FACT SHEET

Farm Safety Association

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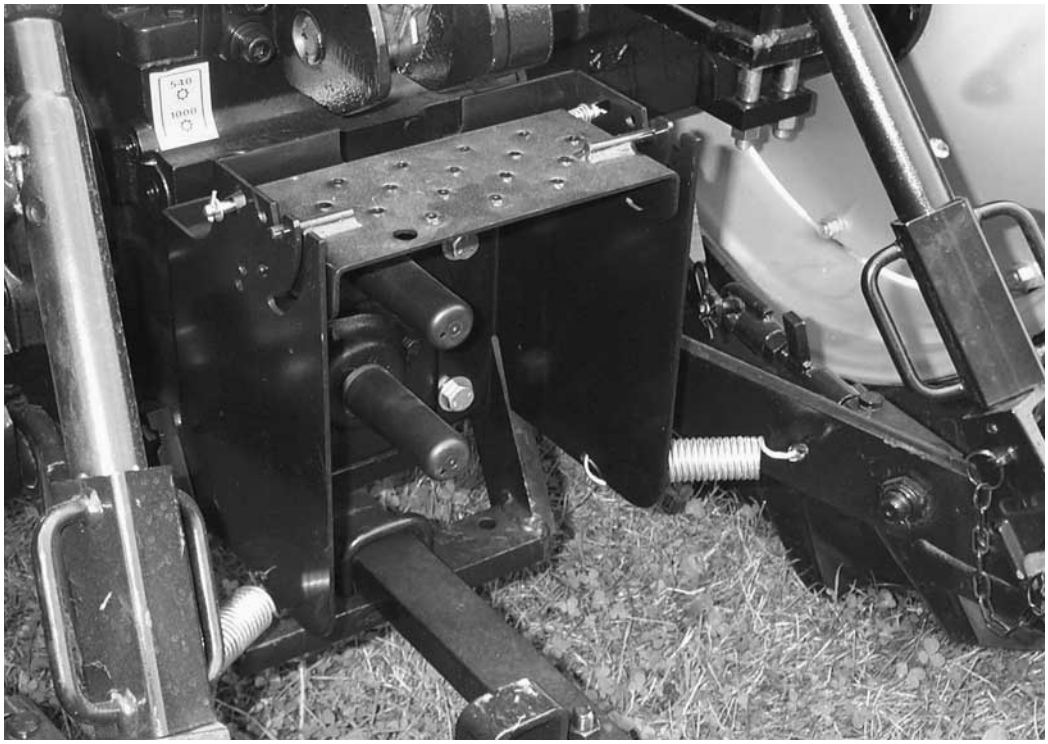
POWER TAKE OFF SAFETY



The Power Take Off (PTO) shaft is an efficient means of transferring mechanical power between farm tractors and implements. It is also one of the oldest and most persistent hazards associated with farm machinery.

Typical injuries resulting from getting caught in an open power take-off shaft are amputations, severe lacerations, multiple fractures, spine and neck injuries or complete body destruction. Broken arms, broken legs and severe facial lacerations are common. Spine and neck injuries are common if a person is rotated around the shaft.

All it may take for a person to become entangled in an open power take-off shaft is one single thread, string from a hooded parka or strand of loose hair. As the items begin to wrap extremely fast around the power take-off shaft they pull the victim directly into the PTO unit.

The following parts of the PTO have been found to be hazardous:

Power Take-Off (PTO) Stub: Most incidents involving PTO stubs stem from clothing caught by an engaged but unguarded PTO stub.

The reasons a PTO stub may be left engaged include:

The operator forgetting or otherwise not being aware the PTO clutch is engaged. Seeing the PTO stub spinning but not considering it dangerous enough to disengage, or, where the operator is involved in a work activity requiring PTO operation.

Boot laces, pant legs, coveralls, sweat shirts, and windbreakers are clothing items that can become caught and wrapped around a spinning PTO stub shaft.

The PTO driveline hazard - This drive shaft is known as the implement input driveline (IID). The entire IID shaft is a wrapping point hazard if it is completely unshielded.

If the IID shaft is partly guarded, the shielding is usually over the straight part of the shaft, leaving the universal joints, the PTO connection (the front connector), and the Implement Input Connection (IIC, the rear connector) as the wrapping point hazards.

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The machine IID shaft is coupled to the tractor PTO stub. At recommended or slower speeds clothing is pulled around the IID shaft much quicker than a person can pull back or take evasive action. Once wrapping begins, the person instinctively tries to pull away. This action simply results in a tighter, more binding wrap.

If an IID shaft is coupled to the tractor PTO stub but no other hitch is made between the tractor and the machine, then the tractor may pull the IID shaft apart. If the PTO is engaged, the shaft on the tractor end will swing wildly and may strike anyone in range. The swinging force may break a locking pin allowing the shaft to become a flying missile, or it may strike and break something that is attached or mounted on the rear of the tractor.

Separation of the driveline shaft is not a commonly occurring event. It is most likely to happen when three-point hitched equipment is improperly mounted or aligned, or when the hitch between the tractor and the attached machine breaks or accidentally uncouples.

Protruding pins and bolts used as connection locking devices are particularly adept at snagging clothing. If clothing doesn't tear or rip away, as it sometimes does for the fortunate, a person's limb or body may begin to wrap with the clothing. Even when wrapping doesn't occur, the affected part may become compressed so tightly by the clothing and shaft that the person is trapped against the shaft.

Other unsafe practices include mounting, dismounting, reaching for control levers from the rear of the tractor, and stepping across the shaft instead of walking around the machinery. An extra rider while PTO powered machinery is operating is another exposure situation.

SHIELDING THE TRACTOR

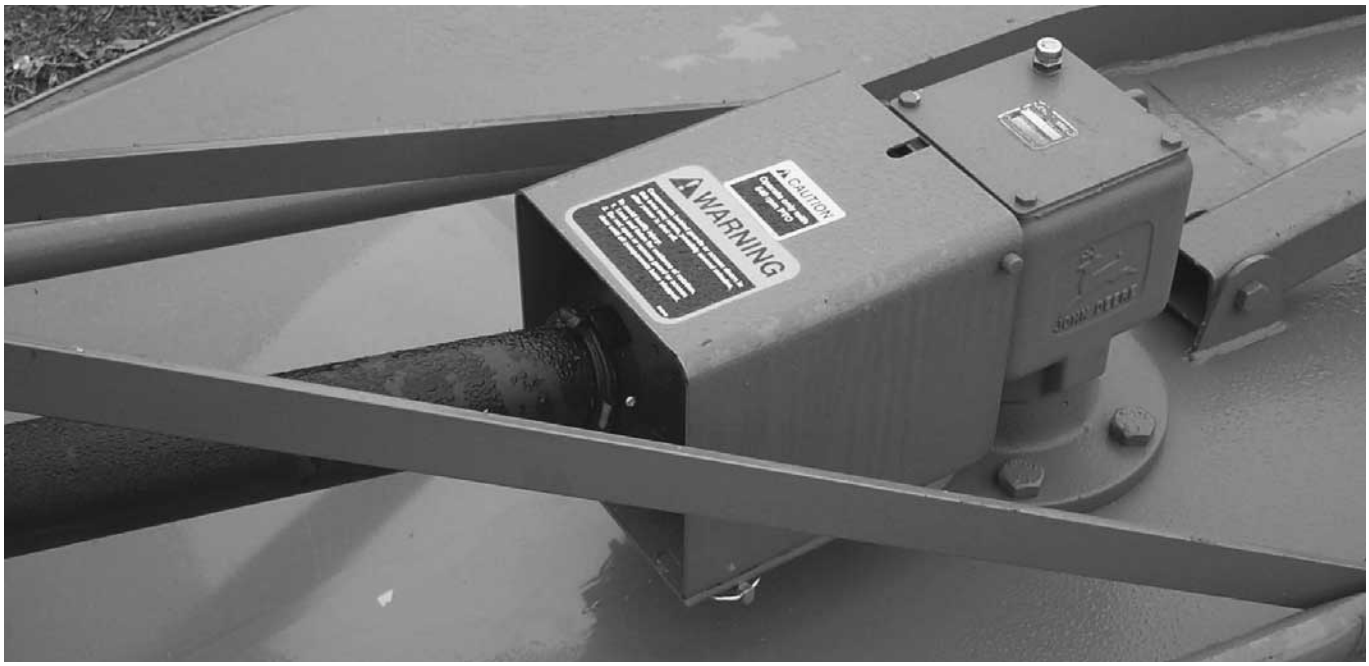
Master Shield: The first shield in the PTO driveline is the master shield on the rear of the tractor. This shield prevents the operator from accidentally coming into contact with the tractor stub shaft and the front universal joint of the equipment's driveline. Operators should make it a practice to replace the tractor PTO shaft guard, which completely covers the tractor stub shaft, when the PTO is not in use.

SHIELDING PTO-OPERATED EQUIPMENT

Fully Shielded Driveline: This type of driveline shielding encases the shaft in a plastic or metal casing supported by bearings at each end of the shaft. The bearings allow the shield to stop spinning if someone or something comes into contact with the driveline, while the shaft inside continues to spin.

The ends of the driveline shield are bell-shaped to cover the universal joints of the shaft. Because universal joints are irregularly shaped and prone to grab objects, operators should never modify the bell-shaped shield to make maintenance, greasing parts or connecting the shaft easier.

Guards: Manufacturer installed guards must be replaced when removed for maintenance. These guards are designed to protect the operator and equipment. Guards not only reduce the risk of an injury; they also keep dust and other foreign objects from damaging gears and other moving parts.



MAINTENANCE

Like any moving part, the driveline shield must be maintained to ensure proper operation.

PTO equipment is frequently operated in inclement weather and exposed to dust, chaff and other foreign materials, which can quickly damage the bearings that allow the shaft to spin freely inside the shield.

Rust, dirt and crop debris must be cleaned frequently to allow the bearings to spin freely. Replace any damaged or worn shields with the manufacturer's recommended parts. Storing equipment inside will also help extend the lifetime of the equipment and reduce maintenance costs. Many newer machines have a bracket attached to keep the driveline off the ground, thus preventing dirt and other materials from damaging it.

POSITIONING THE DRAWBAR TO THE PTO SHAFT

The length and height of a tractor drawbar may need to be adjusted to match the implement to the manufacturer's specifications. It is important to make these adjustments to ensure that the PTO driveline does not compress or separate during operation.

To make this adjustment, check the implement manufacturer's recommendations and adjust the height of the drawbar and the distance from the PTO stub shaft to the center of the drawbar hitch hole (see Figure 2).

Failure to match the drawbar to the implement can result in the driveline being compressed or separated when the tractor makes a sharp turn or comes to the top or bottom of a hill. Separation or compression frequently damages the protective shield to the point where it no longer slides together or allows the shaft to spin freely inside the shield.

Most PTO-driven equipment has some form of a shear pin to prevent damage to the shaft or gearbox. Always follow the manufacturer's recommendations for size and hardness when replacing a damaged shear pin or bolt. Using a pin or bolt that is longer than necessary creates a potential catch point that may snag the operator's boot lace or clothing, resulting in a possible entanglement.

PTO SAFETY PRACTICES

Always disengage the PTO, shut off the engine and remove the key before getting off the tractor. This protects you from accidental entanglement while servicing the equipment and ensures that no one else can start the tractor during maintenance procedures.

Keep the master shield in place at all times. The master shield should be removed only when required for hooking up special equipment with equivalent shielding. Replace the PTO tractor stub shaft guard whenever PTO driven equipment is not being used.

Check that the PTO driveline shields are in good condition. With the PTO stopped, test driveline guards by spinning or rotating them to ensure they have not become stuck to the shaft the shield should rotate freely by hand. Make any necessary repairs to damaged bearings or shields.

Never modify driveline shields to make servicing or connections easier. Cutting or drilling a hole in the shield allows dirt; chaff or other foreign materials access to shaft bearings. This reduces the life of the shield and also increases the risk of the operator getting clothing caught in the spinning shaft. Always use the driveline recommended for your machine. Never switch drivelines among different machines.

Never step across a rotating PTO driveline. Always take the time to walk around a rotating shaft. Although the shaft may be enclosed in safety shields and guards, there is a chance that clothing could be caught in the spinning shafts.

Reduce PTO shaft abuse by observing the following: avoid tight turns that pinch rotating shafts between the tractor and machine; keep excessive telescoping to a minimum; engage power to the shaft gradually; and avoid over tightening of slip clutches on PTO-driven machines.

Wear snug fitting clothing. Bulky, loose fitting clothing can quickly be caught in a spinning shaft, entangling an unsuspecting operator. Boots or shoes without laces are preferred because laces may become entangled in the shaft.

STEPS TO FREE A PTO ACCIDENT VICTIM

Rescue procedures to remove a victim from the power take-off shaft should start by shutting off the tractor and making sure it will not re-start. Next, chock the tractor wheels so that the tractor cannot move. The critical time to remove a victim from the equipment may vary from only a few minutes to several hours.

There are several methods that can be used to remove a victim from a PTO shaft:

- PTO entanglements cause extensive damage to trapped limbs and sometimes require limb

amputation. Use caution if disengaging the PTO as it can cause additional movement or injury to the victim.

- Place the power take-off drive unit in neutral and turn the PTO shaft counterclockwise to un-wrap the person from the shaft.
- This may require using a large pipe wrench or putting a small shaft or bar into the yoke of the Power Take-Off Unit and turning with considerable pressure.
- You may be able to disconnect the hitch pin that attaches the trailing equipment to the tractor and move the tractor forward to pull the PTO shaft apart.
- After the PTO shaft separates into two parts, you will have to turn the shaft counterclockwise to remove the victim. If the shaft is solid, the rescuers may have to cut it with a cutting device such as a portable power grinder, hacksaw or oxyacetylene torch.
- Under no circumstances should tractor power be used to rotate the shaft.
- If there are combustible materials in the area, rescuers should be extremely careful when using any type of flame-producing equipment, or even portable grinders that produce sparks.
- If such equipment must be used, adequate fire equipment must be readily available in case a fire starts. If explosive products such as gasoline may be have been spilled in the area, open flame must be ruled out. In this case, rescuers and observers should be alert and not smoke in the area.
- While the victim is being removed from the power take-off shaft, other rescuers must provide life support to the victim and monitor his vital signs continuously. Cut away clothing, if necessary, to allow the victim to breathe easier. Do this with caution to prevent the victim from moving. Any movement may allow a severed limb to fall free and may aggravate internal and spinal injuries or cause severe blood loss
- Extrication is only the first step of saving the victim's life. If an arm, foot, leg or other part of the body was amputated, it should be located and handled properly for possible reattachment. If possible, rinse the tissue in a saline solution, wrap the part in a clean, moistened towel and place it in a plastic bag.
- The amputated body part should be transported with the victim, placed in a container so the part is not in direct contact with ice used to lower its temperature. Amputated tissue often can be reattached to the victim if it is properly cared for and is promptly available.
- Sometimes, it is best to transport a stabilized victim still entangled with part of the PTO shaft. Extrication can be completed by a surgeon under hospital conditions. Spine and neck injuries are common in PTO entanglements. Appropriate stabilization procedures must be followed.

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