

Tractor & Machinery Operations: Science of Stability



Photo Credit: Penn State Agricultural Safety and Health Team

Outline

- Pre-operation Checks
- Hitching and Backing



Pre-operation Inspections

- Review
 - ground conditions, terrain, obstacles
 - Complete visual inspection of equipment
 - Lights
 - Brakes
 - Steering
 - Tires
 - Fluids
-

Operating the Tractor

- Roll-overs hazard
 - Side
 - Rear
- Run-overs hazard
 - Bystanders
- Falls
- Noise
- Eye Injury
- Entanglement



Safe Operations

Always face the tractor for mounting and dismounting. Use three points of contact. Never jump from the tractor.

Fasten Seat Belt
(ROPS equipped tractor)

Avoid ditches, embankments, and holes

Reduce speed when turning, crossing slopes, and on rough, slick, or muddy ground

Stay off slopes too steep for safe operation



Safe Operation

Watch where you are going

No riders

Avoid jerky turns, starts, and stops

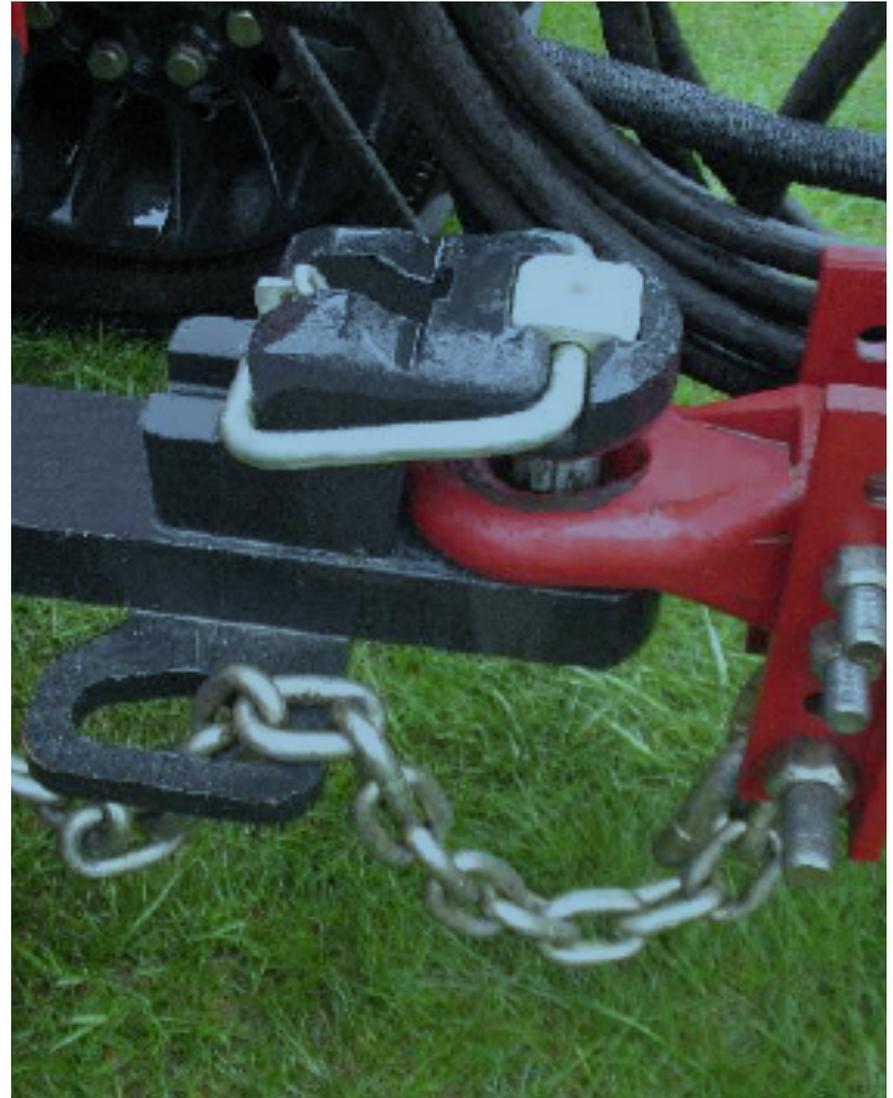
Hitch properly (Drawbar and three-point)

Set brakes securely when stopped
(parking brake)



Drawbar

- Categories
 - 0-5; increase in size
 - Increase in loads
- Adjustable or Fixed
- Single attachment point
 - Engineered and placed low to minimize rear rollover



Drawbar

- Avoid
 - “homemade” bars or modifications
 - Pre-operation Checks
 - Distance from PTO Stub end to hitch pin hole
 - Distance from OD of rear tire to pin hole (1”)
 - Cracks/gouges
 - Bolt torque
 - Tongue and Clevis
 - Pins & Keepers
-

Drawbar Hazard Identification

- Crush
- Run-over
- Stored energy
 - Hitch jack
- Load detachment



Hitch Pins



Hitch pin selection

Diameter

Grade (shear strength)

Length



Safety Chain

Length

Grade

Intermediate support



Safety chains a rate for a specific load. The load will be marked on a metal tag.

Three-point Hitch

- Raise and lower implement
 - Hydraulic cylinder
 - Top link to adjust set of the implement level
 - Pre-op checks
 - Ensure controls are in depth position
 - Restrict side movement of draft links
 - Check drawbar position
 - Check ballast requirements
 - Check hitch pins and alignment
-

Three-point Hitch Hazard Identification

- Pinch point
- Run-over
- Crush
- Roll-over or tipping
- Load detachment



Power Take Off Shaft

- Power transmission to implement
- 540 rpm or 1000 rpm
 - Size of shaft diameter changes
- Pre-op checks
 - Guards
 - Alignment of drawbar and three-point



PTO Hazard Identification

- Entanglement
- Pinch point
- Run-over



PTO Connections

Different types of shaft retainers:

- **Steel Pin**
- **Steel Bolt and Nut**
- **Push Pin**
- **Sliding or Rotating Collar**



Hydraulic Connections

- Operate at high pressures
 - 2,100-3,000 psi
- Allows raising or lowering of implement
- Rotational power
- Engaging mechanisms



Hydraulic Remote Operation



Photo Credit: Michael Houtz, Penn State Extension

Hydraulic Hazard

- Fluid injection
- Run-over
- Crushing
- Pinch
- Burn



Hydraulics

- Pre-op checks
 - Leaks
 - Remove dirt and debris before connections
 - Check hoses for wear
 - Ensure pressure has been released from the system
 - Ensure hoses are protected
 - Check fluid level
 - Transport locks



Electrical

- Operation of safety lighting
 - Wiring and terminals
 - Clean and Inspect
 - Check for:
 - Corrosion
 - Wear
 - Maintain support(s) for wiring
 - Ensure functions with controls in the cab.
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Communicating with hand signals

- Review common hand signals to communicate during tractor operations.
- ASABE Standard S351



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