

**AI 3401 TRACTORS AND ENGINE SYSTEMS**

**UNIT V NOTES**



### **Power Tiller**

Power tiller is a single axle, self-powered and self-propelled tractor, which can pull and power various farm implements such as rotary, cultivator, harrow, plough, seeder, harvester, and trailer.

### **Classification of Power Tillers**

Power tiller with rotary and fitted with cage wheel for rice field preparation

o Power tiller with tyres and fitted with rotary for tillage and weeding in unsaturated soils. o

Power tillers with rubber tyres and used for haulage

o Power tillers with rubber type or lugged wheel and used for drawbar work like ploughing , Sowing , digging potato, turmeric.

### **The components are**

- **Engine or Prime mover**

The prime mover of the power tiller is four stroke, single cylinder, horizontal or vertical engine which is mounted on chassis or frame with adjusting bolts. The adjusting bolts are used for tightening the clutch belts by sliding the engine on frame. Some engines has rubber pad to dampen to minimize vibration. The main cause of use of horizontal engine is to minimizing the vibration and batter field stability in operation. Power range of engine is 5 H.P. to 20H.P. It can also be used as prime mover for small generator sets, and small agricultural processing equipment's.

The power produced by the engine is taken off to clutch assembly by means of v-belt pulley which is fitted on flywheel by bolts. The axial size of engine pulley must be Airt equal to pulley of the driven equipment to prevent the torsion of the v-belt. Due to single cylinder and small in size engine started manually by Handle or Rope winding.

### **Cooling system of engine**

- The following type of water cooled engines are used in power tillers:

Hopper Type: Hopper has air fins which assist in cooling to the water. This is also known as Evaporative cooling system. In this hopper is fitted on surrounding to water jacket of engine cylinder. On starting of engine water start to cool on the principle that cooled water due to heavy in weight goes down and warm water become light in weight comes up itself But after some time water of hopper starts boiling and evaporated. Therefore some time it is called Evaporate Cooling method.

### **Thermo-siphon or Radia- tor cooling method:**

- This system is very popular in power tiller. It has a radiator and fan to cool the water by thermo-siphon method. Radiator has a pressurized cap to prevent water loss by changing boiling temperature of water since 106 to 112 degree C. Also fan blown fresh air on radiator and engine due to this cooling efficiency of engine increases and water losses is limited. Using dirty, muddy radiator. This reduced cooling efficiency of engine.

### **Fuel System**

1. Fuel Tank: It is fitted above the engine and fuel flow from it by gravity feed method to the fuel filter. Always check fuel level in tank and refill it after work. Be careful not to let any dust or foreign particles get into tank while re-filling. Fuel cock is fitted below the tank. Shut-off it after work.

2. Fuel Filter Assy: It has a paper element which clean and filter the fuel and supply to fuel injection pump. The element has to be changed periodically according their service manual.

3. Fuel Pump: Single plunger type pump fitted on engine and operated by cam-shaft gear. It injects fuel to injector assembly, according fuel injection timing during the end of compression stroke. The fuel injection timing is required adjustment by the following method after repair in fuel system or engine repaired. The fuel injection timing can be adjusted by adding or removing the shims between the F.I. pump and cylinder block. Normally adjustment of injection timing is not required in new engine. The beginning of fuel delivery is at 15 to 21 degree before TDC by rotating the crankshaft.

### **Lubricating oil System**

Engine moving components are lubricated by splash and pressure feed system. A lobe (Rotor) type pump is provided inside the crankcase. A metallic strainer is fitted at suction of this pump which remains dip in oil for removing any foreign particles like metal etc. and cleans it. This strainer has to be removed and clean periodically.

### **CLUTCH ASSY**

Engine power is transmitted through V-belt & pulley to the clutch assembly. This is multi-disc dry friction unit and located at LHS of power tiller at transmission housing. This clutch unit transmits engine power to gear box by chain & sprocket. The clutch assembly has multi- dry friction plates made of antifriction material. This clutch is operated by left hand lever. By pulling to disengage position. The clutch assembly consists following components Friction disc plates, Clutch springs, Clutch driving disc, Belt Pulley, Clutch Bearing, Belt pulley cover. Clutch release levers.

### **TRANSMISSION SYSTEM**

It is divided in two parts:

1. Chain and sprocket type transmission and
2. Main gear box Assy.

1. **Chain and sprocket type transmission:** It is provided in between clutch assembly and main gear box. Engine power is transmitted through clutch Assy. to chain type transmission by chain and sprocket. It has chain tension bolt or chain tensioner. Check the chain tension at the loose side of chain and tight the adjusting bolts by hand or spanner if required. Avoid the any over tighten to prevent damage of the chain or bearing.

Adjustment of clutch release finger 1. Release lever, 2. Adjusting nut, 3. Locking nut, 4. Release bearing.

loose chain will rub the inner surface of housing. Fill the specified oil up to the level mark and check the slackness of chain periodically.

2. Main gear box: This is constant and sliding mesh type gear box and located on the axle. It is driven by chain transmission. Gear box, operated manually and controlled by High/Low lever and speed selection levers. Both levers are hand operated push & pull type in horizontal position.

The main gear box assembly has 6 forward and 2 reverse speeds (High and Low) but some power tiller has 3 forward and 1 reverse speed gears also. Main gear box and rotary tiller operated by two separate levers.

Forward and reverse speed gears are selected by main gear shift lever. This lever is located between handlebars horizontally upper side. Second lower lever is High/Low speed gear lever, used to select trans- mission speed and also selects high and low speed range for the rotavator. The high or low speed of rotary tiller is obtained by turning the H/L gear shifting to the right or left respectively. When it is pulled in 'slow' position. If reverse gear is required in rotary culti- vation work, shift the H / L speed gear lever to 'neutral' position to stop the rotary, and then change the reverse speed gear.

### **Steering**

Jaw or dog clutch type Steering clutch is provided in power tiller. (Fig. 25.16) This has manual hand operated individual side lever for taking turn in RHS or LHS. The left and right hand levers are used for taking turn as steering. To take turn either side with the help of hand levers jaw clutch is disconnected from transmission main drive shaft. Due to this one drive wheel stop and power tiller take turn in same side. If we used both levers simultaneously tiller will not move forward. If right turning is intended, gripe the right hand lever, while left turning, just gripe the left lever. Therefore it is called side clutch steering also.

Don't apply sudden steering when rotavator tilling blades or implement are still in soil. If steering clutch is not working properly then adjust the following as:

Adjustment of steering clutch

Check the clearance between handle grip and handle lever at disengaged position. Normally it is 5 to 10mm if it is more than reduced the length of pull rod. Main components in steering linkage assy, are as below:

1. Handle
2. Hand grip
3. Steering pull rod
4. Lock nut and  
& Connecting clevis

### **Brake**

Wet disc type brake is fitted in power tiller.

This is provided inside the gear box. In some power tiller inner expanding ring is provided for brake purpose inside transmission housing. Always remember that clutch and brake system controlled by same pull rod and handle which is provided at left side of operator. When clutch handle or lever is pulled at backward, clutch will disengage and on further pulled to rear most position then brake is affected. The brake can be used as parking brake also on Mop position. Always reduce the accelerator on before the brake is applied. Whenever an emergency braking necessary take care on handlebar of power tiller that due to inertia will get a sudden 'rise-up' and the power will deviate at certain angle.

If brake is not effected then do the adjustment as below:

1. Brake lever free play adjustment: Shift clutch lever in disengage position and adjust it to get a free play of 20-30 mm.
2. Adjustment of brake cam: If brake is not effective even after setting of free play then adjust it by brake cam, which is provided in transmission housing at left side Pull the clutch lever to disengaging position. Remove the cam arm and turn 1-2 teeth of gear shaft in anti-clockwise until the brake is effective. Refit the brake cam arm and tighten the nut.

This is an attachment which is provided in general purpose type power tiller. Some times it is called rotary tiller also. The rotavator is a multi- edge rotary cultivation device. After single operation of rotovator seed can be sown directly for most crops. It is used for breaking or crushing clods after ploughing operation

in dry field to achieve a high level of soil pulverization. The use of rotavator is also highly effective in mix in the green crop, fertilizers and manures. It is fitted at rear of transmission

housing of power tiller and easy to remove from it to attach other equipments like trailer, plough etc. There are the following functions of rotavator:

- (1) Wet land field operation (Puddling operation)
- (ii) Rotary tilling and weeding of row crops such as cotton, sugarcane, banana etc.
- (iii) Weeding in vegetable field.
- (jy) Cultivating fields, green houses, orchard etc.

Main components of rotavator Assembly are as below

1. Tiller Transmission body
2. Chain case
3. Chain and sprockets
4. Left support housing and arm, 5. L/R bearing housing
6. Chain Transmission assy.
7. Rotavator shaft and Cutting blades or tines
8. Mud protecting cover.

The speed of rotavator may be achieved by H/L speed change lever and by inter-changing the sprockets of chain case (Exchange the upper and lower sprocket). The field speed of tiller is depends on type and soil condition and may be select according field requirement. The speed of rotary assembly is different in different make/model of power tiller. The rotavator is operated in paddy field or dry land in low speed at 1st or 2nd speed (speed range 1.5 to 2.5km / h ) and cultivation for clod crushing at 2nd and 3rd speed gears (Speed range 2.5 to 4km / h . The high speed of rotating speed used in paddy field. Normally ratio of rotavator speed and rated engine speed is about 1:10.

The satisfactory depth of tiller can be achieved by adjusting the Tail wheel or Rear wheel. The main soil cutting tool is blades/tines which are mounted on rotary shaft with bolts & nuts.. Type of blades and their selection depends on type of work and surface condition. There are following two types of blades: Bend blade and Flat hook blade.

#### **TAIL WHEEL/TRANSPORT WHEEL**

The tilling depth can be achieved by adjusting the height of tail wheel by turning the handle up and down. This rear wheel has to be selected according to the type of work. When operating on road for transport use rubber tire wheel for less vibration and any damages.

#### **DRIVE WHEEL/ANTI-SKID WHEEL**

Drive wheel (Pneumatic tires) are used for transportation work and on dry land in ploughing. Increase the wheel track width in transportation and hilly area operation. If wheel slip is more

during ploughing mount the C.I. weight of 25 Kg per wheel to reduce wheel slip and increase pull.

The iron wheel is known as Anti-skid wheel also. Always replace rubber tires by the anti-skid wheels, depending on type of work. Never operate power tiller on hard surface or road with iron wheels. These are used to reduce the wheel slip in plough operation and sinking of power tiller in wet or paddy field. In dry fields and semi-wet paddy fields, no need to change pneumatic wheels but in wet field and puddling change suitable anti-skid wheels.

### **Key Differences Between Power Tillers And Tractors**

#### **Size and Power:**

**Power Tillers:** Power tillers are smaller and compact machines designed for light to medium-duty tasks. They typically have engine power ranging from 5 to 15 horsepower (HP) and are suitable for small-scale or backyard farming operations.

**Tractors:** Tractors are larger and more powerful machines capable of handling heavy-duty tasks. They come in a range of sizes and power outputs, with horsepower ranging from 20 to several hundred HP. Tractors are suitable for large-scale farming operations and can handle various implements and attachments.

#### **Functionality:**

**Power Tillers:** Power tillers are primarily used for soil preparation tasks such as ploughing, tilling, harrowing, and cultivating small to medium-sized fields. They are compact and maneuverable, making them suitable for narrow or confined spaces. Power tillers usually come with a limited range of attachments.

**Tractors:** Tractors are versatile machines capable of performing a wide range of tasks. They can be used for soil preparation, ploughing, tilling, planting, harvesting, hauling, and more. Tractors have the ability to connect and operate various implements and attachments, such as ploughs, disc harrows, seeders, sprayers, loaders, and mowers.

#### **Applications:**

**Power Tillers:** Power tillers are commonly used in small-scale agriculture, horticulture, and gardening operations. They are ideal for cultivating vegetable gardens, orchards, nurseries, and

small plots of land. Power tillers are also suitable for tasks like weed control, inter-cultivation, and seedbed preparation.

**Tractors:** Tractors find applications in a wide range of agricultural operations, including large-scale farming, field preparation, crop cultivation, harvesting, and transportation. They are also used in non-agricultural tasks such as construction, landscaping, and material handling.

Cost and Maintenance:

**Power Tillers:** Power tillers are generally more affordable compared to tractors. They have simpler designs, fewer components, and lower horsepower engines, which contribute to their lower cost. Maintenance and repair costs for power tillers are typically lower as well.

**Tractors:** Tractors tend to be more expensive due to their larger size, higher horsepower engines, and the ability to handle various implements. Maintenance and repair costs for tractors can be higher, especially for larger and more complex models.

**The Scale of Operations:**

**Power Tillers:** Power tillers are suitable for small to medium-scale farming operations, backyard gardens, and specific applications where compact size and manoeuvrability are essential.

**Tractors:** Tractors are designed for medium to large-scale farming operations, where higher power, efficiency, and the ability to handle a wide range of implements are necessary to maximize productivity.