending along the line to avoid pipe damage and unnecessary pressure on the pump. This will also have an impact on the life of the pump.

Page 75 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

#### **Step 7:**

- The final step will be to fixing a tripod for the sprinkler. Fix the tripod,
- Inserting the discharge pipe at the center of the tripod and tighten the clamp properly with a screwdriver
- Removing the red plastic cover from the nozzle tip and install it at the top of the tripod carefully. • Insert the suction pipe end with the strainer into the well (water point),
- Filling water into the pump until it is full before starting to remove the air inside the suction side of the pipe. This process is called priming.
- Checking and fill the fuel tanker with fuel, depending on the length of time the pump will be used
- Finally, starting the engine and water your land area.

#### **4.4.3. Thresher/shellers attachment**

##### **Installation**

Once arrived on location the threshing/shelling machine has to be placed horizontally on its four support legs. This might be done by raising the thresher by jack, first at the front then at the back, before lowering the support legs depending on the design. These support legs provide the machine stability and prevent vibration, which otherwise would influence the threshing in a rather negative way. The machine always has to be placed with the drum shaft horizontal.

The machine should always be placed in a horizontal position, both lengthwise as widthwise. For this purpose, some thresher/Sheller designs may have a liquid level indicator, which is mounted on the main frame.

##### **Drum (cylinder) speed**

The threshing speed of the drum is adjusted depending on the type of crop that needs to be threshed. Due to the difference in humidity, maturity and even in variety within a single crop, it is not possible to give one exact rotation speed for every crop. However, it is possible to give a range within which the optimal speed is obtained. Speed can be varied by using different

Page 76 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

combinations of pulleys for the drum drive. Refer manufacturer's chart for a specific threshing or shelling machine. It is recommended that in general a first trial is made about in the middle of the range.

### **Changing pulleys:**

For adjusting the drum speed, pulleys have to be interchanged. There are different diameter sizes of pulleys. Any combination which can give the desired threshing drum speed can be selected, depending on the design of the thresher/Sheller and the crop type. For replacement, the tension of the belt has to be taken away completely. After taking off the belt, the pulleys can be removed by loosening the bolts with which the pulleys are held to their flanges. Then, once the correct size of pulleys is mounted, the belt can be replaced and tensioned again. Make sure the tensioning nuts are properly tightened.

### **Position of the concave**

The concave can be adjustable or fixed, depending on the design. This means, when multi-crop threshing/ shelling machines have adjustable concave, the distance between the drum and concave can vary, while single crop threshers/shellers have a fixed concave that is not adjustable. The concave and its hinge point are placed in such a way that the opening between the concave and the drum has a wedge shape. The opening at the beginning is always twice the size of the opening at the rear. The position of the concave can be set by a special key which fits on an eccentric. Placing the concave high means a narrow opening and maximum threshing effect. Placing the concave low on the other hand means a big opening and minimum threshing effect. Generally speaking, the concave should be set narrower when the humidity of the grain is higher. But when threshing dry and very mature grain, the opening can be set wider

### **Exchanging drums and concave**

For rice, a peg-tooth type drum and concave are recommended. For replacement, take away the cover plate over the drum; remove the drive belt and the belt for the drive of the conveyor chain. After removing the securing bolts and nuts with which the bearing blocks are mounted on the

Page 77 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			April, 2023



frame, the complete drum can be taken out by lifting it up. Place the bearing blocks in vertical position. The concave is taken out by removing the hinge bolts in the side plate

## 4.5 Adjusting and calibrating attachment

### 4.5.1 Adjusting furrow opener

Width of planting is adjusted by increasing or decreasing the width between furrow openers.

Determine the number of rows (from agronomic recommendations for the seed to be sown), for example if we are going to sow a wheat (let us say the row spacing is 20 cm) install the four furrow openers supplied with the planter. If the seed is maize and row spacing is 75cm, remove the two central furrow openers and measure the distance between the remaining furrow openers and adjust if necessary. Loosen the four U- bolts for each furrow opener, increase or decrease the horizontal spacing depending on the agronomic recommendation of the crop to be sown.



**Figure 4:26 adjusting furrow opener spacing**

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Page 78 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			April, 2023

#### 4.5.2 Adjustment of thresher/Sheller

##### Field Adjustment of thresher/Sheller

- Setting machine horizontally.
- Selecting correct drum speed (see chart depending on the design of thresher/Sheller).
- Setting concave in correct position (normally in the middle) if dry, and very mature in maximum opening and if wet and not mature in minimum position.
- Setting air direction properly (light material levers up, heavy material levers down.).
- Adjusting top sieve (opening equal to length of seed or 1.5 times diameter round seed). (Optional: depending on the type of thresher/Sheller).
- Selecting proper bottom sieve.
- Adjusting chaff plate shield:

**For dry grain:** set in high position.

**For wet grain:** set in low position.

After these adjustments, the machine has to be tested on proper threshing and cleaning.

**Following points have to be examined.**

##### Feeding Platform

For a proper operation, the feeding has to be done by 3 persons, 2 persons place material on the left-hand side of the platform and 1 person feeds this material in an even flow in to the conveyor.

Note: the number of people feeding the machines may vary depending on the available persons, but generally the feed rate is directly related with the output of the machines.

**Warning:** - Do not try to push the material too far towards the drum, because the drum does not make any difference between grains and hands.

##### Tensioning of drive belt

Make sure tension of drive belt is never too low or is never too high. This will cause misalignment of drum shaft, resulting into poor quality of threshing and damage to driveshaft and

Page 79 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			April, 2023

bearings. Tension is okay when you can push the drive belt in over a distance of at least the width of two of your fingers. If you have to push too hard, or you cannot push far enough, loosen check nut. Check tension again. Repeat doing this, until belt has right tension. Now tighten tensioning nut. Note: If belt tension is too low, belt slippage will occur, or at extreme low tension, belt will simply come off. In these cases, tension regulation should be in line with adjustment procedure.

#### **4.5.3 Calibration of self-prime water pump**

Calibrating the flow rate of a pump is important for ensuring that the pump is delivering the right amount of fluid. The first step in calibrating a pump is to measure the output flow rate with a graduated cylinder.

The next step is to adjust the setting on the pump to get an output flow rate that matches what you measured. There are two methods for adjusting the setting: linear or non-linear adjustment. Linear adjustment involves turning a screwdriver or knob on the front of the pump until it matches your desired flow rate, while non-linear adjustment requires you to adjust two knobs at once, one on either side of the pump.

#### **4.5.4 Reaper harvester problems and adjustments**

For proper field efficiency and minimum grain loss, correct field layout and preparation of the field are the most important factors.

**Table 4:1 Reaper harvester problems and adjustments**

No	Part	Problem	Adjustment
2	Cutter bar	Unsatisfactory cutting	i) Reduce forward speed

			ii) Correct the registration iii) Sharpen the knife sections or replace if worn out. iv) Check drive belt tension. If loose, tighten
3	Binding & tying mechanism	i) Broken or torn twine ii) Loose or untied knot iii) Frequent untied bundles iv) Improper cutting of twine	i) Remove twine and clean needle eyelet and pliers. Reduce tension on twine under the tension plate through fly-nut ii) Tighten the twine disc with the help of spring loaded screw-bolt provided for the purpose iii) Adjust spring tension and smooth face of pliers by emery paper. Use twine of uniform technic
4	Conveyor	i) Bundles keep collecting on conveyor ii) Conveyor slackened & bundles not conveyed at regular interval	i) Check the tension or the v-belt over the conveyor roller pulley. ii) Tighten the canvas conveyor with help of the sum buckles provided
5	Bundle size		Increase or decrease the size of bundles by increasing or decreasing the tension of trigger. For this the trigger spring is hooked on to different holes provided

## 4.6 Removing attachment

### 4.6.1 Dismounting

This Safety Talk is to raise awareness of workplace hazards that can cause a MSI. An injury that results in a strain, sprain, torn muscle, tendon, ligament or joint is called a MSI (musculoskeletal injury).

Page 81 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1 April, 2023
----------------	--	---	--------------------------

Entering or exiting an excavator can be a hazard if not done properly. Slips and falls are common causes of injury. The following safety information will provide you with training on assessing hazards that could lead to a MSI and instruct on implementing control measures to prevent a MSI.

## **Regulations**

The Construction Projects regulation states that construction equipment must have a means of access to the operator's station that will not endanger the operator, and must have skid-resistant walking, climbing, and work surfaces. Ensure that your equipment complies with the law. And keep running boards, treads, steps, footholds, and platforms clear of mud, ice, snow, grease, debris, and other hazards. Housekeeping keeps you and your co-workers safe!

## **DO's**

- Always refer to the Operation & Maintenance Manual for proper mount and dismount procedures.
- Inspect the ground before climbing up or down.
- Note where feet should be placed to avoid a twisted or sprained ankle.
- Make sure the machine is off.
- Always check the condition of steps, ladders, and rails for mud, water, ice, dust or any other material that could cause slips.
- Always maintain three points of contact when mounting and dismounting equipment – This means ALWAYS have two feet and one hand or two hands and one foot in contact with the machine at all times.
- Always mount and dismount while facing the equipment.
- Always close the latch gates, as required, for fall protection.

Page 82 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			April, 2023

## **DON'TS**

- Don't carry items when dismounting equipment.
- IF carrying items is necessary, place the item on a bench or a ledge of the equipment and stagger step the items up or down with the extra hand while maintaining three points of contact or you can also use a rose to raise or lower the items.
- DO NOT RUSH- Take the time needed to properly enter and exit the equipment; do not skip steps or rungs in the ladder.
- Avoid wearing loose or torn clothing that can catch on the equipment.
- Don't jump down or off the equipment.

### **4.6.2 Safely dismounting equipment**

Most operators probably don't really give a lot of thought to dismounting their equipment. I mean it's part of their getting-in and out and they probably do it a zillion times a day (no exaggeration at all here ☐). Whether you are mounting a piece of heavy equipment for the first time or it's your zillionth time today, there are a few things you should do to ensure a safe and injury free entrance or exit.

The first thing you should do... as with any piece of equipment is read the operator's manual. This will give you the proper way to dismount this particular equipment. Always give a once over to look for mud, ice and other conditions that could cause a slip, trip or fall. Also see where your feet will land, to avoid a sprain or twist. Give the guards and rails an inspection too. Use 3 points of contact. This means no large double, double in one hand. Obviously you will need to bring items... especially that coffee, in and out of the cab; so you can either ask someone to hand it to you (if safely possible) after you have safely mounted, or place it safely on a step or ledge and alternate having your 3 points and move it when you have two feet planted and one free hand. Always close and latch the gate or door, both while in the equipment and when exiting. Face the equipment while mounting or dismounting if equipment with a ladder; if it has stairs face the direction of travel.

Page 83 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			April, 2023

Self-check 4	Written test
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Name..... ID.....Date.....

Time started: \_\_\_\_\_ Time finished: \_\_\_\_\_

**Directions: Answer all the questions listed below**

**Test I: Choose the best answer (2 point)**

- 1) Which one is the way to get power/pull from the walking tractor?
  - a) Through direct assembly to the drawbar
  - b) Through a pin to the drawbar
  - c) Through a v-belt on the pulley
  - d) Through a sprocket on the driving axle
  - e) All
- 2) The factor which is not consider the walking tractor is best suited to your needs
  - a) Available storage space
  - b) Available budget
  - c) The land surface area
  - d) Implements needed
  - e) None
3. One of the following is not adjustment part of thresher/Sheller
  - a) Setting machine horizontally
  - b) Selecting correct drum speed
  - c) Selecting improper bottom sieve
  - d) Adjusting chaff plate shield
- 4) From the following, which one is the problem causes to reaper harvester
  - a) Unsatisfactory cutting
  - b) Improper cutting of twine
  - c) Improper gathering of crop
  - d) all

Page 84 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1 April, 2023
----------------	--	---	--------------------------

5) Which one is measure should be not taken to maintain the walking tractor?

- a) Selecting the parking place
- b) Removing dirt and oil from the surface of the walking tractor,
- c) Checking, adjusting and tightening all parts
- d) Parking the walking tractor in wet place

### Test II: Short answer questions

- 1) Write the procedure of mounting the seed drill to walking tractor
- 2) Write the procedure of pump installation
- 3) List component of thresher/Sheller
- 4) Write the way to adjust row spacing and depth of planting
- 5) Explain the way to Calibrating seed and fertilizer rate

Page 85 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			April, 2023



## Operation Sheet -4

### 4.1 Techniques of mounting the planter to walking tractor

#### A. Tools and equipment

- PPE, PC/TV or LCD, flipchart, marker for show video
- Walking tractor
- Seeder/planter
- Tool box (spanner, wrenches etc.)
- Oil
- Fuel
- Water
- Hard copy of the operation manual
- Note book and pen

#### B. Techniques

- Before mounting the planter, select a leveled surface. At least three persons are required to carry and mount the planter on two-wheel tractor.
- Two persons (one on the left and one on the right) carry and mount the planter.
- Align the tractor drawbar pull cover and the planter tool bar hole.
- Slightly lower and raise the two-wheel tractor until the hole is aligned.
- If the hole on the draw bar pull cover is aligned with the three holes on the tool bar, insert the middle pin first and then insert the rest two pin respectively.
- Insert the cotter pin in each pin.

Page 86 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			April, 2023

## 4.2 Steps of assembling self-prime water pump

### A Tools and equipment

- PPE, PC/TV or LCD, flipchart, marker for show video
- Walking tractor
- Tool box (spanner, wrenches etc.)
- Oil
- Fuel
- Water
- Hard copy of the operation manual
- Note book and pen

### B. Techniques

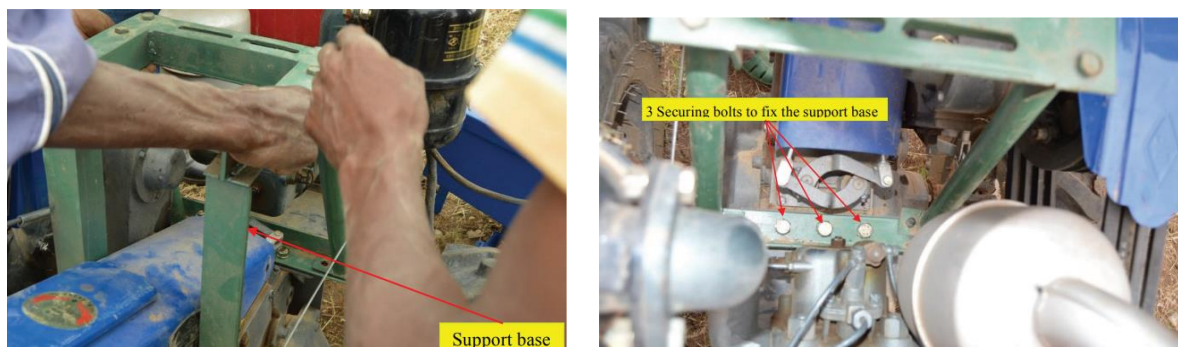
**Step 1:** Remove the securing bolts and nuts from the base of the pump supporting frame



**Removal of the securing bolts**

Page 87 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			April, 2023

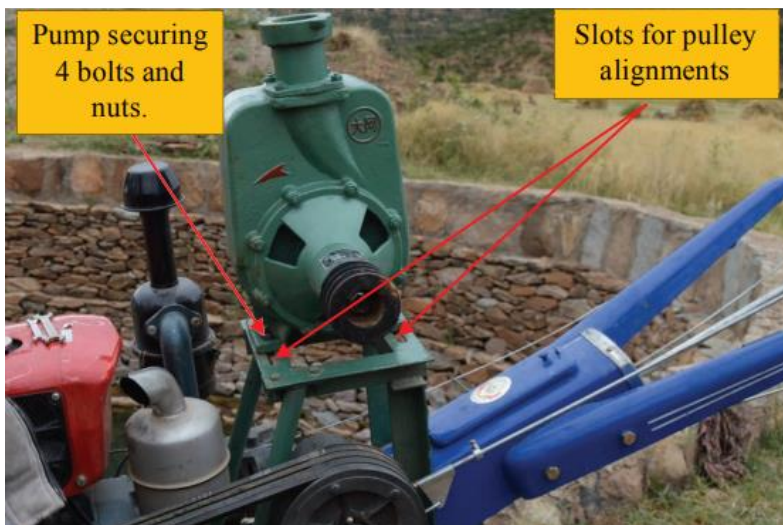
**Step 2:** Secure the pump support base with three bolts that you removed from the walking tractor below when viewed from the front top of the walking tractor



**Installing the pump support in the walking tractor viewed from the top**

**Step 3:** Install the pump on the pumping support by four bolts and nuts. Note that the pump pulley should be aligned with the engine pulley. Alignment of the two pulleys can easily be done by visual inspection and taking the pump support securing left and right slots. After ensuring that the two pulleys are aligned, tighten the nuts at a proper torque.

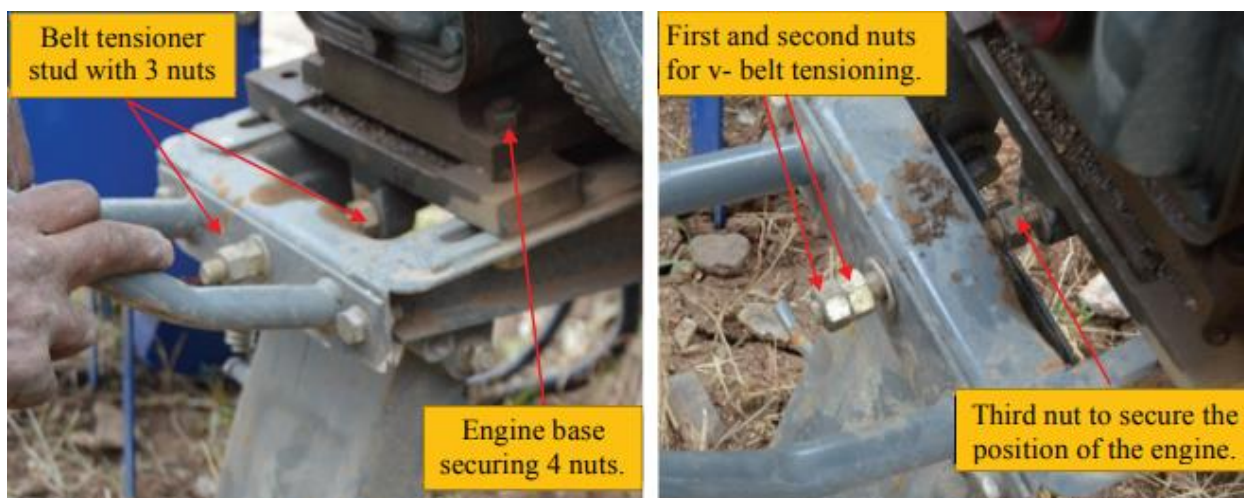
**Caution:** Note that bolts are placed up-side down as in the picture below.



**Install the pump on the pumping support**

**Step 4:** After the pump is installed properly, the next step is to remove the belts from the clutch to the walking tractor engine pulleys. This step involves tightening the engine belt tensioner and the engine base securing bolts as follows:

- First start by loosening the four engine base securing nuts. Caution: do not remove them yet, just loosen them until they are free from the base.
- Next, loosen the first and second nuts on the tensioner stud and then loosen the inner nut and tighten the second nut clockwise so that the engine will be pushed away from you. As a result, the three-engine v-belts will be loosened enough to be removed from the crankshaft pulley and clutch pulleys respectively



**Tightened (Left side) and Loosened engine belt tensioner (Right side).**

**Step 5:** Now after loosening the belts, the next step is to remove all three v-belts starting from the outer most to the middle and the inner v-belt. While rotating the engine with the manual starting lever, using a long flat screw driver put in the inner side of the v-belt. Slowly remove the v-belts one by one starting from the engine pulley and finishing with the clutch pulley. After inserting the new v-belt into the pulleys, secure the engine v-belt tensioner. Caution: Please exercise caution while removing the v-belts, as you may hurt your hands in the process.

Page 89 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1 April, 2023
----------------	--	---	--------------------------



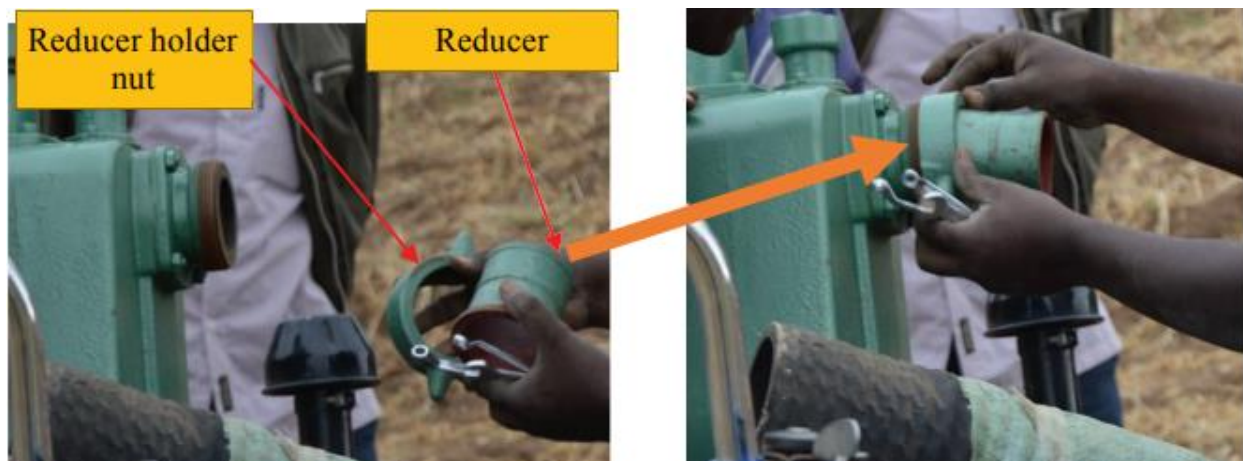
**Inserting a v-belt from the engine pulley side and then from the clutch pulley**

**Step 6:**

- Now all the necessary steps have been taken, what is left installing the discharge and suction pipes.
- Start with installing the suction pipe with tightening the reducer holder nut with your hand
- Then insert the suction pipe into the reducer. Caution: Tightening the reducer holder correctly is very crucial. If there is a leak, the pump will not work and will also lead to unnecessary and increased fuel consumption.
- Insert strainer at the end of the suction pipe and tighten the clamp properly with a flat screw driver.
- Similarly, install the elbow with its holder in the discharge side of the pump.
- Now secure the blue discharge pipe on the elbow and tighten the clamp with a screwdriver. Caution: Unless you tighten the clamp properly, there will be water leakage as soon as the pump starts working.
- Finally, stretch the discharge pipe without any bending along the line to avoid pipe damage and unnecessary pressure on the pump. This will also have an impact on the life of the pump.

Page 90 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			April, 2023





**Tightening the reducer holder while inserting the reducer in the suction pipe**

#### **Step 7:**

- The final step will be to fix a tripod for the sprinkler. Fix the tripod,
- Insert the discharge pipe at the center of the tripod and tighten the clamp properly with a screwdriver
- Remove the red plastic cover from the nozzle tip and install it at the top of the tripod carefully. • Insert the suction pipe end with the strainer into the well (water point),
- Fill water into the pump until it is full before starting to remove the air inside the suction side of the pipe. This process is called priming.
- Check and fill the fuel tanker with fuel, depending on the length of time the pump will be used
- Finally, start the engine and water your land area.

Page 91 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			April, 2023



**Removing the red plastic cover from the nozzle tip and installing it at the top of the tripod carefully**



**Inserting the suction pipe into the well (water point).**

Page 92 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1 April, 2023
----------------	--	---	--------------------------



**Check and fill the fuel tank with fuel**



**Check the pump and begin watering**

#### **4.3 Techniques of Calibration of seed drill**

##### **A. Tools and equipment**

- PPE, PC/TV or LCD, flipchart, marker for show video
- Walking tractor
- Seeder/planter
- Tool box (spanner, wrenches etc.)
- Meter
- Oil
- Fuel
- Water
- Hard copy of the operation manual
- Note book and pen

##### **B. Techniques**

- Determine the nominal width (W) of seed drill
- Find the length of the strip (L) having nominal width (W).
- Determine the number of revolutions (N) of the ground wheel of the seed drill required to cover the length of the strip (L)

Page 93 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1 May, 2023
----------------	--	---	------------------------



- Jack the seed drill so that the ground wheels turn freely. Make a mark on the drive wheel and a corresponding mark at a convenient place on the body of the drill to help in counting the revolutions of the ground wheel
- Fill the selected seed in the seed hopper or plastic bags. Place a container under each boot for collecting the seeds dropped from the hopper
- Set the seed rate control adjustment for maximum position and mark this position on the control for reference
- Engage the clutch and rotate the ground wheel for  $N = 10000/P \times D \times W$ , revolutions per minute
- Weigh the quantity of seed collected in the container and record the observation.
- Calculate the seed rate in kg/ha
- If the calculated seed rate is higher or lower than the desired rate of selected crop, repeat the process by adjusting the seed rate control adjustment till the desired seed rate is obtained.
  - ✓ Measure the ground wheel diameter ‘cm’
  - ✓ Measure the number of furrow openers
  - ✓ Measure distance between two openers ‘cm’
  - ✓ Perimeter of ground wheel  $P = \pi D$
  - ✓ Width of implement  $W = 1.2 \text{ m}$
- Let us use Diameter  $D = 40 \text{ cm}$
- Give one revolution to the ground wheel
- Area covered/revolution of ground wheel  
 $= \pi DW$
- Recommended seed of wheat = 100 kg/ha.
- If number of furrows to be sown simultaneously, say 6.
- Find seed to be dropped by each furrow opener per revolution of ground wheel
- As this is not measurable quantity
- Calculate seed dropped in 200 revolutions

Page 94 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

#### **4.4 Techniques of adjusting reaper harvester**

##### **A. Tools and equipment**

- PPE, PC/TV or LCD, flipchart, marker for show video
- Walking tractor
- Reaper
- Harvested crop
- Tool box (spanner, wrenches etc.)
- Oil
- Fuel
- Water
- Hard copy of the operation manual
- Note book and pen

##### **B. Techniques**

- Check tension of reel belt. Reel by hand to ensure that the drive pulley key and belt are secured.
- Ad Reduce forward speed
- Correct the registration
- Sharpen the knife sections or replace if worn out.
- Check drives belt tension. If loose, tighten just height according to height of crop
- Remove twine and clean needle eyelet and pliers. Reduce tension on twine under the tension plate through fly-untighten the twine disc with the help of spring loaded screw-bolt provided for the purpose
- Adjust spring tension and smooth face of pliers by emmer paper. Use twine of uniform thiclmen
- Check the tension or the v-belt over the conveyor roller pulley.
- Tighten the canvas conveyor with help of the sum buckles provided
- Increase or decrease the size of bundles by increasing or decreasing the tension of trigger.  
For this the trigger spring is hooked on to different holes provided

Page 95 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

#### 4.5 Techniques of adjusting thresher/Sheller

##### A Tools and equipment

- PPE, PC/TV or LCD, flipchart, marker for show video
- Walking tractor
- Thresher
- Digital balance
- Tool box (spanner, wrenches etc.)
- Oil
- Fuel
- Water
- Hard copy of the operation manual
- Note book and pen

##### B. Techniques

- Set machine horizontally
- Select correct drum speed (see chart depending on the design of thresher/Sheller)
- Set concave in correct position (normally in the middle) if dry, and very mature in maximum opening and if wet and not mature in minimum position
- Set air direction properly (light material levers up, heavy material levers down.)
- Adjust top sieve (opening equal to length of seed or 1.5 times diameter round seed). (Optional: depending on the type of thresher/Sheller)
- Select proper bottom sieve
- Adjust chaff plate shield

Page 96 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

#### **4.6 Steps for hitching walking tractor to a drawbar:**

##### **A Tools and equipment**

- PPE, PC/TV or LCD, flipchart, marker for show video
- Walking tractor
- Implements
- Tool box (spanner, wrenches etc.)
- Oil
- Fuel
- Water
- Hard copy of the operation manual
- Note book and pen

##### **B. Techniques**

- Position the tractor to align the hole in the drawbar with the hole in the implement hitch.
- This is called spotting. You may need to practice this skill.
- Stop the engine, put the tractor in park, or set the brakes.
- Attach the implement using the proper-sized hitch pin and security clip.
- Raise the implement jack stand and remove chock blocks from the wheels.
- Connect the PTO shaft, hydraulic hoses, and/or electrical connections as required. Refer to the appropriate task sheets on these subjects.

Page 97 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

Lap test-4	Performance Test
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Name..... ID..... Date.....

Time started: \_\_\_\_\_ Time finished: \_\_\_\_\_

**Instructions:** Given necessary templates, tools and materials you are required to perform the following tasks within 25 hour. The project is expected from each student to do it.

Task-1 Mount seed Planter to walking Tractor

Task-2 Assemble self-prime water pump

Task-3 Calibrate seed drill

Task-4 Adjust Reaper harvester

Task-5 Adjust thresher/Sheller

Task-6 Hitch walking tractor to a drawbar

Page 98 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

**LG #16**

## **LO #5- Undertake agricultural work using walking tractor**

### **Instruction sheet 5**

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Fitting selected attachment for the required agricultural work
- Carrying out the required adjustments to meet the desired job performance requirement
- Following driving speed and clearance of attachment
- Potential risk when turning, driving at speed and rough terrain
- Code of practice for driving agricultural machinery on public road
- Common methods of securing a load

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Fit selected attachment for the required agricultural work
- Carry out the required adjustments to meet the desired job performance requirement
- Follow driving speed and clearance of attachment
- Identify potential risk when turning, driving at speed and rough terrain
- Adhere ode of practice for driving agricultural machinery on public road
- Demonstrated common methods of securing a load

Page 99 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

## Information Sheet 5

### 5.1 Fitting selected attachment for the required agricultural work

#### Agricultural crop work

- Land preparation
- Planting and seeding system
- Irrigation work operation
- Harvesting system
- Threshing
- Transportation

#### A) Land preparation

##### i) Mould board plough

The two bottom reversible plough is a unique implement, which is directly mounted to the tractor. This is a hydraulically /mechanically operated basic implement for preparation of land. It is very useful for primary tillage in hard and dry trashy land. The Mold Board retain their mirror finish at all-time contributing to well-turned furrows. The plough has special wear resistant steel bottoms with bar points for toughest plough jobs. Bar point bottom ensures longer life as it can be extended or reversed. The mold board bottom reversing mechanism is operated by a lever provided on the distributor. When the implement is hitched, plough bottom is free to rotate 180 degree along the axis of the hollow shaft.



Page 101 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



**Figure 5:1 Mould board plough**

**Source:** <https://i.ytimg.com/vi/9vKoiPR8bb0/hqdefault.jpg>

**i) Disc plough**

The machine is completely mounted with walking tractor, during operation, it is suitable for operation on the field with grasses, straw and stems of crops or plants, big soil resistance and with many stones and brickbat, etc in the field. It is good at cutting the grasses and straw and free from stopped by the grasses, soil or stones, etc. It is efficient in the work it's good quality during operation. It is easy to adjust and strong.



**Figure 5:2 Disc plough walking tractor**

**Source:** <https://encryptedtbn0.gstatic.com/images?q=tbn:ANd9GcSBHNsKqAlMAo4t7pJn3t62-OjZXKFx2EeuXzJs3AdEUGPNBetwfdWPCCo1VcjA0S8lls&usqp=CAU>

**ii) Power Tiller**

Power Tiller is a two-wheeled agricultural implement fitted with rotary tillers, disk harrow, moldboard plough, trailer, water pump and chisel for easing farm operations. It can complete 1ha per day by one operator in about two hours. This will vary depending on the climatic conditions, soil types, soil moisture content, stamina and experience of the operator. Fuel consumption is about 15 liters per ha. Though varies with the technical ability of the operator.

Page 102 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



**Figure 5:3 Power tiller**

**Source:**[https://img.diytrade.com/cdimg/1238463/13720949/0/1280735050/DF-151L\\_power\\_tiller.jpg](https://img.diytrade.com/cdimg/1238463/13720949/0/1280735050/DF-151L_power_tiller.jpg)

### **Critical factors to consider during land preparation**

- Availability and quality of irrigation water;
- Field selection;
- Mechanical actions to be implemented;
- Chemical needs for pre-plant soil improvement;
- Tools and equipment needed for date cultivation;
- Labor needs;
- Irrigation design and installation;
- Leaching schedule;
- Hole preparation;
- Financial requirements and
- Time schedule.

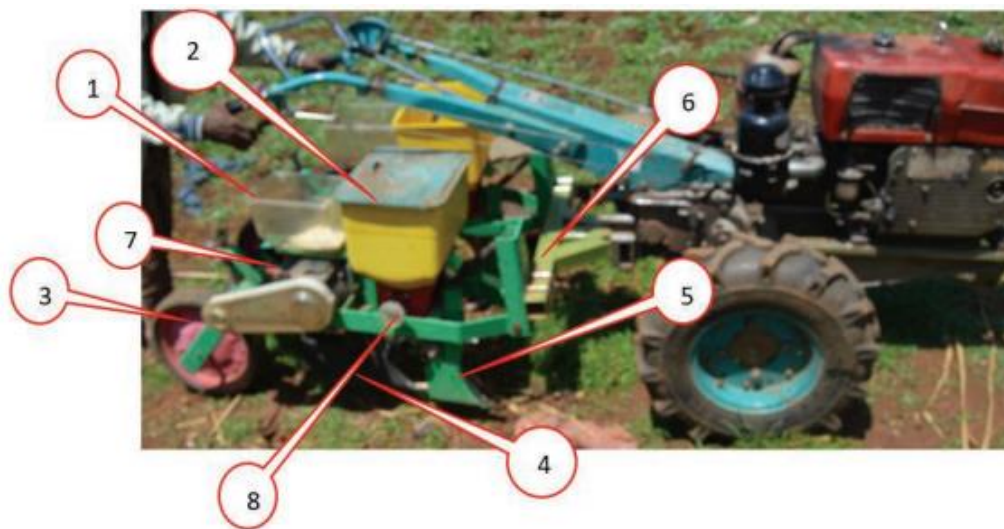
Page 103 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

## B) Seeding operation system

### Major components and their description of seeder

For proper maize planting, it is important to understand each part of the planter and their function properly. This zero till maize planter consists of seed hopper, fertilizer hopper, seed metering units, and furrow opener, toolbar and drive wheel.

- 1: Seed hopper,
- 2: fertilizer hopper,
- 3: drive wheel,
- 4: furrow opener for seed,
- 5: furrow opener for fertilizer,
- 6: toolbar,
- 7: metering unit speed adjusting gearbox.



**Fig 5:4. Major parts of maize planter**

**Source:**<https://repository.cimmyt.org/xmlui/bitstream/handle/10883/22432/65930.pdf?sequence=1&isAllowed=y>

Page 104 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

**The seeding operation includes:**

1. Plant spacing
2. Time of planting
3. Transplanting stage
4. Planting time and depth
5. Basin preparation
6. Mulching
7. Irrigation
8. Protection
9. Aftercare etc.

**Operation system**

This particular walking tractor attached planting machine operates with the power obtained from the rotation of sprocket mounted on the wheel drive. As the tractor starts to move forward, the sprocket on the wheel Seed metering mechanism and its components. The sprocket on the wheel drive is connected to three different sprockets on seed metering shaft, fertilizer metering shaft and gearbox attached on the seed metering unit through a chain. Then, the shaft on the seed metering unit, fertilizer metering unit and gearbox will rotate, which intern rotates the inclined seed metering plate, fertilizer fluted roller and seed metering unit gears in the gearbox, leading to the seed and fertilizer metered to be delivered into the seed and fertilizer outlet



**Figure 5:5 Seeding operations**

Page 105 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

**Source:**[https://sc01.alicdn.com/kf/H1a634192e53d47deb970c83cb74aacfcC/234902868/H1a634192e53d47deb970c83cb74aacfcC.jpg\\_.webp](https://sc01.alicdn.com/kf/H1a634192e53d47deb970c83cb74aacfcC/234902868/H1a634192e53d47deb970c83cb74aacfcC.jpg_.webp)

### C) Irrigation work operation

#### Pump parts & Definitions

**i) Pump housing:** Pump housing is the main body of the water pump, which creates pressure to suck from the water point and discharge at the desired place.

**ii) Pump supporting frame:** Pump supporting frame is the frame structure specially made to support the pump on top of the walking tractor.

**iii) Strainer (dirt filter):** It is a plastic strainer used to filter dirt during the suction process from the water point.

**iv) Discharge hose:** Discharge hose is a hose made of hard plastic material used to transport the sucked water to the desired place.

**v) Sprinkler nozzle:** Sprinkler nozzle is a nozzle made from cast iron which can add more pressure to the sucked water by reducing the size of the water droplets and producing a splashing effect while the water is getting out of the discharge hose via the sprinkler.



Page 106 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



**Figure 5:6. Complete set of walking tractor attached water pump**

Source: <https://repository.cimmyt.org/xmlui/bitstream/handle/10883/22432/65930.pdf?sequence=1&isAllowed=y>

### **Irrigation work operation**

A portable two-wheel tractor driven pump is small in volume, light in weight, good in performance, easy in operation and maintenance. It is also reliable and widely used in agricultural irrigation, drainage, mines, construction sites and daily water supply systems.



**Figure 5:7 Irrigation work operation**

Source: [https://img.agriexpo.online/images\\_ag/photo-mg/170572-16047570.webp](https://img.agriexpo.online/images_ag/photo-mg/170572-16047570.webp)

### **D) Harvesting system**

A front mounted vertical conveyor reaper is the most common reaper, to harvest wheat and paddy crops. It can also be used for harvesting of soybean and other similar crops. Engine operated reaper can be operated with a 5-6 hp engine; whereas, tractor operated reapers can be operated with 25-35 hp tractor. Width of cut is about 1.6 m in power tiller reaper, and about 2.05 m in tractor operated reapers. Stroke per min of cutter bar is 1225 and 1550 in case of power tiller and tractor operated reapers, respectively. Power tiller and tractor-front mounted vertical conveyor reaper windrower can cover about 0.2 ha/h and 0.4 ha/h, respectively.

Page 107 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



**Figure 5:8 harvesting operation system**

**Source:**<https://tiimg.tistatic.com/fp/1/002/924/4gk100-walking-tractor-mini-harvester-and-paddy-rice-reaper-and-bundler-212.jpg>

#### **E) Thresher/Sheller operation system**

Threshing and shelling of crops are among the most important agricultural operations, but are also time consuming and labor-intensive. It is estimated that harvesting and threshing of crops consume about one third of the total requirement of the production process. The total labor requirements for harvesting/threshing of cereals/pulses vary from 120-200 man-hours per hectare.

**Threshing** is the process of separating the grain from the crop/chaff/pod/nut by applying mechanical force that creates a combination of impact, shear, and/or compression. The operation of separation refers to separating threshed grains from bulk plant material such as straw.

**Shelling** is threshing action by cutting coupled with rubbing action in such as case we call the process of separating the grain from a cob. Maize is one of the most important staple crops in Ethiopia. Lack of appropriate maize shellers is one of the major constraints affecting maize production, both in terms of quantity and quality. Farmers shell the bulk of the maize using the traditional method of beating on the bare ground or loosely packed in sacks.

Page 108 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

## Parts of thresher

- 1) Threshing drum
- 2) Belt driving thresher
- 3) Threshed grain outlet
- 4) Feeding Tray
- 5) Powering thresher



**Figure 5:9 Thresher/Sheller parts and Operation system**

## F) Transportation

The trailer coupled with a two-wheel tractor is one of the conveyances used by farmers. But in terms of ergonomics, the use of trailer and two-wheel tractor is not ergonomic. The operation of two-wheel tractor handlebar with trailer has disadvantages that occur when the tractor turns. The tractor handlebar will move away from the operator when turning, while the trailer has not turned. This results in reduced steering control by the operator.

Page 109 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



## The working motion of operating a two-wheel tractor with a trailer

The elements of work related to the operation of two-wheel tractor with trailer for transportation are of three types, namely:

- a. Straight motion:** this movement shows that the trailer with a two-wheel tractor runs straight with the operator's position sitting on the front of the trailer and both hands are on the handlebars of a two-wheel tractor. In this position the operator does not experience flexion in the neck. While the back, knees, shoulders and elbows are flexed in a safe zone based on the Range of Motion table
- b. Turning movement  $\leq 45^\circ$ :** this motion shows that the two wheel tractor turns at an angle of holds the handlebar, one example is when the tractor wants to turn left at an angle of  $45^\circ$ : this motion shows that the two-wheel tractor turns at an angle  $> 45^\circ$  and the trailer follows the tractor's movements of tractor.
- c. Turn  $> 45^\circ$ :** this motion shows that the two-wheel tractor turns at an angle  $> 45^\circ$  and the trailer follows the tractor's movements. At this position, the operator tends to lower his legs fatigue / road because the turning radius is too large so that the hand is not able to reach when the operator's position is still in a sitting position on the front of the trailer.



**Figure 5:10 operating a two-wheel tractor with a trailer**

Page 110 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1 May, 2023
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**Source:**<https://c8.alamy.com/comp/DW4WM5/farmers-using-a-two-wheel-tractor-to-transport-rice-straw-in-vientiane-DW4WM5.jpg>

## **5.2 Carrying out the required adjustments to meet the desired job performance requirement**

### **5.2.2 Adjusting and calibration row spacing**

Row spacing need to be adjusted according to agronomic recommendations and depending on the type of crop to be sown. Add or remove number of furrow openers with seed delivery pipes. In the case of drilling, shut off the metering inlets with a rectangular transparent plastic provide with the machine. Simply rotate the screw clockwise so that it will firmly close. Removing the fertilizer delivery pipes may not necessarily close the system. A plastic masking tape may be needed to firmly close the inlets of both fertilizer and seed metering system. Caution: Check whether the openings are firmly closed to avoid wastage of seed and fertilizer.

### **5.2.2 Adjusting depth of planting**

Depth of planting is adjusted by increasing or decreasing the height of the furrow opener. Determine the number of rows (from agronomic recommendations for the seed to be sown), for example if we are going to sow a wheat (let us say the depth of planting is 3 cm) install all the four furrow openers supplied with the planter. If the seed is maize and depth of planting is 5 cm, remove the two central furrow openers and measure the distance between the remaining furrow openers and adjust if necessary. Loosen the four U- bolts for each furrow opener, increase or decrease the vertical spacing depending on the agronomic recommendation of the crop to be sown. Finally run the VMP and fine tune the results according to the recommended values.

### **5.2.4 Calibrating seed and fertilizer rate**

First, change the seed meter setting to suit the type of seed to be sown/drilled. For large seeds and spaced crops (maize, etc.) the large flute setting should be used. Attach transparent polythene bags to each of the six seed delivery tubes,

Page 111 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



**Figure 4:27 attaching transparent polythene bags to each of the six seed delivery tubes.**

**Source:** <https://knowledgeplatform.hellotractor.com/wp-content/uploads/2020/02/EIAR-CIMMYT-operator-training-manual.pdf>

The seed drill should be operated on a pre-measured 50 meter (m) travel distance with a sowing width of 1 m, thus providing a 50 m<sup>2</sup> area. After every 50 m linear distance run, collected seeds and fertilizers in transparent polythene bags should be weighed separately using calibrated digital scale and the total seed weight should be also noted.

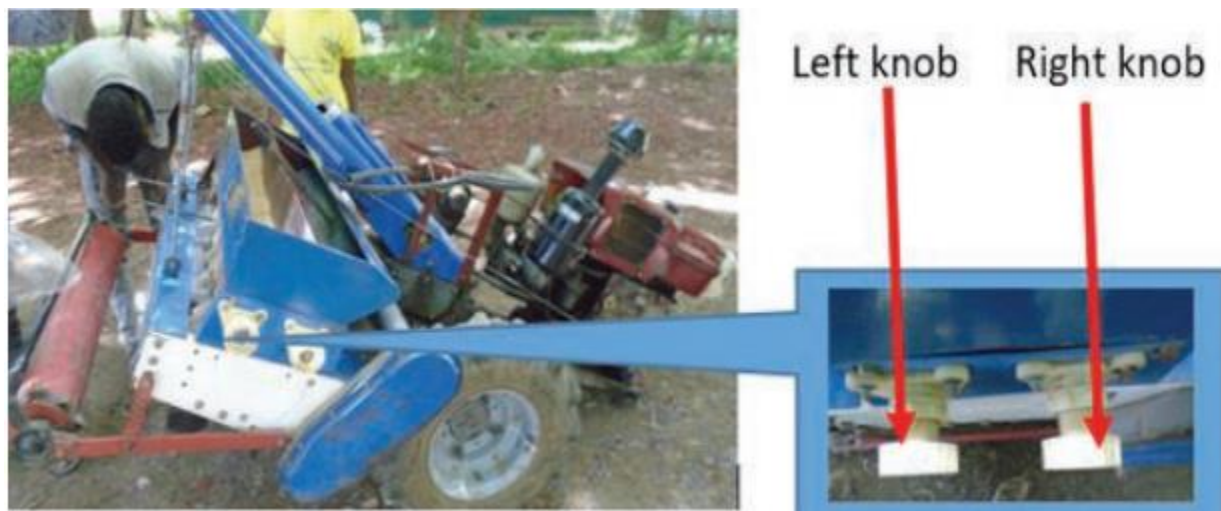


**Figure 4:28. Weighting collected seeds separately.**

**Source:** <https://knowledgeplatform.hellotractor.com/wp-content/uploads/2020/02/EIAR-CIMMYT-operator-training-manual.pdf>

Page 112 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1 May, 2023
-----------------	--	---	------------------------

This method should be repeated by turning the knobs to either increase or decrease the opening of the fluted roller until the desired seed rate is obtained. there are two adjusting knobs, in which the left one is used to adjust the opening of the seed fluted roller metering unit, while the right adjusting knob is used to adjusting fluted roller fertilizer opening. Since the seed metering device is connected by a chains pocket arrangement to the walking tractor wheel axle, the speed of the tractor should not be a factor in calibration, unless there is wheel slippage. Repeat this method by turning the knobs to either increase or decrease the opening of the fluted roller until the desired seed rate obtained. Once the desired rate is obtained; fix the knobs at right position and replicate the test run three times



**Figure 4:29 Seed and fertilizer rate adjusting knob.**

**Source:** <https://knowledgeplatform.hellotractor.com/wp-content/uploads/2020/02/EIAR-CIMMYT-operator-training-manual.pdf>

#### **5.2.4 Adjustment on Mounting the Planter to Two-Wheel Tractor**

- Before mounting the planter, select a leveled surface. At least three persons are required to carry and mount the planter on two-wheel tractor.
- Two persons (one on the left and one on the right) carry and mount the planter.
- Align the tractor drawbar pull cover and the planter tool bar hole.

Page 113 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

- Slightly lower and raise the two-wheel tractor until the hole is aligned.
- If the hole on the draw bar pull cover is aligned with the three holes on the tool bar, insert the middle pin first and then insert the rest two pin respectively.
- Insert the cotter pin in each pin.

#### 5.2.4 Adjustment with Starting and Running a Thresher/Sheller

- Ensure that all the security bolts on the concave are tightened down and the concave is snug.
- Rotate the threshing drum by hand to make sure that there are no restrictions to rotation.
- Step 3: Insert the belt to the pulley in the drum and on the engine.
- Make sure that the belt is aligned to avoid belt slipping.
- Start the engine with a cranking button/key (depending on the method of starting for different engines)
- Slide the engine with handle pulley up on the slide to tension the belt (remember to only tension the slack side of the belt) and make sure that the belt is seated properly in all pulleys and is not rubbing on anything. All set screws on the pulley should be tightened and the nuts on the idler should be wrench tightened. (Caution: un-tightened pulley may fly and can cause serious fatal injuries).
- After the engine is started, lower the speed to idle speed for 3-5 minutes for warming up.
- Now the engine is warmed up, gradually increase the speed (RPM) and insert the threshed/unshelled material through the inlet of the thresher/Sheller.
- Check the outlet and take a sample to see whether the thresher/Sheller is working properly i.e. there is no breakage and no un-threshed grain. If there is un-threshed /unshelled grain slowly increases the speed (rpm) and repeat until you get threshed grain. If there is breakage, reduce the speed so that the breakage will be avoided.

**Note:** Breakage is not only due to higher speed but it may be due to over dried un-threshed harvest.

Page 114 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



### **5.3 Following driving speed and clearance of attachment**

#### **5.3.1. Effect of loading and driving speed**

Increasing tractor speed in the forward driving system increased tractor wheel slips and soil compaction. In addition, increasing soil moisture content resulted in an increase in soil compaction, and this event was intense in fine soils like clay loam.

Pulling a load with the downward and rearward force above the tractor's center of gravity will result in a rear overturn. You must hitch only to the drawbar to prevent the tractor from rearing up and turning over. Even small lawn and garden-size tractors can flip rearward if not properly hitched to a load.

The effect of forward tractor speed and depth of plough in some technical indicators and physical properties of soil in Loam soils in. Two factors were studied, depths of plough and the practical speed of the tractor and their effect on some of the studied technical indicators, including the practical and theoretical field capacity, the slide percentage, the percentage of porosity, the volume of disturbed soil, the soil particles with less than 5 cm in diameter and practical productivity.

#### **5.3.2. Effect of hitching position**

Always fit attachments to your tractor according to the manufacturer's instructions.

- When attaching equipment, only use the mounting points or the draw bar provided by the manufacturer, do not use improvised methods
- Do not alter, modify, or raise the height of the draw bar outside of adjustments made by the manufacturer
- Never hitch above the centerline of the rear axle, around the axle housing, or to the top link pin
- When a power implement is attached, ensure all guards are in place before operating
- Do not attempt to adjust or work on implements while they are in motion
- Do not use or attach implements unless the power shaft or power take-off shaft is guarded

Page 115 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

## **5.4 Potential risk when turning, driving at speed and rough terrain**

### **5.4.1. Walking Tractor's Start, Shift and Turn**

Normally, walking tractor is able to run after warming the machine. When starting the tractor, lift up the front support frame, do not hold the steering handle, instead, and sway the hand support frame from left to right until the pendulum stops. Then adjust the clutch brake handle to the “OFF” position, push the shift lever and put it in the desired gear.

Then the clutch lever should be adjusted to the “CLOSE” position so that the 18 HP walking tractor will start to move. While moving, the driver can control the throttle according to the load. At this point, start process is done. So, how to shift gears? When the load or the road condition changes while driving, it needs to adjust the traction or speed in time.

To achieve this, shifting is required. It is important to note that before doing the shift operation, the clutch brake handle should be pulled to the “OFF” position quickly. And put the shift lever to the desired position, left is the low gear, right is the high gear. Gradually work with clutch, 18 HP walking tractor will be able to get the corresponding speed.

When changing the direction, it is usually done by turning the steering wheel to the left and right. Bear in mind that, when making the turn, you should first reduce the throttle and reduce the speed. Generally speaking, push the right steering handle then turn right, left steering handle to turn left.

### **5.4.2. Working on slopes with a gradient higher than 40% or in uneven terrain**

On slopes with a gradient of over 40% or in uneven terrain, the device can slip or tip over; the danger zone is extended by the possible slipping or tipping area of the machine. Select the correct tires: Twin tires, additional iron slope wheels, spiked roller. Use the maximum possible track and axle width. Check the tire pressures. It is compulsory to wear sturdy, closed shoes with gripping soles. Work with crampons if necessary.

Page 116 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

Keep persons clear of the danger area. Adapt your working speed to the surroundings. Keep a constant watch on the lie of the terrain. Pay attention to the weather- increased risk of accident in wet weather Only authorized persons may work with the walking tractor. The minimum age for operators is 16 years. Operating permit and driving license are required (in some countries) for single-axle traction and working machines guided by pedestrians via steering shafts. The operator is responsible for the safety of third parties in the working area.

- **Housekeeping**

- ✓ Clean away any foreign material, debris from in and around the motor, tines and guards.
- ✓ Keep the work area and implement shed in a clean and tidy condition.

- **Potential hazards**

- ✓ Noise
- ✓ Flying debris
- ✓ Trip hazards
- ✓ Foot injuries
- ✓ Entanglement

## **5.5 Code of practice for driving agricultural machinery on public road**

### **A) Code of Practice**

- This Code of Practice is a legal document issued by Department for Transport, Energy & Infrastructure (DTEI) under a Notice in the South Australian Government Gazette, titled ‘Transport of Agricultural Vehicles Carried as a Load’. It sets out the conditions under which you can transport oversize agricultural implements and agricultural machines as loads that are not normally allowed general access to roads.
- This Code replaces the requirements of the Road Traffic (Oversize or Over mass tractor Exemptions) Regulations 1999 when you are transporting oversize agricultural machines and implements.

Page 117 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



- This Code enables you to know what you can do, how you can do it, and what the law requires of you.
- You must also comply with any registration conditions specified for your vehicle.
- You commit an offence if you do not comply with any of the conditions in this Code when transporting an oversize agricultural tractor as a load on the road.
- You must carry this document, or a legible copy, when transporting an oversize agricultural machine or implement.

#### **B) Agricultural tractor’ can be carried under this Code**

- For the purposes of this Code, an ‘agricultural vehicle’ is an agricultural machine or implement that:
  - ✓ Cannot be divided without great difficulty, expense or risk of damage; and,
  - ✓ Cannot be carried on any tractor or combination of tractor without exceeding any of the general access dimension limits for length, width and height
- Due to the nature and use of agricultural machines and implements, the following may also be transported under this Code:
  - ✓ Combinations of agricultural tractor, machines or implements connected and operated by hydraulic hoses, drive shafts, or other couplings;
  - ✓ Header with its comb detached can be transported together on the same vehicle

#### **Explanatory Note**

Examples of oversize agricultural machines and implements covered by this Code include:

- ✓ Harvester;
- ✓ Tractor and air seeder combination;
- ✓ Conveyor or auger

Page 118 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

### **C) Types of tractor use to carry these loads**

- You can operate under this Code when carrying loads using:
  - ✓ Articulated tractor (prime mover and semi-trailer);
  - ✓ Rigid tractor; or
  - ✓ Rigid tractor and one trailer.

### **D) Time to use code**

- You use this Code when your vehicle and load exceeds any of the following general access Tractor dimensions:
  - ✓ 2.5metres wide;
  - ✓ 4.3metres high; or
  - ✓ 19metres long for an articulated Tractor

### **Explanatory Note**

There is no exemption from the overall length requirement of 12.5 meters for a rigid Tractor

### **E) Tractor which not transport agricultural machines**

- You cannot use the following tractor for transporting agricultural machines or implements:
  - ✓ Tractor, either being driven or towed, that were not built to carry loads;
  - ✓ Tractor that permanently exceed 2.5 meters wide, and/or 4.3 meters high, and/or 12.5 meters long for a rigid Tractor and 19 meters long for an articulated Tractor
  - ✓ Tractor of variable size that cannot be restored to 2.5 meters or less in width, 4.3 meters or less in height, and 19 meters or less in length for an articulated Tractor

If your proposed haulage operation does not comply with this Code of Practice, you must apply for a separate, individually-issued exemption (known as a permit). Applications for permits are assessed by DTEI, which will issue the appropriate permit if your proposed operation complies with the guidelines for the transport of oversize agricultural machines and implements.

Page 119 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

## 5.6 Common methods of securing a load

Losing cargo on the road is serious business. First of all, it's a loss: whatever falls is spilled, damaged, or destroyed. Falling cargo can cause direct or indirect human injury and destruction of personal property. There may be environmental impacts if a fallen chemical contaminates surface water; and if your insurance doesn't cover the cost of remediation, you have to pay for cleanup and restoration. The proper loading, positioning, and securing of cargo on a truck or trailer can prevent accidents in transit. But you must always select the right tie-downs for the job and use them correctly. How the right tie-downs, placed correctly, can secure cargo carried on farm and commercial trucks and trailers.

### 5.6.1 Common Methods of Cargo Securement

Manufacturers offer a variety of tie-downs, blocks, braces, etc., for securing cargo, but tie-downs are the most frequently used. Tie-down assemblies may consist of rope, chain, cable, or webbing as well as ratchets, binders, bolts, or hooks. The most important criteria are strength and durability, and tie-downs are rated to aid your selection process. Never base your selection on price: a few dollars saved may result in very expensive road debris if the tie-downs prove inadequate for the job.

**Chains:** Chains offer the advantage of durability and strength. Their main drawbacks are weight and the potential to physically damage cargo. Steel chains are graded to industry standards based on their intended use: securing a load or lifting cargo.

**Web Straps:** Web straps are popular tie-downs used by multiple industries. They can be used to secure equipment, pallets of cargo, or individual items. Compared to steel chains, they are lighter, easier to handle, and less likely to damage cargo. However, rough edges or surfaces can cut or abrade the webbing.

**Wire Ropes:** Wire ropes (cables) consist of multiple bundles (strands) of metal wires twisted around a core of steel or synthetic fibers such as polypropylene. They are lighter than chains, more durable than webbing, and less expensive than either

Page 120 of 153	Ministry of Labor and Skills	Agricultural Machinery and Equipment Operation	Version 1
	Author/Copyright	Level -II	May, 2023

Self-check 5	Written test
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Name..... ID.....Date.....

Time started: \_\_\_\_\_ Time finished: \_\_\_\_\_

**Directions: Answer all the questions listed below**

**Test I: Choose the best answer (2 point)**

- 1) Which one is not agricultural crop work?
  - a) Land preparation
  - b) Transportation
  - c) Threshing operation
  - d) Swimming
- 2) From the following which one is seeding operation?
  - a) Plant spacing
  - b) Transplanting stage
  - c) Irrigation
  - d) all
3. One of the following is not safe starting and stopping
  - a) Remove the starting key when the tractor is not in use
  - b) Do not step down from a moving tractor
  - c) Park a tractor on a steep slope
  - d) Start the tractor from the driving position and not from the ground
- 4) Which one is critical factor to consider during land preparation?
  - a) Field selection
  - b) Irrigation design and installation
  - c) Availability and quality of irrigation water
  - d) Leaching schedule      e) all

Page 121 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1 May, 2023
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- 5) Which one are Potential hazards
- a) Noise
  - b) Foot injuries
  - c) Trip hazards
  - d) Flying debris
- 6) Which one is used for cargo Securement?
- a) Tie-downs
  - b) Blocks
  - c) Braces
  - d) all

### Test II: Short Answer Questions

- 1) Write seeding operation system
- 2) Write operating step of walking Tractor driven water pump
- 3) Write Harvesting operation system
- 4) Write safety precaution of agricultural crop work
- 5) Explain code of practice for driving agricultural machinery on public road

Page 122 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

## Operation Sheet -5

### 5.1 Method of adjustment on mounting the planter to two-wheel tractor

#### A. Tools and equipment

- PPE, PC/TV or LCD, flipchart, marker for show video
- Walking tractor
- Planter
- Tool box (spanner, wrenches etc.)
- Oil
- Fuel
- Water
- Hard copy of the operation manual
- Note book and pen

#### B. Methods

- Before mounting the planter, select a leveled surface. At least three persons are required to carry and mount the planter on two-wheel tractor.
- Two persons (one on the left and one on the right) carry and mount the planter.
- Align the tractor drawbar pull cover and the planter tool bar hole.
- Slightly lower and raise the two-wheel tractor until the hole is aligned.
- If the hole on the draw bar pull cover is aligned with the three holes on the tool bar, insert the middle pin first and then insert the rest two pin respectively.
- Insert the cotter pin in each pin.

Page 123 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

## 5.2 Methods of calibration and adjusting row spacing

### A Tools and equipment

- PPE, PC/TV or LCD, flipchart, marker for show video
- Walking tractor
- Seeder/planter
- Seed
- Digital balance
- Fertilizer (organic or inorganic)
- Meter (30-50 meters length)
- Tool box (spanner, wrenches etc.)
- Oil
- Fuel
- Water
- Hard copy of the operation manual
- Note book and pen

### B. Techniques

- Row spacing need to be adjusted according to agronomic recommendations and depending on the type of crop to be sown.
- Add or remove number of furrow openers with seed delivery pipes. In the case of drilling, shut off the metering inlets with a rectangular transparent plastic provide with the machine.
- Simply rotate the screw clockwise so that it will firmly close. Removing the fertilizer delivery pipes may not necessarily close the system. A plastic masking tape may be needed to firmly close the inlets of both fertilizer and seed metering system. Caution: Check whether the openings are firmly closed to avoid wastage of seed and fertilizer.
- Width of planting is adjusted by increasing or decreasing the width between furrow openers.
- Determine the number of rows (from agronomic recommendations for the seed to be sown), for example if we are going to sow a wheat (let us say the row spacing is 20 cm) install the four furrow openers supplied with the planter. If the seed is maize and row spacing is 75cm,

Page 124 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

remove the two central furrow openers and measure the distance between the remaining furrow openers and adjust if necessary.

- Loosen the four U- bolts for each furrow opener, increase or decrease the horizontal spacing depending on the agronomic recommendation of the crop to be sown.

### **5.3 Methods of adjusting depth of planting**

#### **A Tools and equipment**

- PPE, PC/TV or LCD, flipchart, marker for show video
- Walking tractor
- Seeder
- Seed
- Digital balance
- Fertilizer (organic or inorganic)
- Meter (30-50 meters length)
- Tool box (spanner, wrenches etc.)
- Oil
- Fuel
- Water
- Hard copy of the operation manual
- Note book and pen

#### **B. Techniques**

- Depth of planting is adjusted by increasing or decreasing the height of the furrow opener.
- Determine the number of rows (from agronomic recommendations for the seed to be sown), for example if we are going to sow a wheat (let us say the depth of planting is 3 cm) install all the four furrow openers supplied with the planter. If the seed is maize and depth of planting is 5 cm, remove the two central furrow openers and measure the distance between the remaining furrow openers and adjust if necessary.

Page 125 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



- Loosen the four U- bolts for each furrow opener, increase or decrease the vertical spacing depending on the agronomic recommendation of the crop to be sown.
- Finally run the planter and fine tune the results according to the recommended values.

#### 5.4 Techniques of calibrating for seed and fertilizer rate

##### A. Tools and equipment

- PPE, PC/TV or LCD, flipchart, marker for show video
- Walking tractor
- Seeder/planter
- Seed
- Digital balance
- Fertilizer (organic or inorganic)
- Meter (30-50 meters length)
- Tool box (spanner, wrenches etc.)
- Oil
- Fuel
- Water
- Hard copy of the operation manual
- Note book and pen

##### B. Techniques

- Attach transparent polythene bags to each of the four seed delivery tubes.
- Operate the planter on a pre-measured 50-meter travel distance
- After every 50-meter linear distance run, collected seeds should be counted and fertilizers in transparent polythene bags should be weighed separately, using calibrated digital balance and the total fertilizer weight should be also noted.
- Repeat this method by varying the gears on the seed metering unit, fertilizer adjusting knob and seed rate adjusting/control lever until the desired rate is obtained.
- Check that all chains are well greased and are free for smooth operation.

Page 126 of 153	Ministry of Labor and Skills	Agricultural Machinery and Equipment Operation	Version 1
	Author/Copyright	Level -II	May, 2023

- Check that the clutch is free and working well.
- Check that all seed and fertilizer tubes are free and not blocked.
- Check that fertilizer fluted rollers are clean and free of all old, caked fertilizer and dust

## **5.5 Steps of adjustment with starting and running a thresher/Sheller**

### **A. Tools and equipment**

- PPE, PC/TV or LCD, flipchart, marker for show video
- Walking tractor
- Thresher
- Tool box (spanner, wrenches etc.)
- Oil
- Fuel
- Water
- Hard copy of the operation manual
- Note book and pen

### **B. Steps**

Step 1: Ensure that all the security bolts on the concave are tightened down and the concave is snug.

Step 2: Rotate the threshing drum by hand to make sure that there are no restrictions to rotation. Step 3: Insert the belt to the pulley in the drum and on the engine.

Step 4: Make sure that the belt is aligned to avoid belt slipping.

Step 5: Start the engine with a cranking button/key (depending on the method of starting for different engines)

Step 6: Slide the engine with handle pulley up on the slide to tension the belt (remember to only tension the slack side of the belt) and make sure that the belt is seated properly in all pulleys and is not rubbing on anything. All set screws on the pulley

Page 127 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

should be tightened and the nuts on the idler should be wrench tightened. (Caution: un-tightened pulley may fly and can cause serious fatal injuries).

Step 7: After the engine is started, lower the speed to idle speed for 3-5 minutes for warming up.

Step 8: Now the engine is warmed up, gradually increase the speed (RPM) and insert the threshed/unshelled material through the inlet of the thresher/Sheller.

Step 9: Check the outlet and take a sample to see whether the thresher/Sheller is working properly i.e. there is no breakage and no un-threshed grain. If there is un-threshed /unshelled grain slowly increases the speed (rpm) and repeat until you get threshed grain. If there is breakage, reduce the speed so that the breakage will be avoided.

Note: Breakage is not only due to higher speed but it may be due to over dried un-threshed harvest.

Page 128 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

Lap test-5	Performance Test
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Name..... ID..... Date.....

Time started: \_\_\_\_\_ Time finished: \_\_\_\_\_

**Instructions:** Given necessary templates, tools and materials you are required to perform the following tasks within 7 hour. The project is expected from each student to do it.

Task-1 Adjust seed planter mounting Walking tractor

Task-2 Adjust starting and running a thresher/Sheller

Task-3 Calibrate and adjusting row spacing

Task-4 Adjust depth of planting

Task-5 Calibrate seed and fertilizer rate

Page 129 of 153	Ministry of Labor and Skills	Agricultural Machinery and Equipment Operation	Version 1
	Author/Copyright	Level -II	May, 2023

**LG #17**

**LO #6- Complete walking tractor operation**

**Instruction sheet 6**

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Conducting Shut-down procedures
- Chocking wheels/ applying trailer parking brake
- Conducting post inspection
- Detailing and reporting malfunctions, faults, irregular performance or damage to tractor
- Maintaining tractor operational reports
- Cleaning, securing and storing tractor
- Cleaning and storing attachments

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Conduct Shut-down procedures
- Chocking wheels/ applying trailer parking brake
- Conduct post inspection
- Detail and report malfunctions, faults, irregular performance or damage to tractor
- Maintain tractor operational reports
- Clean, secure and store tractor
- Clean and store attachments

Page 130 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
1. Follow the instructions described below.
2. Read the information written in the information Sheets
3. Accomplish the Self-checks
4. Perform Operation Sheets
5. Do the “LAP test”

Page 131 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

## Information Sheet 6

### 6.1 Conducting Shut-down procedures

To stop walking tractor we have to be follow the following procedure

- Engaging clutch lever to the neutral position.
- Locating gear lever in neutral position.
- Disengaging drive to the digging knives by pulling the PTO lever backwards.
- Moving the engine stop lever to position ‘STOP’ which will result in engine stopping

### 6.2 Chocking wheels/ applying trailer parking brake

#### 6.2.1. Proper use, recommendations, & procedures for using wheel chocks

- ALWAYS chock wheels at the center point of the wheel. NEVER chock wheel at off-center or at an angle.
- Improper chocking can lead to the chock not working correctly and/or could lead to damage of the vehicle or even possible injury/death.
- ALWAYS position wheel chock against the wheel so that it is making contact.
- If chocking on an incline or decline, chock the wheels accordingly based on type of vehicle, weight, tire diameter/size etc. Consult full wheel chocking recommendations in this guide.
- ALWAYS consider the surface/terrain and environment around the vehicle. Soft “Soil”, wet, or slippery terrain can affect the usability of wheel chocks and/or cause a potential for failure.
- TIRE SIZES/GVW - Always consider the tire size and type of tire/wheel configuration. Radial vs. Biased Tires may require a different sized chock.
- Always consider the vehicles “Gross Vehicle Weight” (for “hauler” type vehicles, always consider “loaded weight”).
- Always use a minimum of (2) wheel chocks.

Page 132 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

### **6.3 Conducting post inspection**

#### **Post inspection part of walking tractor**

- Parking place
- Position of parking
- Cracked or broken parts
- Leaking or damaged hoses
- Conserve the engine (change the oil)
- Coverage of the tractor and its equipment
- Wheels Jack up
- All shields are in place
- Loose parts, bolts, or nuts
- Clean or not from any grease or mud
- Wheels and rims
- Fuel level, Oil level, Coolant and Belt etc.

### **6.4 Detailing and reporting malfunctions, faults, irregular performance or damage to tractor**

#### **Faults or irregular performance to tractor:**

- Failure to Start
- Gears failing to engage
- Low Engine Power
- Tractor will not turn
- Engine difficult to turn when starting
- Smoke coming from the Clutch thrust bearing
- Engine failing to cut when accelerator is pushed down
- Tractor keeps moving when the clutch is in neutral or park position
- Engine difficult to turn when starting etc.

Page 133 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



Below is a detailed table of most precautions one should take before using two wheel tractors and possible danger if there is no precaution

<b>Precaution</b>	<b>Possible danger or malfunctions, If no precaution</b>
<ul style="list-style-type: none"> <li>• When disconnecting the battery remove the negative terminal first, and when connecting, install the positive terminal first.</li> <li>• Use the recommended batteries only.</li> <li>• Do not reverse positive and negative terminals It may cause an electric shock, a burn and a fire</li> </ul>	It may cause an electric shock, a burn and a fire.
<ul style="list-style-type: none"> <li>• Maintain recommended tire pressure</li> <li>• Do not use ripped or worn out tires</li> </ul>	Over inflating the tire pressure may cause injuries from explosion
<ul style="list-style-type: none"> <li>• Check for any straws or alien substances from the engine, muffler, battery, and oil tank before starting the engine</li> </ul>	These may reduce the components' efficiency
<ul style="list-style-type: none"> <li>• When inspecting the tractor, disengage the covers or other implements safely.</li> <li>• Engage the covers or other implements properly after the inspection</li> </ul>	Touching the rotating parts for any reason can cause serious injury
<ul style="list-style-type: none"> <li>• When starting the engine, be sure to locate the main clutch lever and make sure it is in the OFF position and the shift lever in the neutral position.</li> </ul>	Mishandling of clutch or shift lever causes unexpected tractor movement that may result in accidents.
<ul style="list-style-type: none"> <li>• Do not make abrupt start, stop and a sharp turn.</li> </ul>	Tractor may overturn and cause injuries.
<ul style="list-style-type: none"> <li>• Stop operation of any attached farming implement while driving on farm or public</li> </ul>	

roads.	
<ul style="list-style-type: none"> <li>• Before driving the tractor in reverse, check to see that there are no obstacles around.</li> <li>• Hold the tractor handles tight to prevent it from rising when driving in reverse.</li> <li>• Do not reverse the tractor at high speed</li> </ul>	Due to rotation of the wheels, steering wheel tends to lift when driving in reverse
<ul style="list-style-type: none"> <li>• Keep away from hot engine.</li> <li>• Completely stop the engine for inspection and avoid touching the engine until it is cooled off</li> </ul>	Touching heated parts may cause a burn
<ul style="list-style-type: none"> <li>• Ensure tire pressure is sufficient before using the tractor</li> </ul>	Low pressure may cause instability and can be a safety hazard
<ul style="list-style-type: none"> <li>• Check bolts securing tires, engine and onto frame before starting.</li> <li>• Check belt pulley alignment</li> <li>• Check belt condition</li> <li>• Check oil and water levels</li> </ul>	<p>Loose bolts can cause injuries when the loosened part detaches from the tractor</p> <p>Belts may cause the tractor to jam and misfire.</p> <p>Water is an engine coolant, if low in levels it may cause overheating of engine.</p>

## 6.5 Maintaining tractor operational reports

### Maintenance schedules and procedures

Maintenance is the regular care done to machines to work well and prolong their life span. Maintenance is protecting machines so that they do not break down or wear out too quickly. In maintenance machines are protected from

Page 135 of 153	Ministry of Labor and Skills	Agricultural Machinery and Equipment Operation	Version 1
	Author/Copyright	Level -II	May, 2023

- Wear – Grease and oil are used to protect moving parts from wear.
- Dirt – Filters are used to catch and hold dirt before it gets inside and damage parts.
- Heat – The cooling system protects the machine from heat provided it has enough coolant and it does not leak.

### **Regular maintenance of the tractor will:**

Service your tractor regularly to ensure its reliable and safe operation. This includes checking the soundness of any rollover protective structure (ROPS).

Also:

- Reducing primitive tractor failures on the farm and therefore increases productivity.
- Saving on operation cost.
- Keeping the tractor in good operational condition.
- stopping the engine before servicing or greasing
- do not remove or replace belts while the pulleys are under power
- keep steps and working platforms free of grease and oil to avoid slips and falls
- changing wheels on flat surfaces only – before removing any wheel check the other wheels, avoid improvised lifting arrangements, use a wide-based jack of adequate lifting capacity, and when the tractor is jacked up block it up evenly for additional support
- ensure all the air pressure has been released before removing a tyre from the rim – use correct procedures and inflate tires in a cage (see Rim wheels – single-piece and multi-piece for further information)

Page 136 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

**Table 6:1 Two-wheel tractor (2WT) maintenance schedule**

	OPERATION	EVERY DAY (8Hrs)	EVERY WEEK (40Hrs)	EVERY MONTH (200 Hrs)	1000Hrs
<b>Engine</b>	Check engine oil level (10w/40) Replace engine oil	X	X		
<b>Gear box and controls</b>	Check gearbox oil level	X	X		
	Check nuts and bolts	X	X		
	Ensure clutch has free play		X		
	Check tyre pressure		X	X	
	Lubricate control cable/linkages		X		
	Check control cable operation		X		
	Change gearbox oil			X	
	Grease gearbox speed detent ball		X	X	
<b>Radiator</b>	Check water level	X	X		
	Replace water	When water level			

## 6.6 Cleaning, securing and storing tractor

### Cleaning and maintaining work area

A clean and organized work area is essential to any agricultural mechanics project. Knowing where to find tools, supplies and materials will save time and useful in maintaining the proper inventory of tools and materials.

### Storing walking tractor

If the machine is not be used for a long period of time it is advisable to take the following precautions:

- Empty the carburetor and fuel tank (refer to engine manual for details). Alternatively, add a fuel stabilizer.
- Empty the engine of oil.

- Petrol engine: lubricate the cylinder with a few drops of engine oil through the plug hole then turn the engine over several times without starting it.
- Diesel engine: remove the injector by unscrewing the two bolts which fasten it to the head and pour a little oil into the hole.
- Clean the engine and the machine thoroughly.
- When restarting checks that all security devices are working.

**Some positive indicators of a properly cleaned work place area are as follows:**

- Benches are cleared and clean,
- Machines are clean,
- Paint brushes and spray equipment are properly cleaned and stored,
- Solvents, paints and greases are properly stored,
- Tools are in their place,
- Lumber, metal and other construction materials are stored,
- Projects and other related materials are in approved places,
- Floor is clear and trash is in a container,
- Cabinets and storage areas are locked, and
- Every job is checked for completeness.

## **6.7 Cleaning and storing attachments**

- **Seed drill storage**

Before storing the seed drill for any length of time:

- ✓ Clean each part of the machine.
- ✓ Ensure seed and fertilizer boxes are completely empty.
- ✓ Reapply grease to the sprocket and chain.
- ✓ Store the seed drill in a dry, well-ventilated room.
- ✓ Keep the appropriate tools with the machine during storage to ensure that they will be available when needed again.

Page 138 of 153	Ministry of Labor and Skills	Agricultural Machinery and Equipment Operation	Version 1
	Author/Copyright	Level -II	May, 2023

- **Storage of a Water Pump**

- ✓ Drain any remaining water from the pump components
- ✓ Store water pump away from rain, high humidity and high temperatures to avoid development of rust on parts of the pump.
- ✓ Inspect periodically to check if the protection of the pump is adequate.
- ✓ Keep water pump dry and do not add oil/grease.

- **Storage of Threshers and Shellers**

- ✓ Do not expose the V-belt to acid or alkali substances.
- ✓ Remove the belt to clean debris.
- ✓ Open all parts of the machine to clean the internal debris.
- ✓ To maintain the balance of the wheel, clean the mud and straw of each driving belt.
- ✓ Store planters in dry places, away from rain or direct sun

Page 139 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

Self-check 6	Written test
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Name..... ID.....Date.....

Time started: \_\_\_\_\_ Time finished: \_\_\_\_\_

**Directions: Answer all the questions listed below**

**Test I: Choose the best answer (2 point)**

- 1) Which one is not shut down procedure of walking tractor?
  - a) Engaging clutch lever to the neutral position.
  - b) Locating gear lever in start position
  - c) Disengaging drive to the digging knives by pulling the PTO lever backwards.
  - d) Moving the engine stop lever to position 'STOP'
- 2) From the following which one is true bout Proper use, recommendations, & procedures for using wheel chock
  - a) Always chock wheels at the center point of the wheel
  - b) Always consider the surface/terrain and environment around the vehicle
  - c) Improper chocking can lead to the chock not working correctly
  - d) all
3. One of the following is not Post checklist of walking tractor
  - a) Leaking or damaged hoses
  - b) Coverage of the tractor and its equipment
  - c) Wheels Jack up
  - d) Pre operational check
- 4) Which one are malfunction and faults to tractor
  - a) Tractor will not turn
  - b) Smoke coming from the Clutch thrust bearing
  - c) Gears failing to engage
  - d) Engine difficult to turn when starting
  - e) all

Page 140 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1 May, 2023
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- 5) Which one is not true about walking tractor operation?
- When inspecting the tractor, disengage the covers or other implements safely.
  - Engaging the covers or other implements properly after the inspection
  - Making abrupt start, stop and a sharp turn.
  - Checking belt pulley alignment

### Test II: Short Answer Questions

- Write Post inspection of walking tractor
- List faults or irregular performance to tractor
- If there is no safety to operate walking tractor, next possible danger is comes, write that possible danger due to unsafely
- What is maintenance? Write uses of maintenances
- Write advantage of cleaning, securing and storing tractor and attachment

Page 141 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



## Operation Sheet -6

### 6.1 Methods of maintenance schedule of walking tractor

#### A. Tools and equipment

- PPE, PC/TV or LCD, flipchart and marker for showing video
- Walking tractor
- Attachments
- garage
- Grease
- Tool kit
- Oil
- Fuel
- Coolant
- Hard copy of the operation manual

#### B. Technical

- Review the operator's manual for recommended service.
- Maintain proper oil levels and lubrication of moving parts.
- Maintain the cutting edges on blades (not required on tiller tines).
- Replace the tiller tines when they are excessively worn or damaged.
- Properly tension or tighten all belts, drive shafts and connections.
- Inspect, adjust or replace all guards and safety features.
- Drain the fuel tank in a safe area and run the engine on idle until it stops, before storing the equipment for extended periods.
- Do not wear loose or ragged clothing. Dangling or frayed edges can get caught in moving parts

Page 142 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

## **6.2 Procedure to shut down walking tractor**

### **A. Tools and equipment**

- PPE, PC/TV or LCD, flipchart and marker for showing video
- Walking tractor
- Attachment
- Tool kit
- Oil
- Fuel
- Coolant
- Hard copy of the operation manual

### **B. Technical**

- Engage clutch lever to the neutral position.
- Locate gear lever in neutral position.
- Disengage drive to the digging knives by pulling the PTO lever backwards.
- Move the engine stop lever to position 'STOP' which will result in engine stopping

## **6.3 Method to Storing walking tractor**

### **A. Tools and equipment**

- PPE, PC/TV or LCD, flipchart and marker for showing video
- Walking tractor
- Shade
- warehouse
- Attachment
- Tool kit
- Oil
- Fuel
- Coolant

Page 143 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

- Hard copy of the operation manual

## B. Technical

If the machine is not be used for a long period of time it is advisable to take the following precautions:

- Empty the carburetor and fuel tank (refer to engine manual for details). Alternatively, add a fuel stabilizer.
- Empty the engine of oil.
- Petrol engine: lubricate the cylinder with a few drops of engine oil through the plug hole then turn the engine over several times without starting it.
- Diesel engine: remove the injector by unscrewing the two bolts which fasten it to the head and pour a little oil into the hole.
- Clean the engine and the machine thoroughly.
- When restarting checks that all security devices are working.

Page 144 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

Lap test-6	Performance Test
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Name..... ID..... Date.....

Time started: \_\_\_\_\_ Time finished: \_\_\_\_\_

**Instructions:** Given necessary templates, tools and materials you are required to perform the following tasks within 7 hour. The project is expected from each student to do it.

Task-1 Apply Maintenance schedule of walking tractor

Task-2 Conduct Shut down procedure of walking tractor

Task-3 Store walking tractor safely

Page 145 of 153	Ministry of Labor and Skills	Agricultural Machinery and Equipment Operation	Version 1
	Author/Copyright	Level -II	May, 2023

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Page 146 of 153	Ministry of Labor and Skills	Agricultural Machinery and Equipment Operation	Version 1
	Author/Copyright	Level -II	May, 2023

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Page 147 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

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Page 148 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023

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Page 149 of 153	Ministry of Labor and Skills Author/Copyright	Agricultural Machinery and Equipment Operation Level -II	Version 1
			May, 2023



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