



CONNECTING IMPLEMENTS TO THE TRACTOR

HOSTA Task Sheet 5.1

Core

NATIONAL SAFE TRACTOR AND MACHINERY OPERATION PROGRAM

Introduction

“The owner says that I should be able to connect (hitch) the rake to the tractor and be in the nearby field within 5 minutes. It has been 10 minutes, and I still can’t seem to get the drawbar of the tractor lined up with the hitch on the rake.”

Can you steer in reverse? Can you use the clutch and brakes smoothly? If not, review the lessons on steering in reverse and moving and steering the tractor.

Do you understand where to hitch to the load to insure tractor stability? If not, review the lessons on tractor stability.

This task sheet provides an overview of safe and efficient hitching of implements to the tractor. See Task Sheet 5.2 or 5.3 for additional details.

Hitching and the Center of Gravity

In Task Sheet 4.12, *Tractor Stability*, you learned about the tractor’s center of gravity and stability baseline. Tractor hitches are designed so the downward and rearward force during a pull are below the center of gravity (see Figure 5.2.a.). To maintain tractor stability, the “angle of pull” should be kept as low as possible by hitching to the drawbar only.

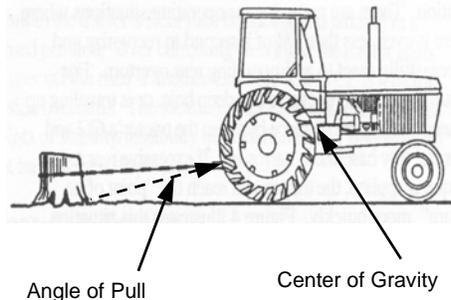


Figure 5.1.a. An example of safe hitching. The drawbar will lower if the front end lifts off the ground. This reduces the “angle of pull” and the risk of a rear overturn.

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.

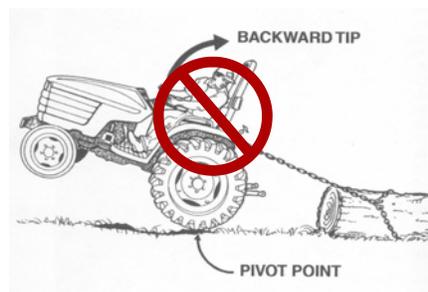


Figure 5.1.b. The log is fairly immovable. A chain hooked above the center of gravity of the tractor (e.g., top of 3-point hitch bracket), allows a rearward tip of the tractor. Improper hitching has overridden safe tractor engineering design. Many people have lost their lives as a result. *Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses*, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.

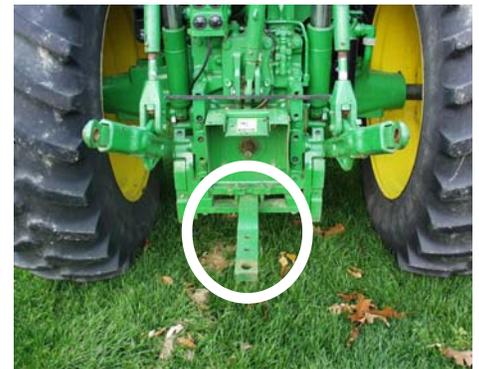


Figure 5.1.c. The tractor drawbar is the only safe place to connect a load. Do not hitch higher than the drawbar so all pulling forces stay below the tractor’s center of gravity. For most operations, the drawbar should be placed midpoint between the rear tires to maximize pulling power. Hillside operations may require a drawbar adjustment to one side to balance the pulling forces.

Hitch to the drawbar only! Hitching anywhere else can result in rear turnover and death.

Learning Goals

- To safely connect an implement to the tractor’s drawbar
- To safely connect an implement to the tractor’s 3-point hitch

Related Task Sheets:

Tractor Stability	4.12
Using the Tractor Safely	4.13
Operating the Tractor on Public Roads	4.14
Using Drawbar Implements	5.2
Using 3-Point Hitch Implements	5.3



Figure 5.1.d. Tractor drawbars are designed at the correct height from the ground to keep the pull forces below the center of gravity. See Table 5.1.a. Only use the drawbar to tow a load. A swinging or floating drawbar permits adjustment of the center line of pull to be maintained even on a hillside.

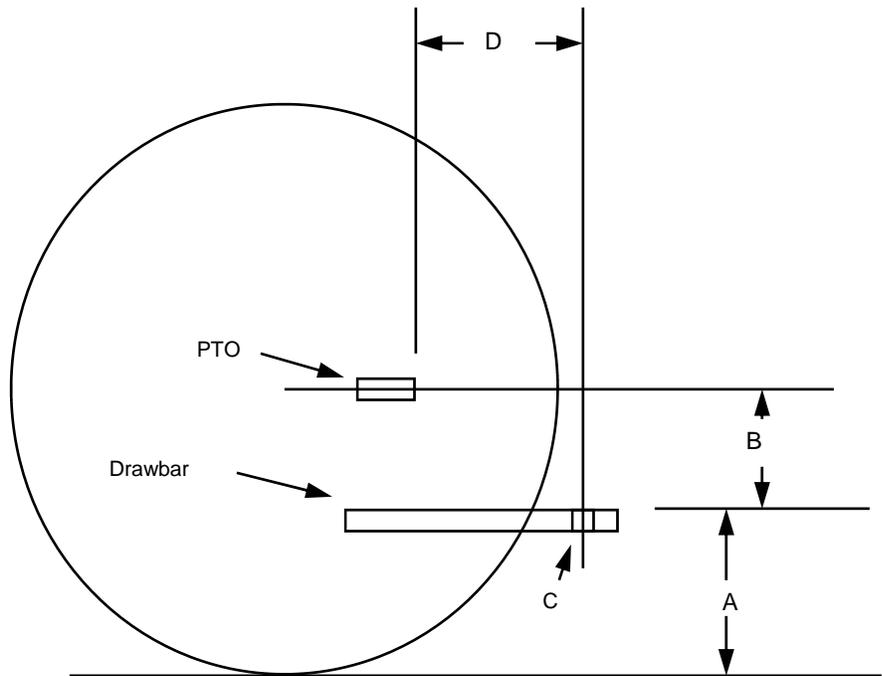


Figure 5.1.e. The tractor power take-off and drawbar position are designed with specific measurements for the size and horsepower rating of the tractor. The operator should not make changes to these design standards by changing the hitch point. Table 5.1.a lists the measurements and relationships at points A, B, C, and D above for each range of tractor size.

A bolt laying around the farm shop is not a substitute hitch pin! Hitch pins are designed for specific drawbar loads and power ratings and must fit the drawbar hole.

Item	Drawbar Hitch Category			
	I	II	III	IV
Tractor HP	20-45	40-100	80-275	180-400
Drawbar Height				
above ground (A)	15" +/-2"	15" +/-2"	19" +/-2"	19" +/-2"
Drawbar to PTO (B)	8"-12"	8" - 12.5"	8.5" -14"	10" -14"
Hitch-Pin Hole Size(C)*	1.1"	1.3"	1.7"	2.1"
Nominal Hitch Pin Size*	1.0"	1.2"	1.6"	2.0"
Drawbar Dimensions				
(Thickness x width)	1-3/16"x2.0"	1-9/16"x2.5"	2"x 3-3/16"	2-3/8"x 4-7/8"
Regular Size PTO				
Stub Shaft to Drawbar				
Hitch Hole (D)	14-20"	14-20"	14-20"	14-20"

* The measurement has been rounded to the nearest 1/10 (0.1) inch. Hitch pins must fit the hitch-pin hole without excessive movement.

Table 5.1.a. Drawbar Sizing and Positioning Standards (ASAE S482)

The 3-Point Hitch

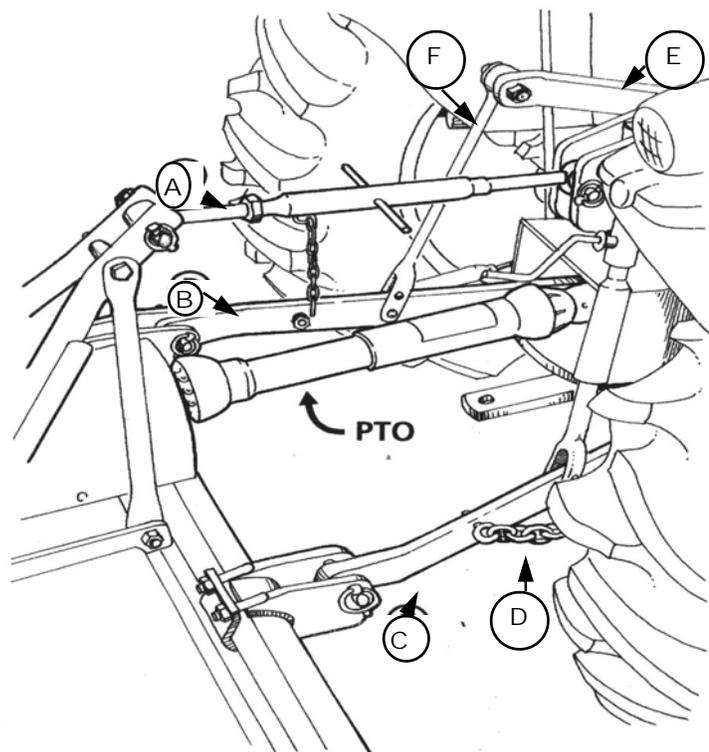


Figure 5.1.f. Parts of the 3-Point Hitch

- A. Upper Link B,C. Draft Arms D. Anti-sway bar or chain
- E. Lift Arm F. Lift Rod

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Implement Hitching

Follow these steps for hitching to a drawbar: Also see Task Sheet 5.2.

1. 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.
2. Stop the engine, put the tractor in park, and set the brakes.
3. Attach the implement using the proper-sized hitch pin and security clip.
4. Raise the implement jack stand and remove chock

blocks from the wheels.

5. Connect the PTO shaft, hydraulic hoses, and/or electrical connections as required. Refer to the appropriate task sheets on these subjects.

Follow these steps for hitching to a 3-point hitch attachment: Also see Task Sheet 5.3.

1. Move the stationary tractor drawbar forward for clearance.
2. Position the tractor so the pin holes of the draft arms are closely aligned with the implement hitch points.
3. Raise or lower the draft arms

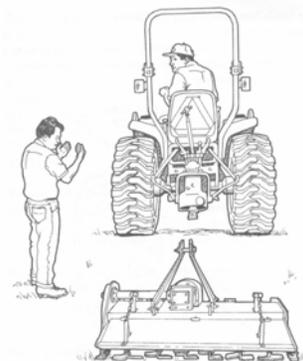


Figure 5.1.g. Never let another person stand between the tractor and the implement during hitching. Too fast of an approach or the operator's foot slipping from the clutch can lead to injury or fatality to the person standing nearby. *Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.*

to match the implement hitch points.

4. Stop the engine, securely park the tractor, set the brakes.
5. Attach each draft arm to the implement hitch point using the proper size hitch pin and security clip.
6. Remount and start the tractor to use the hydraulic system to raise the lift arms if needed.
7. Match the upper link of the 3-point hitch to the implement's upper hitch point. The upper link is adjustable by screw threads to make the final connection. The implement may not be level if the upper link has been adjusted too many times. If it is out of level, the machine may not work properly *If you cannot level the machine, ask for help.*
8. Securely attach the upper hitch pin with the proper size hitch pin and security clip.

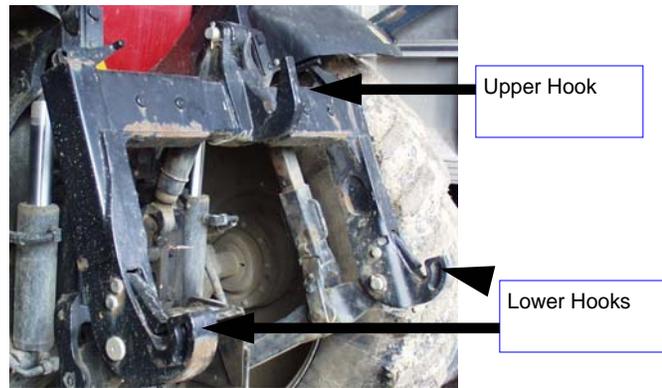


Figure 5.1.h. Heavy-duty quick-attach couplers are mounted on to the tractor's 3-point hitch and can safely handle large 3-point hitch implements without a person moving between the tractor and the implement. See the circled areas which show these hook and latch points. Refer to the Owner's Manual for additional instructions on their use or have a qualified operator demonstrate to you the correct procedure to use a quick-attach coupler.

Safety Activities

1. Practice backing a tractor with a drawbar to an implement to "spot" the hole in the drawbar to the hole in the implement tongue. You should be able to perform this skill with a minimum number of changes of direction to be a proficient tractor operator.
2. Practice backing a tractor with a 3-point hitch to an implement to adjust the pin hole in the draft arms to the lower hitch pins on the implement's 3-point hitch attachment. As you become more able to align these points, securely park the tractor. Attach the draft arm hitch pins, restart the tractor, adjust the draft arms to align, and connect the upper link point. You should be able to perform this skill with a minimum change of direction to be a proficient tractor operator.
3. On a tractor you can easily measure, take measurements and record the following:
 - a. distance from ground to drawbar _____ inches
 - b. dimensions of drawbar (width and thickness) _____ x _____ inches
 - c. hitch-pin hole opening in drawbar _____ inches
 - d. vertical distance from drawbar to center of PTO stub shaft _____ inches
 How do these measurements compare with the standards shown on Table 5.2a?
4. Using a battery-operated toy truck or tractor, devise a place to hitch a load at a point above the toy's axle. Make a sled from sheet metal or cardboard, and attempt to pull a load of small objects such as nuts, bolts, etc. What happens as the toy attempts to pull the load? Change the height and length of the angle of pull, and record the reaction of the toy truck or tractor to the changes made.

References

1. www.asae.org/Click on Technical Library/Find Standards on pull down menu/Type in Drawbars, Download PDF for S482, December 1998.
2. www.asae.org/Click on Technical Library/Find Standards on pull down menu/Type in Three-Point Free Link Attachment, Download PDF for S217, December 2001.
3. Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.

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Credits

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