

## Kansas Hazardous Occupations Training

# Kansas Supplement to Student Manual *Safe Operation of Agricultural Equipment*

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While the student manual *Safe Operation of Agricultural Equipment* (S67) deals with most issues relating to farm tractor safety, some additional information is necessary concerning the following subjects:

- External raise and lower switches for three-point hitches
- Radar ground speed sensors
- Approaching running tractors
- Carrying starting fluid
- Articulated four-wheel drive (4WD) tractors
- Track tractors
- Mechanical front-wheel drive (MFWD) tractors

### External Raise/Lower Switches for Three-point Hitches

Many tractors are equipped with a rear-mounted raise/lower switch that allows an operator to raise or lower the tractor's three-point hitch while standing at the rear of the tractor.

To prevent injury when using this switch, always make sure the transmission is in PARK or the parking brake is set to prevent the tractor from moving.

Stay clear of pinch points between:

- hitch components and the tractor, including tires.
- hitch and implement.
- implement and the ground.

### Radar Ground Speed Sensors

Many tractors currently are equipped with radar ground speed sensors. These sensors emit very low intensity microwaves. The microwave intensity is low enough to cause no ill effects during normal

use. However, to avoid any possibility of eye damage, do not look directly into the face of the sensor if the unit is in operation (tractor running or key switch in ON position).

### Approaching Running Tractors

It is never completely safe to approach a tractor with its engine running and an operator near the controls. It is preferable for the operator to shut off the tractor, dismount, and come talk to you. However, if this is not possible, a number of precautions can reduce potential hazards.

- Make sure the tractor operator sees you. Establish eye contact with the operator before you approach the tractor.
- Do not approach tractor if operator is depressing the clutch. This usually means the tractor is in gear. If the operator's foot slips, the tractor will lurch and likely injure an approaching person. Do not approach until operator has removed foot from clutch.
- A person approaching an articulated tractor can be crushed between the front and rear tractor wheels if the operator turns the steering wheel. Approach articulated tractors only if the operator has been well trained and understands the hazard. Likewise, do not walk next to implements attached to an articulated tractor as the implements will also move if the steering wheel is turned.

### Carrying Starting Fluid

Ether is extremely flammable, much more so than gasoline. Follow the instructions printed on the can and those in the tractor's operator's manual. To prevent accidental discharge when storing pres-

sured cans, keep the cap on the container and store in a cool protected place. **Do Not Carry Ether Inside A Tractor Or Pickup Cab.** Flash fires have occurred when cans were ruptured by seat suspension or tools. Extremely flammable vapor fills the cab and any small spark (static electricity, cab pressurization fan, electric controls) can ignite the vapor.

## Four Wheel Drive (4WD) Articulated Tractors

Super-sized tractors have become much more prevalent in Kansas as farm and field sizes have expanded. Most 4WD tractors articulate (bend in the middle) to maneuver.

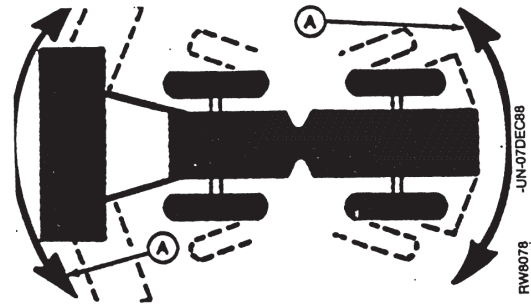
The unique steering systems of large 4WD tractors present handling problems, especially for beginning drivers. All-wheel steering can shift a towed device into an unexpected path. Articulated steering changes the tractor's center of gravity so an overturn can occur under unexpected conditions. With articulated steering, high-speed road travel requires more operating skill than conventional tractor steering does. When an operator steers a unit with articulated steering while it is standing still, a bystander can be trapped in the hinge region. All new tractors carry warnings, but it is the operator's responsibility to be sure everyone is clear before starting or maneuvering the machine.

Overall, a 4WD articulated tractor is one of the safest tractors to operate when a few precautions are taken. Why are 4WDs safer to operate?

- With over 50 percent of the tractor's weight on the front wheels, it is very unlikely that a rear rollover will occur.
- When equipped with dual tires, a 4WD is very resistant to side rollovers. Most 4WDs in Kansas are equipped with duals.
- The tractor will go where it is steered. The novice operator does not have to learn to use steering brakes. If the steering wheel is turned, the tractor will change direction regardless of drawbar load, hitch load, or speed.

An articulated tractor and any equipment attached to it will move when the steering wheel is moved. On some models steering movement may occur as the engine starts. Be sure people and

animals are clear of the tractor and attached implements before starting the engine or moving steering wheel. Be aware of this characteristic when maneuvering in close quarters. Do not park the tractor extremely close to other equipment or structures. Do not use the steering wheel as a hand hold when entering or exiting tractor.



**Figure 1:** Steering directions of an articulated tractor

Articulated tractors can be very unstable on single narrow wheels set at a narrow spacing. If it becomes necessary to remove outer duals, adjust wheels to a wider tread if possible, travel at slow speeds, and stay on level ground. High transport speed with outer duals removed can cause loss of steering control or vehicle stability – if this occurs reduce speed immediately.

Heavy towed equipment or rear mounted equipment may start swaying in transport. Excessive swaying will result in loss of steering control. Slow down and avoid quick turns of the steering wheel.

Use extra caution when moving articulated tractors at high road speeds. Excessive bouncing or loping at transport speeds may cause loss of steering control or vehicle stability. If this occurs, slow the tractor to a speed that allows steering control and tractor stability to be maintained.

Turns must be initiated sooner with articulated tractors. The tractor's rear wheels follow in the path of the front wheels during turns. This means that a towed implement will follow the front wheel's path during a sharp turn more closely than with a similar implement when being towed by a 2WD tractor.

Heavily ballasted, big tractors do not stop quickly. When towing heavy equipment without brakes, the added load can increase stopping distance to an unsafe degree, especially on downgrades.

Slow down early. Equip large towed equipment with brakes if possible. Keep the tractor brakes properly adjusted and equalized.

Install hinge locks when recommended by operator manual. Hinge locks may be needed:

- when using stationary PTO equipment.
- when lifting tractor.
- when transporting on another vehicle.
- when working in hinge area.

A crushing hazard exists in the hinge area of articulated tractors. Approach this area only if tractor is not running or hinge locks are in place.

## Track Tractors

First introduced by Caterpillar, then by Case-IH and John Deere, the track tractor uses tracks instead of wheels. Track tractors are being used by some farm operations in Kansas. It, too, is one of the safer tractors to operate for a number of reasons, including:

- Rear rollovers are unlikely due to the location of center of gravity.
- Side rollovers should not be a problem given track gage (distance between track centers) and location of center of gravity.
- All track tractors are equipped with ROPS cabs.

The track tractor does have unique steering characteristics. It “steers” by slowing down one track and speeding up the other. The amount of speed differential is controlled by the steering wheel. With the self-centering steering wheel “centered” both belts turn at the same speed. When the steering wheel is turned slightly to the left (counterclockwise) the left track slows slightly while the right track speeds up an equal amount, resulting in the tractor turning to the left. The more the steering wheel is turned to the left, the greater the speed differential between the two tracks. The maximum speed differential is about 6 mph regardless of forward speed. This means that the actual turning radius depends on both the speed differential between the two belts and the forward speed of the tractor. Thus, as with 4WDs, the track tractor has some unique steering characteristics that require getting used to by new operators.

**Warning:** With the engine running, this ma-

chine spot-turns when the steering wheel is turned, even with the transmission in neutral and the parking brake engaged. To avoid personal injury from unexpected machine movement, make sure the area is cleared of people and animals before starting the engine. **Do not steer** when starting the engine. If the tractor does steer, stop the engine.

### What this means:

- The track tractor will rotate around in a circle (spot turn) even if it’s not moving forward or backward, if the steering is moved from the centered position. While this makes the tractor very maneuverable, it can also result in serious accidents if the steering wheel is turned while the tractor is parked next to a pickup, building, fuel tank, or person. Do not use the steering wheel as a hand hold when entering or exiting the cab.
- The slower the track tractor’s speed (forward or reverse), the shorter the turning radius will be for a given steering wheel position. When the tractor’s forward or reverse motion stops, it will spot turn until the steering wheel is released. If a novice operator is not aware of this, serious accidents can occur when maneuvering in tight quarters. Operators experienced with operation of 2WD and MFWD tractors may have the most problems with this steering characteristic. **Rule of Thumb:** Release the steering wheel when the clutch is depressed.
- As with 4WD tractors, it is easy for a person approaching a track tractor with its engine running to be seriously injured if the operator turns the steering wheel. Likewise do not walk next to implements attached to a track tractor because the implements will also move if the steering wheel is moved.
- Turning performance under heavy drawbar loads more closely approximates that of a 2WD tractor than an articulated 4WD tractor, which can pull a heavy draft load around a sharp corner. At near maximum draft loads track tractors may respond poorly to the steering wheel, tending to continue in a nearly straight path. Reducing the draft and/or letting the drawbar swing will improve steering performance.

## Mechanical Front Wheel Drive (MFWD) Tractors

Mechanical front wheel drive (MFWD) tractors began to dominate the large row crop tractor market (150 PTO hp) during the 1980s. MFWDs offer some of the advantages of 4WDs in a familiar chassis.

Since few were produced prior to 1973, almost all are equipped with ROPS cabs and seat belts. Compared to a 2WD tractor, a higher percent of total tractor weight is carried by the front axle on a MFWD tractor, which decreases the chances for a rear overturn. The MFWD tractor may be easier for a novice operator to gain proficiency at turning because the powered front wheels pull the front of the tractor around corners, reducing the need for turning brakes.

### Cautions:

- MFWD greatly increases traction on steep side slopes. When compared to a 2WD tractor a MFWD will maintain traction on steeper side slopes increasing the possibility of a side roll-over. Extra caution is required when operating with a single rear tire set at narrow wheel tread.
- When driving on icy, wet, or graveled surfaces, reduce speed and be sure tractor is properly ballasted. Engage MFWD for better braking performance.
- In good traction conditions (pavement), disengage MFWD to increase tire life.
- Most MFWD tractors have a three-position switch “on”, “off”, and “auto”. In the “auto” mode the MFWD operates as follows:
  - At field speeds the MFWD is normally engaged; however if one turning brake is pressed the MFWD turns off until the brake is released.
  - At transport speeds the MFWD is normally disengaged; however when both turning brakes are applied the MFWD is engaged to assist braking.
- Always use front/rear tire combinations specified by the manufacturer to ensure acceptable tire wear and MFWD performance.

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