TWISTER
30 SERIES

OPERATORS MANUAL

LIMITED WARRANTY:

Mandako Agri Marketing (2010) Ltd. ("MANDAKO") warrants for a period of one (1) year from the date of delivery to the purchaser that any new machinery purchased from MANDAKO (the "Product") will be free of manufacturing and materials defects (the "Covered Defects"). Before using the Product, the purchaser shall determine the suitability of the Product for its intended use. This Limited Warranty is non-transferable and valid to the purchaser of the Product only.

Except for the Covered Defects, this Limited Warranty shall not apply to any other defects or problems in the Product, including without limitation: (i) alterations, changes, replacements or repairs to the Product made by anyone other than MANDAKO or MANDAKO authorized Dealers; (ii) accessories, attachments, tools or parts sold or operated with the Product, if they have not been manufactured by MANDAKO; (iii) application or installation of accessories, attachments, tools or parts not completed in accordance with MANDAKO's operator's manual, specifications or printed instructions; (iv) defects or problems caused by misuse, abuse, neglect, improper testing, improper storage, improper handling or abnormal conditions; and (v) defects caused by wear and tear from ordinary use of the Product.

During the one (1) year warranty period, provided that written notice of the Covered Defects is given to MANDAKO within seven (7) days from the date that the defect was, or ought to have been, discovered, the liability of MANDAKO under this Limited Warranty shall be limited to the repair or replacement of any defective Product. For clarity, the purchaser shall be responsible for all expenses incurred as a result of any repairs, labour, parts, transportation or any other work, unless MANDAKO has otherwise authorized reimbursement of such expenses. In order to obtain repair or replacement, the written notice provided by the purchaser must contain full details of the Covered Defects and submitted online at www.mandako.com/warranty-claim or be sent to:

Mandako
Box 379, 12159B, Hwy 306
Plum Coulee, Manitoba, R0G 1R0

MANDAKO reserves the right to inspect the defective Product prior to repair or replacement. If MANDAKO determines that a defect in the Product is not a Covered Defect, it shall not have any obligation to repair or replace the Product.

No one is authorized to make oral warranties or representations on behalf of MANDAKO regarding the Product. The Product is subject to design changes and MANDAKO shall not be required to retro-fit or exchange items on previously sold Product, except at its own option.

THIS LIMITED WARRANTY IS DEEMED ACCEPTED BY YOU UPON YOUR PURCHASE OF THE PRODUCT. TO THE EXTENT PERMITTED BY LAW, THIS LIMITED WARRANTY IS EXCLUSIVE, AND IN LIEU OF ANY AND ALL OTHER WARRANTIES, CONDITIONS OR REPRESENTATIONS RESPECTING THE PRODUCT, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NON-INFRINGEMENT, SUITABILITY, OR ANY OTHER WARRANTIES, REPRESENTATIONS OR CONDITIONS THAT MAY ARISE FROM USAGE OF TRADE OR COURSE OF DEALING.

MANDAKO'S OBLIGATION SHALL NOT EXTEND BEYOND THE OBLIGATIONS EXPRESSLY UNDERTAKEN ABOVE AND IN NO EVENT SHALL MANDAKO OR ITS SUPPLIERS, AGENTS, OFFICERS, DIRECTORS, CONTRACTORS AND EMPLOYEES BE LIABLE TO THE PURCHASER OR ANY THIRD PARTY FOR ANY INDIRECT, PUNITIVE, EXEMPLARY, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES OR LOSSES (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF BUSINESS, LOSS OF PROFITS OR SALES, BUSINESS INTERRUPTION, LOSS OF BUSINESS INFORMATION, LOSS OF GOODWILL, WORK STOPPAGE, COMPUTER FAILURE OR MALFUNCTION OR ANY OTHER PECUNIARY LOSS OR COMMERCIAL DAMAGE OR LOSS) ARISING FROM ANY CLAIM WHATSOEVER, INCLUDING ANY TORT, EQUITY, NEGLIGENCE, GROSS NEGLIGENCE, WILFUL MISCONDUCT OR STRICT LIABILITY CLAIM, EVEN IF MANDAKO HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES OR LOSSES OR THEY ARE FORESEEABLE. THE PURCHASER WAIVES ANY CLAIM AGAINST MANDAKO FOR PUNITIVE OR EXEMPLARY DAMAGES.

WARRANTY VOID IF NOT REGISTERED
PLEASE REGISTER AT www.mandako.com/registration

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Section 1: INTRODUCTION

Congratulations on your choice of a Mandako 30 Series Twister to compliment your farming operation. This equipment has been designed and manufactured to meet the needs of a discerning agricultural industry.

Safe, efficient and trouble free operation of your Mandako Twister requires that you and anyone else who will be using or maintaining the Twister, read and understand the Safety, Operation, Maintenance and Trouble Shooting information contained within this Operator's Manual.

This manual covers the Mandako 30 Series Twister. Keep this manual handy for frequent reference and to pass on to new operators or owners. Call your Mandako dealer if you need assistance, information or additional copies of the manual.

NOTE:
The directions left, right, front and rear, as mentioned throughout this manual, are as seen from the tractor driver's seat and facing in the direction of travel.

1.1 SERIAL NUMBER LOCATION

Fig. 1 Serial Number Location

Always give your dealer the serial number of your Twister when ordering parts or requesting service or other information.

The serial number plate is located where indicated above. Please mark the number in the space provided for easy reference.

Model Number _____

Serial Number _____

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Section 2: SAFETY

Why is SAFETY important to you?

3 Big Reasons:
- ▲ Accidents Disable and Kill
- ▲ Accidents Cost
- ▲ Accidents Can Be Avoided

This Safety Alert symbol means:
ATTENTION!
BECOME ALERT!
YOUR SAFETY IS INVOLVED!

The Safety Alert symbol identifies important safety messages on the 30 Series Twister and in this manual.

When you see this symbol, be alert to the possibility of personal injury or death.

Follow the instructions in the safety message.

SIGNAL WORDS:
Note the use of the signal words DANGER, WARNING, CAUTION and ATTENTION along with the accompanying safety messages. The appropriate signal word for each message has been selected using the following guidelines:

DANGER - Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
This signal word is to be limited to the most extreme situations typically for machine components which, for functional purposes, cannot be guarded.

WARNING - Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
It identifies hazards that are exposed when guards are removed. It may also be used to alert against unsafe practices.

CAUTION - Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
It may also be used to alert against unsafe practices.

ATTENTION - Indicates practices or situations which may result in the malfunction of, or damage to, the equipment.

2.1 SAFETY ORIENTATION

You are responsible for the SAFE operation and maintenance of your Mandako 30 Series Twister. Ensure that you and anyone else who will use, maintain or work around the Twister be familiar with the Safety, Operating and Maintenance procedures in this manual.

This manual will take you step-by-step through your working day and alerts you to all good safety practices that should be used while using the Twister.

Remember, You are the key to safety. Good safety practices not only protect you but also the people around you. Make these practices a working part of your safety program. Be certain that everyone using this equipment follows all safety precautions, as well as the detailed operating and maintenance procedures.

Most accidents can be prevented. Do not risk injury or death by ignoring good safety practices:

- Twister owners must give operating instructions to operators or employees before allowing them to operate the machine, and review annually thereafter.
- The most important safety device on this equipment is a SAFE operator. It is the operator's responsibility to read and understand ALL Safety and Operating instructions in the manual and to follow these. Most accidents can be avoided.
- A person who has not read and understood all using and safety instructions is not qualified to use the machine. An untrained operator exposes himself and bystanders to possible serious injury or death.
- Do not modify the equipment in any way. Unauthorized modification may impair the function and/or safety and could affect the life of the equipment.
- Think SAFETY! Work SAFELY!

2.2 GENERAL SAFETY

- Read and understand the Operator's Manual and all safety signs before using, maintaining, adjusting or cleaning the Twister.

- Have a first-aid kit available for use should the need arise and know how to use it.

- Have a fire extinguisher available for use should the need arise and know how to use it.
- Do not allow riders.
- Wear appropriate protective gear. This list includes but is not limited to:
  - Hard hat
  - Protective shoes with slip resistant soles
  - Protective glasses, goggles or face shield
  - Heavy gloves
  - Hearing Protection

- Install and secure all guards before starting.
- Wear suitable ear protection for prolonged exposure to excessive noise.

- Place all controls in neutral, set park brake, stop engine, remove ignition key and wait for all moving parts to stop before servicing, adjusting, repairing or unplugging.
- Clear the area of people, especially small children, before operating the unit.
- Review safety related items annually with all personnel who will operating or maintaining the Twister.

2.3 EQUIPMENT SAFETY GUIDELINES

- Safety of the operator and bystanders is one of the main concerns in the design and development of equipment. However, every year many accidents occur, which could have been avoided, by a few seconds of thought and a more careful approach to handling equipment.

- You, the operator, can avoid many accidents by following the precautions in this section. Insist those working with you, or for you, follow them also.

- In order to provide a better view, certain photographs or illustrations in this manual may show an assembly with a safety shield removed. Equipment should never be used in this condition. Keep all shields in place. If shield removal becomes necessary for repairs, replace the shield prior to use.

- Replace any safety or instruction sign that is missing or not readable. The location of these safety signs are indicated in this manual.

- Never use alcoholic beverages or drugs which can hinder alertness or coordination while using this equipment. Consult your doctor about using this machine while taking prescription medications.

- Under no circumstances should young children be allowed to work with this equipment.

- The operator should be a responsible, properly trained and physically able person. They should be familiar with machinery and trained in this equipment's operations.

  If the elderly are assisting with work, their physical limitations need to be recognized and accommodated.

- Use a tractor equipped with a Roll Over Protective Structure (ROPS) and a seat belt.

- Never exceed the limits of the Twister. If its ability to do a job, or to do so safely, is in question - DON'T TRY IT.

- Do not modify the equipment in any way. Unauthorized modification may impair the function and life of the equipment, and result in serious injury or death.

2.4 SAFETY DECALS

- Keep safety decals clean and legible at all times.
- Replace decals that are missing or have become illegible.
- Replaced parts that displayed a safety decal should also display the current sign.
- Safety decals displayed in Section 2.13 each have a part number in the lower right hand corner. Use this part number when ordering replacement parts.
- Safety decals are available from your authorized Distributor or Dealer Parts Department or the factory.

2:4:1 How to Install Safety Decals:

1. Be sure that the installation area is clean and dry.
2. Be sure temperature is above 50°F (10°C).
3. Determine exact position before you remove the paper backing. See Section 2.13
4. Remove the smallest portion of the split backing.
5. Align the decal over the specified area and carefully press the small portion with the exposed adhesive in place.
6. Slowly peel back the remaining paper and carefully smooth the rest of the decal in place.
7. Small air pockets can be pierced with a pin and smoothed out using the piece of the paper backing.

2.5 SAFETY TRAINING

- Safety is a primary concern in the design and manufacture of our products. Unfortunately, our efforts to provide safe equipment can be wiped out by a single careless act of an operator or bystander.
- Accident prevention and identifying hazards are dependent upon the proper training of personnel. Their awareness, concern and common sense are crucial when involved with the operation, transport, maintenance and storage of the equipment.
- Working with unfamiliar equipment can lead to careless injuries. Read this manual to become acquainted with the machine.
- Whether the machine owner is the operator, loans or rents it out, it is their responsibility to make certain that the borrower reads and understands the operator's manuals.
- Know your controls, how to stop the tow unit, the engine and machine quickly in an emergency.
- Train all new personnel and review instructions frequently with existing workers. Be certain only a properly trained and physically able will use the machinery.

  A person who has not read and understood all using and safety instructions is not qualified to use the machine. An untrained operator exposes himself and bystanders to possible serious injury or death.

  If the elderly are assisting with the work, their physical limitations need to be recognized and accommodated.

2.6 PREPARATION

- Never use the Twister until you have read, this Manual and power unit Operator's Manual. Take note of each Safety Message found on the safety decals on the Twister and power unit.

- Personal protective equipment including a hard hat, safety glasses, safety shoes, gloves are recommended during assembly or installation, operation, adjustment, maintaining or repairing, cleaning or moving the unit.

  Do not allow long hair, loose fitting clothing or jewelry to be around equipment.

- PROLONGED EXPOSURE TO LOUD NOISE MAY CAUSE PERMANENT HEARING LOSS!

- Power equipment with or without equipment attached can often be noisy enough to cause permanent, partial hearing loss. We recommend that you wear hearing protection on a full-time basis if the noise in the Operator's position exceeds 80db.

  Noise over 85db on a long-term basis can cause severe hearing loss. Noise over 90db adjacent to the Operator over a long-term basis may cause permanent, total hearing loss.

  NOTE:
  Hearing loss from loud noise (from tractors, chain saws, radios, and other such sources close to the ear) is cumulative over a lifetime without hope of natural recovery.

- When towing with a tractor, use only with a tractor equipped with an approved Roll-Over-Protective-Structure (ROPS). Always wear a seat belt. Serious injury or even death could result from falling off the tractor. If a roll-over occurs, the operator could be pinned under the ROPS or inside the tractor.

- Clear working area of stones, branches or hidden obstacles that might be hooked or snagged, causing damage or injury.

- Be sure the Machine is properly attached, adjusted and in good operating condition.

- Ensure that all safety shielding and safety decals are properly installed and in good condition.

2.7 OPERATING SAFETY

- Read and understand the Operator's Manual and all safety signs before using. Review safety instructions annually.
- Place all controls in neutral, stop engine, set park brake, remove ignition key, and wait for all moving parts to stop before servicing, adjusting, repairing or unplugging.
- Install and secure all guards and shields before starting or operating.

- Keep hands, feet, hair and clothing away from all moving and/or rotating parts.
-
- Do not allow riders on the Twister or tractor during operation or transporting.
- Clear the area of all bystanders, especially children, before starting.
- Stay away from side wings when folding or extending frame. Keep others away.

- Clean reflectors, SMV (Slow Moving Vehicle) emblem and lights before transporting. Be sure you are in compliance with all federal and local regulations regarding transport of equipment on public roads and highways.
- Do not exceed a safe travel speed.
- Use hazard flasher on tractor when transporting.
- Before applying pressure to the hydraulic system, make sure all components are tight and that the steel lines, hoses and couplings are in good condition.
- Fold wings and install transport lock brackets with its retainer over wheel lift cylinder before transporting.
- Stay away from overhead power lines when folding or extending wings. Electrocution can occur without direct contact.
- Attach securely to towing unit using a hardened pin with a retainer and a safety chain.
- Do not drink and drive.

2.8 MAINTENANCE SAFETY

- Good maintenance is your responsibility. Poor maintenance is an invitation to trouble.

- Follow good shop practices.
  - Keep service area clean and dry.
  - Be sure electrical outlets and tools are properly grounded.
  - Use adequate light for the job at hand.
- Place all controls in neutral, stop engine, set the park brake, remove ignition key, and wait for all moving parts to stop before servicing, adjusting, repairing or unplugging.
- Place stand or blocks under the frame before working beneath the machine or when changing tires.

- Always use personal protective devices such as safety glasses, gloves and hearing protection, when performing any service or maintenance work.
- Where replacement parts are necessary for periodic maintenance and servicing, genuine factory replacement parts must be used to restore your equipment to original specifications.

- A fire extinguisher and first aid kit should be kept readily accessible while performing maintenance on this equipment.

- Relieve pressure on hydraulic system before servicing or coulteronnecting from tractor.

- Before applying pressure to a hydraulic system, make sure all components are tight and that steel lines, hoses and couplings are in good condition.

- When completing a maintenance or service function, make sure all safety shields and devices are installed before placing unit in service.

2.9 TIRE SAFETY

- Failure to follow proper procedures when mounting a tire on a wheel or rim can produce an explosion which may result in serious injury or death.
- Do not attempt to mount a tire unless you have the proper equipment and experience to do the job.
- Have a qualified tire dealer or repair service perform required tire maintenance.
- When replacing worn tires, make sure they meet the original tire specifications. Never under size.

2.10 STORAGE SAFETY

- Store the unit in an area away from human activity.
- Do not allow children to play on or around the stored machine.
- Store the unit in a dry, level area. Support the frame with planks if required.
- Lower wings and frame to the ground for storage.

2.11 HYDRAULIC SAFETY

- Always place all tractor hydraulic controls in neutral before dismounting.
- Make sure that all components in the hydraulic system are kept in good condition and are clean.
- Replace any worn, cut, abraded, flattened or crimped hoses and steel lines.
- Relieve pressure from hydraulic circuit before servicing or coulteronnecting from tractor.
- Do not attempt any makeshift repairs to the hydraulic lines, fittings or hoses by using tape, clamps or cements. The hydraulic system operates under extremely high-pressure, Such repairs will fail suddenly and create a hazardous and unsafe condition.

- Wear proper hand and eye protection when searching for a high-pressure hydraulic leak. Use a piece of wood or cardboard as a back stop instead of hands to isolate and identify a leak.
- If injured by a concentrated high-pressure stream of hydraulic fluid, seek medical attention immediately. Serious infection or toxic reaction can develop from hydraulic fluid piercing the skin surface.
- Before applying pressure to the system, make sure all components are tight and that lines, hoses and couplings are in good condition.

2.12 TRANSPORT SAFETY

- Read and understand ALL the information in the Operator's Manual regarding procedures and SAFETY when operating the Twister in the field and/or on the road.
- Maintain wheel bolts to specified torque.
- Check with local authorities regarding Twister transport on public roads. Obey all applicable laws and regulations.
- Always travel at a safe speed. Use caution when making corners or meeting traffic.

- Clean reflectors, SMV (Slow Moving Vehicle) emblem and lights before transporting. Be sure you are in compliance with all federal and local regulations regarding transport of equipment on public roads and highways.
- Install additional lights on the rear of the machine to safeguard against rear end collisions. Daybreak and dusk are particularly dangerous and pilot vehicles are recommended.
- Install wheel cylinder lock brackets and close valves in hydraulic lines before transporting or working under frame.
- Be sure that the machine is securely hitched to the towing vehicle and a retainer is used through the drawbar pin. Always attach a safety chain between the frame and the towing machine.
- Stay away from overhead power lines when raising wings. Electrocution can occur without direct contact.
- Raise wings and install transport lock brackets over wheel cylinders before transporting.
- Keep to the right and yield the right-of-way to allow faster traffic to pass. Drive on the shoulder of the road, if permitted by law.
- Do not exceed 32 km/h (20 mph) on highway transport. Reduce speed on rough roads and surfaces.
- Always use hazard warning flashers on tractor when transporting unless prohibited by law.
- Do not drink and drive.

2.13 SAFETY DECALS

The various safety decals, and their locations on the equipment are shown in the illustrations to follow.

Good safety practices require familiarizing yourself with the decals. Read the warning messages, and note the area, or particular function related to that area, that the decal highlights.

If safety decals have been damaged, removed, become illegible, or replacement parts do not have the decal; new ones must be applied. Safety decals are available from your authorized dealer.

Mandako reserves the right to update safety decals without notice. Safety decals may not be to scale or exactly as shown.

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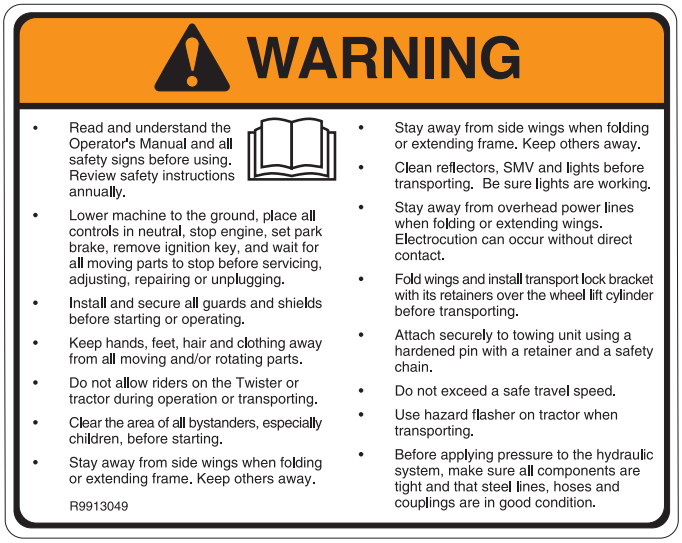

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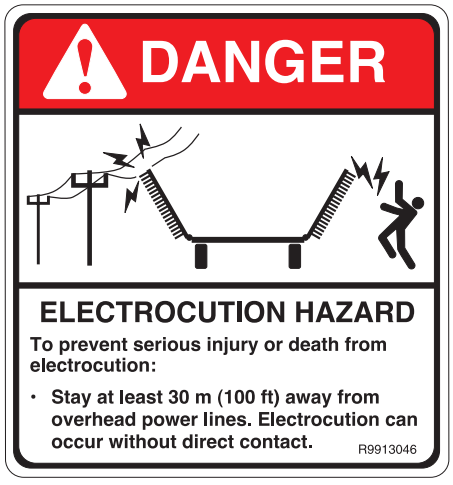

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Part No. R9913113

Remember - Safety Decals are for your protection!
If they have been damaged, removed, become illegible, or replacement parts do not have the decal; new ones must be applied. Safety decals are available from your authorized dealer.

2.14 SAFETY DECAL LOCATIONS

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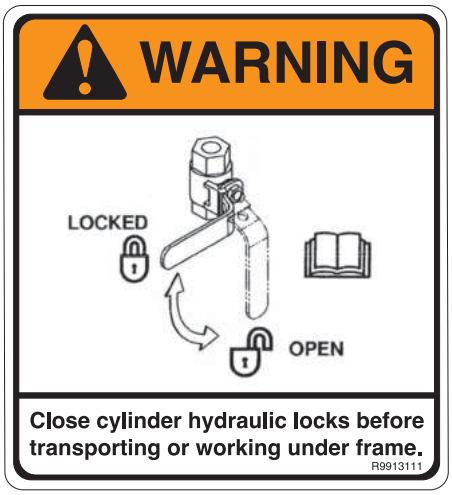

Part No. R9913111

Remember - Safety Decals are for your protection!
If they have been damaged, removed, become illegible, or replacement parts do not have the decal; new ones must be applied. Safety decals are available from your authorized dealer.

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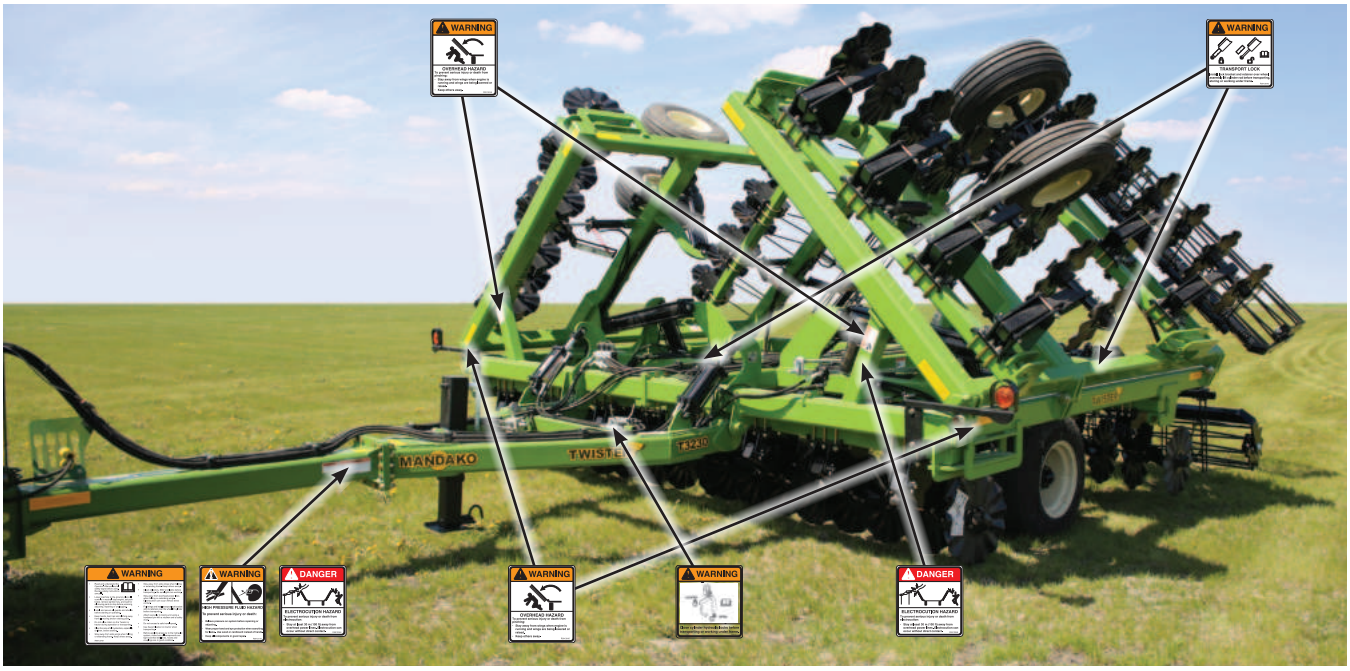

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Section 3: OPERATION

- Read and understand the Operator's Manual and all safety signs before using. Review safety instructions annually.
- Lower machine to ground, place all controls in neutral, stop engine, set park brake, remove ignition key, and wait for all moving parts to stop before servicing, adjusting, repairing or unplugging.
- Install and secure all guards and shields before starting or operating.
- Keep hands, feet, hair and clothing away from all moving and/or rotating parts.
-
- Do not allow riders on the Twister or tractor during operation or transporting.
- Clear the area of all bystanders, especially children, before starting.
- Stay away from side wings when folding or extending frame. Keep others away.
- Clean reflectors, SMV (Slow Moving Vehicle) emblem and lights before transporting. Be sure you are in compliance with all federal and local regulations regarding transport of equipment on public roads and highways.
- Do not exceed a safe travel speed.
- Use hazard flasher on tractor when transporting.
- Before applying pressure to the hydraulic system, make sure all components are tight and that the steel lines, hoses and couplings are in good condition.
- Fold wings and install transport lock brackets with its retainer over wheel lift cylinder before transporting.
- Stay away from overhead power lines when folding or extending wings. Electrocution can occur without direct contact.
- Attach securely to towing unit using a hardened pin with a retainer and a safety chain.
- Do not drink and drive.

It is the responsibility of the owner and operator to read this manual. They must to train all others before starting to work with the machine. Follow all safety instructions exactly. Safety is everyone's business. By following recommended procedures, a safe working environment is provided for the operator, bystanders and the area around the work site.

Many features incorporated into this machine are the result of suggestions made by customers like you.

This manual will describe how to set the Twister to provide maximum field efficiency. By following the operating instructions in conjunction with a good maintenance program, your Twister will provide many years of trouble-free service.

3.1 MACHINE COMPONENTS

The Mandako Twister Mandako Twister consists of a main frame with wings on each side that can fold up for transport or storage. Each wing is designed with hanging coulter toolbars to engage the soil. The toolbars can be angled up from 0° to 7° to provide a more aggressive residue cutting, soil moving and residue burying action. It is the responsibility of the operator to monitor the job being done and adjust the angle of the toolbars to provide the desired performance. Each wing frame is designed with adjustable locking pins to hold the toolbar in position when operating and remove the loading on the tractor hydraulic system.

Each wing folds up for transport. Install cylinder stops around wheel lift cylinders before transporting. Use the center wheel lift cylinders to set and control the depth of the coulters penetrating the soil.

Optional harrows and rolling baskets are available to mount on the back of each frame. The hydraulic system is designed with a ball valve that locks the hitch position circuit. This circuit allows the operator to set the fore and aft position of the machine.

Both front and rear toolbars are equipped with a position indicator to assist in positioning the angle of the toolbar.

A 'single point depth' control is mounted on the front of the frame and plumbed into the wheel lift circuit so the coulters return to the same pre-set depth when lowered for working.

A bank of solenoids on the front of the frame direct the oil flow from the yellow circuit to the desired system. The solenoids are controlled by a control box mounted in the cab.

The main components of the unit are as follows:

a. Center Frame
b. Left Wing
c. Right Wing
d. Wheels
e. Hydraulic Line Storage Holder
f. Coulters
g. Coulter Toolbar
h. Toolbar Locking Pins
j. Toolbar Angle Indicator
k. Rolling Baskets
l. Tine Harrows
m. Hydraulic Ball Valve
n. Single Point Depth Control
o. Three-Way Electro-Hydraulic Valve
p. Hydraulic Selector Switch
q. Hitch
r. Hydraulic Accumulator Switch

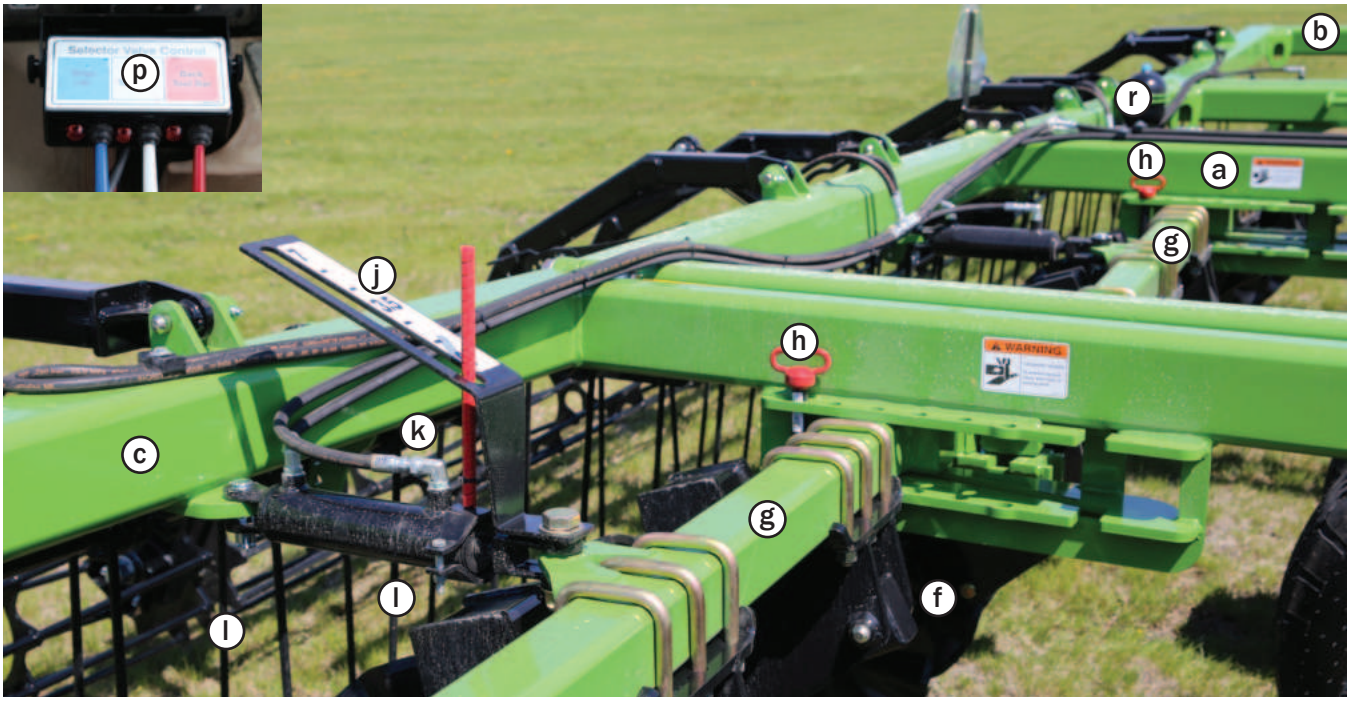
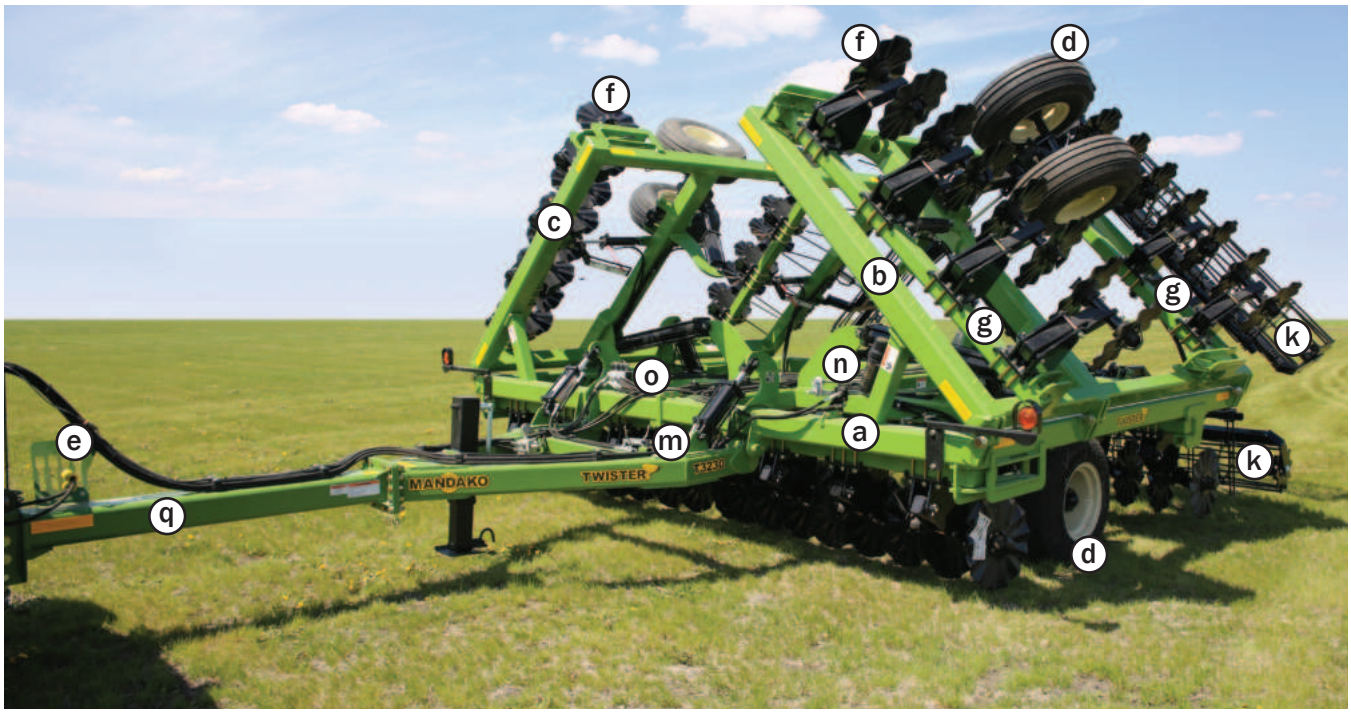


Fig. 2 Machine Components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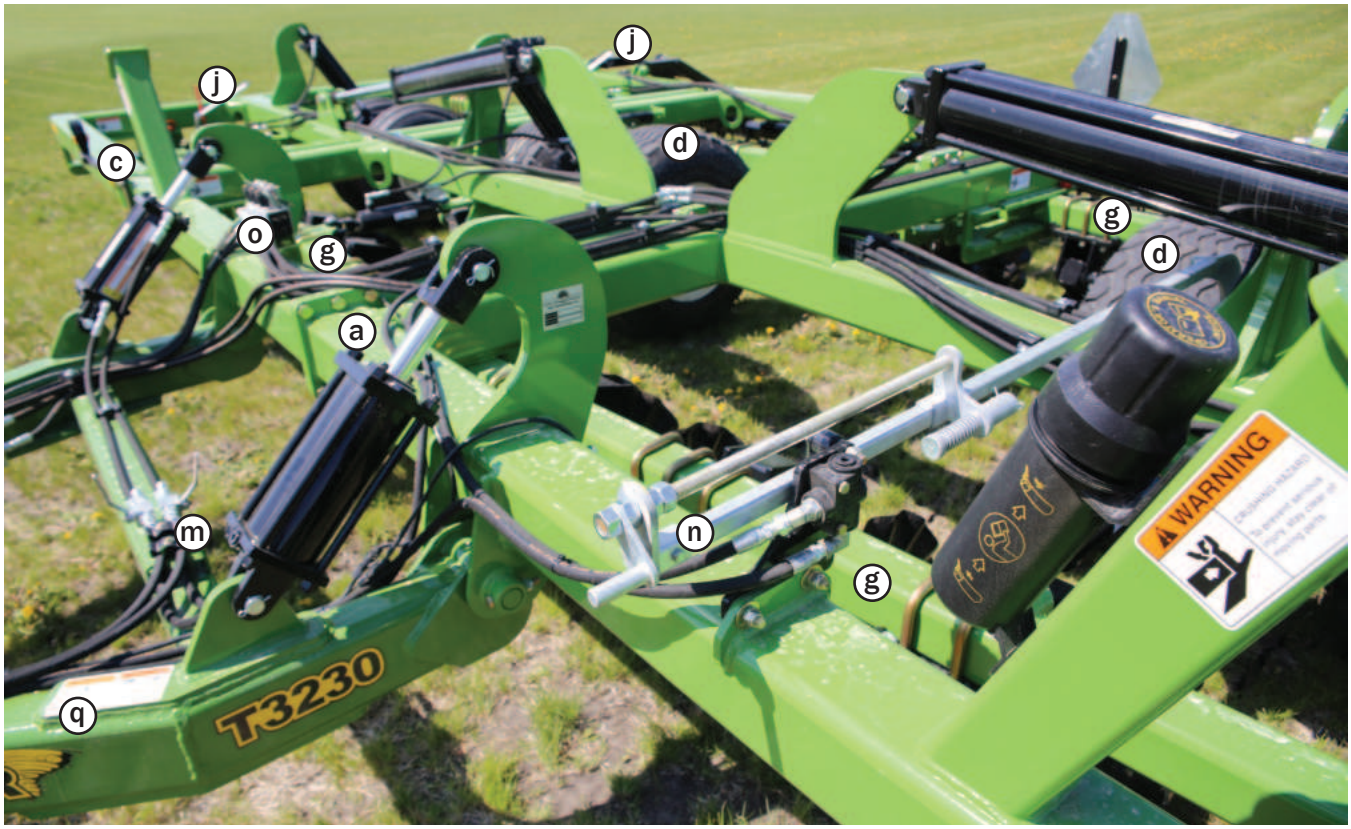
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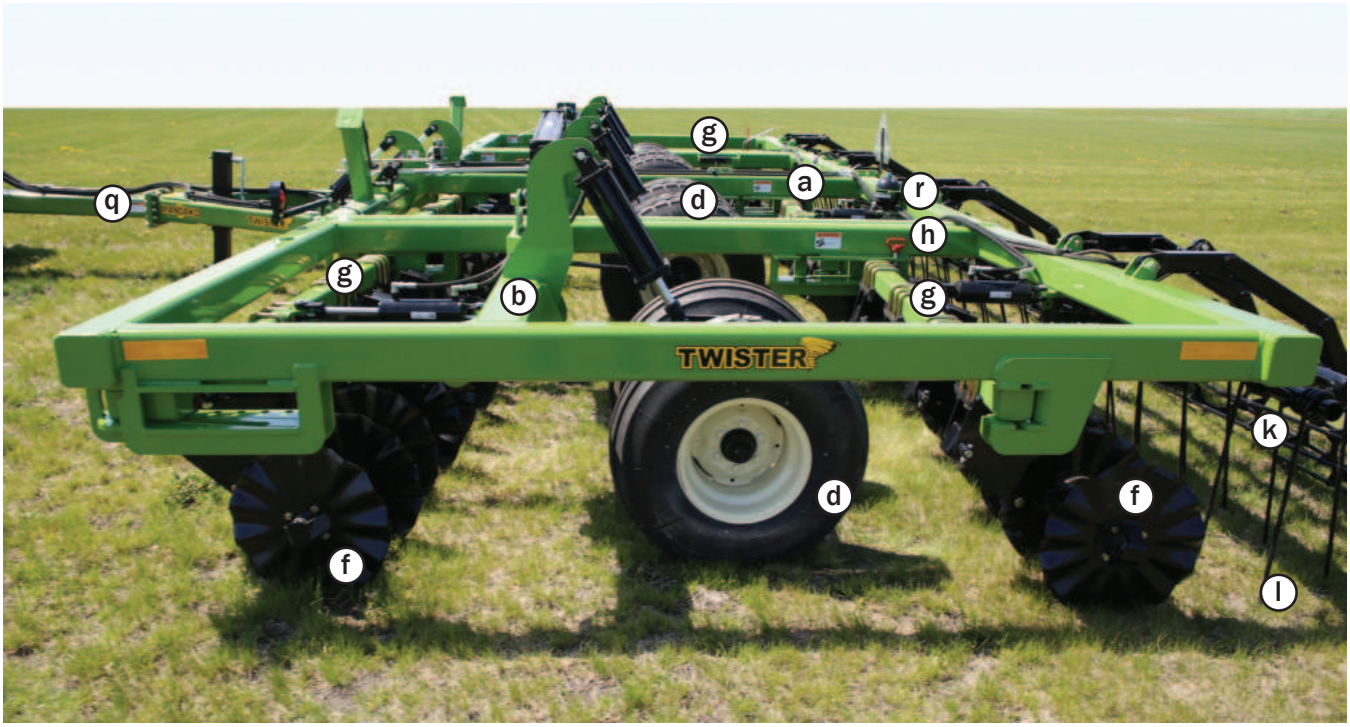
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3.2 MACHINE BREAK-IN

There are no operational restrictions on the Twister when used for the first time.

Although, it is recommended that the following mechanical items be checked:

After operating for 1/2 hour:

1. Re-torque all wheel bolts.
2. Re-torque all fasteners and hardware.
3. Check that no hydraulic lines are being pinched or crimped. Re-route as required.
4. Inspect all hydraulic lines, hoses, fittings and couplers for leaks. Tighten any leaking fitting.
5. Check for, and remove all entangled material.
6. Lubricate all grease fittings except bearings.

After 5 hours and 10 hours of operation:

7. Re-torque all wheel bolts, fasteners and hardware.
8. Inspect all hydraulic lines, hoses, fittings and couplers for leaks. Tighten any leaking fittings.
9. Go to the normal servicing and maintenance schedule as defined in the Service and Maintenance Section.

3.3 PRE-OPERATION CHECKLIST

Efficient and safe operation of the Mandako Twister requires that each operator reads and understands the using procedures and all related safety precautions outlined in this section. A pre-operation checklist is provided for the operator. It is important for both the personal safety and maintaining the good mechanical condition of the Mandako Twister that this checklist is followed.

Before operating Mandako Twister and each time thereafter, the following areas should be checked off:

1. Lubricate the machine per the schedule outline in the Maintenance Section.
2. Use only a tractor of adequate power and weight to operate the Mandako Twister. See section 3.4 for recommendations.
3. Be sure the machine is properly attached to the tractor. Be sure that a mechanical retainer is installed through the drawbar pin and that the safety chain is used.
4. Inspect all hydraulic lines, hoses, fittings and couplers for leaks. Tighten any leaking fitting.
5. Check the tires and ensure that they are inflated to their specified pressure.
6. Check the wheel bolts. Ensure they are tightened to their specified torque.
7. Remove all entangled material.

3.4 EQUIPMENT MATCHING

To ensure the safe and reliable operation of the Twister, it is necessary to use a tractor with appropriate specifications.

As a guideline, be certain that these requirements are met:

1. Horsepower:
   The Twister needs both power and mass to pull and stabilize the unit in all operating conditions.

   The lower levels of power are appropriate for hard, level terrain. Higher levels for soft or hilly land. Extra mass is also required to maintain stability when slowing down or travelling downhill.

2. Hydraulic System:
   The tractor's hydraulic system must be capable of a minimum of 10 gpm (38 lpm) at 1800 psi (12,420 kPa) but not to exceed 2800 psi (19,320 lpm).

   The base Twister requires 4 hydraulic circuits for the hitch position, wheel lift, selector valve and hydraulic basket position. Switches that control the selector valves are mounted in the cab for access by the operator. System ball valves are mounted on the hitch.

   a. Ball valves.

   b. Three-way electro-hydraulic valve.

   c. Operator control box.

Size	Horsepower
8'	80 - 120
12'	120 - 180
16'	160 - 240
24'	240 - 360
28'	280 - 420
32'	320 - 480
36'	360 - 540
40'	400 - 600

Table 1 - Horsepower Recomendation

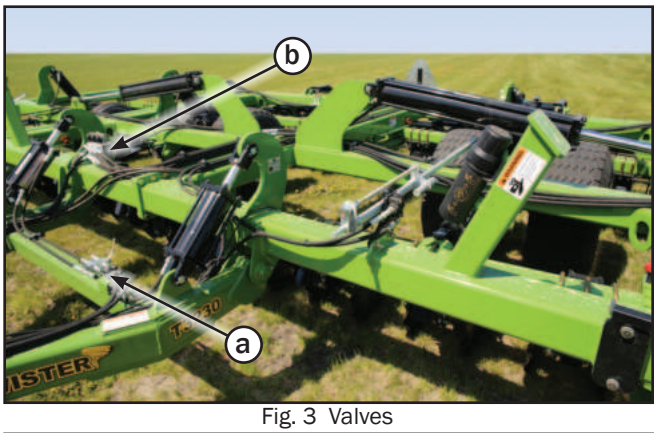


Fig. 3 Valves

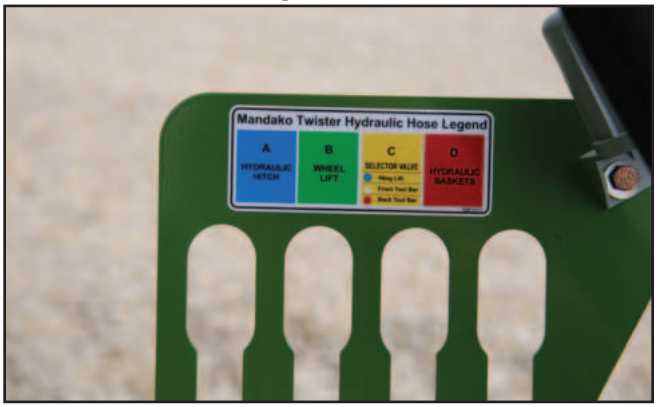


Fig. 4 Hydraulic Circuit

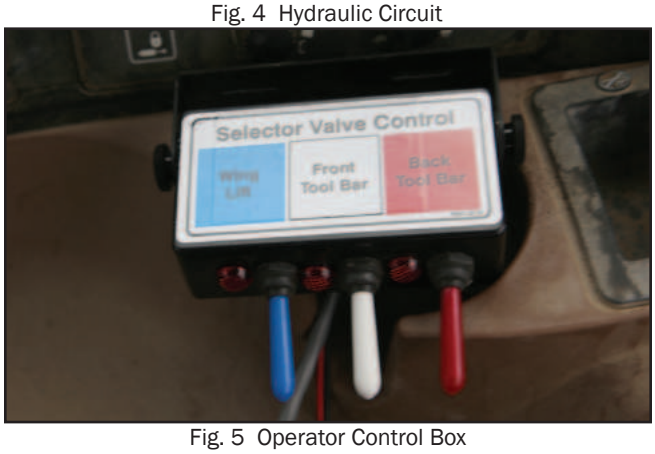


Fig. 5 Operator Control Box

3.5 CONTROLS

Before starting to work, all operators should familiarize themselves with the location and function of all controls.

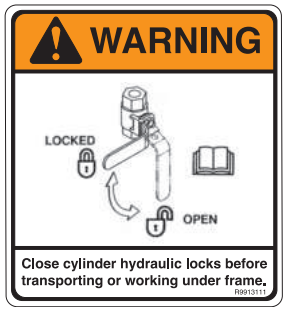
1. Shut-Off Valves:
   The wing raise/lower and hitch position circuits are designed with a valve to lock out or shut off these systems if required.

   a. Unlocked:
      Turn valve handle parallel to hydraulic line to unlock the
      circuit.

Fig. 6 Circuit Unlocked

   b. Locked:
      Turn valve handle at right angles to hydraulic line to lock the circuit.

Fig. 7 Circuit Locked



2. Electro-Hydraulic Selector Valves:
   An electro-hydraulic selector valve is mounted on the front of the frame that controls the hydraulic system and the control switches in the cab.

Fig. 8 Electro-Hydraulic Solenoid Valve

3. Hydraulic Circuit System:
   The Twister requires 4 hydraulic outlets to operate all the circuits.

   a. Hitch position.

   b. Wheel lift.

   c. Three-way selector valve.

   d. Hydraulic rolling baskets.

4. Control Box Switches:
   The yellow hydraulic circuit provides oil to the selector valve mounted on the front of the frame. Switches controlling the valves are mounted in the cab with power provided by the cigarette lighter.

   a. Wing Lift (Blue):
   This blue toggle switch controls the power to the solenoid providing oil to the wing position cylinders. Move the toggle to activate the circuit. Use the hydraulic control lover in the tractor cab to move the wing cylinder.
   When lowering the wings, hold the control lever until you hear the system go over relief. This will insure that the wing cylinders fully extend into the slot on the wing bracket to allow the wing to go up and down (follow the ground contour) as the machine moves across the field.
   Move the hydraulic lever in the opposite direction to raise the wings.
   Move the toggle switch back into its off or neutral position when the wing moving (up or down) operation is completed.

   NOTE:
   Only one circuit can be operated at a time. The toggle must be returned to its off or neutral position before another circuit (system) is turned on.

   b. Front Tool Bar Position (White):
   This white toggle switch controls the power to the solenoid providing oil to the front tool bar position cylinder. Move the toggle to activate the circuit. Use the hydraulic control lever in the tractor cab to move the front tool bar.
   Watch the scale on the left side of the frame to monitor the position of the tool bar.
   Move the hydraulic lever for and aft as appropriate to move and position the front tool bar.
   Move the toggle switch back into its off or neutral position when the tool bar moving (for and aft) operation is completed.

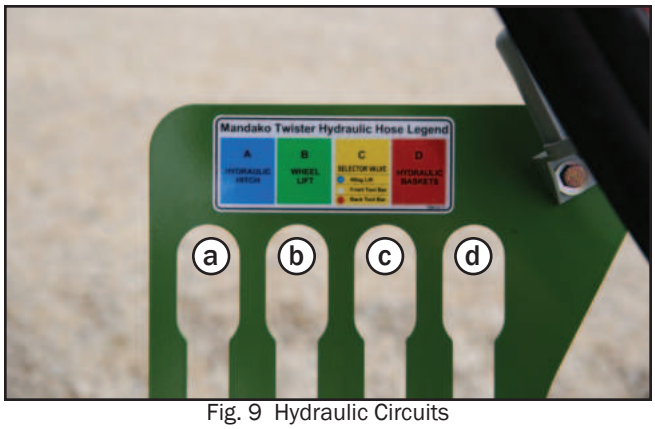


Fig. 9 Hydraulic Circuits

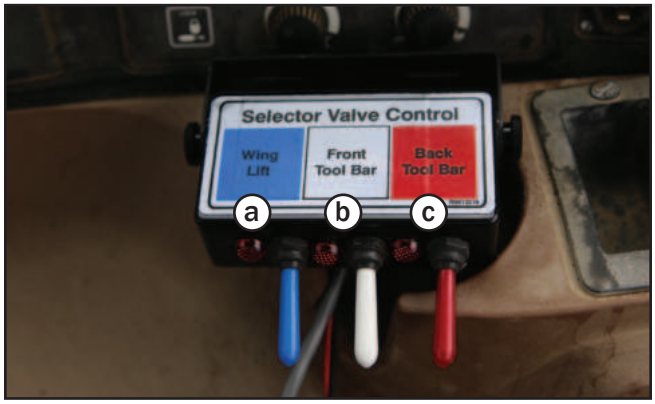


Fig. 10 Circuit Selector Switch

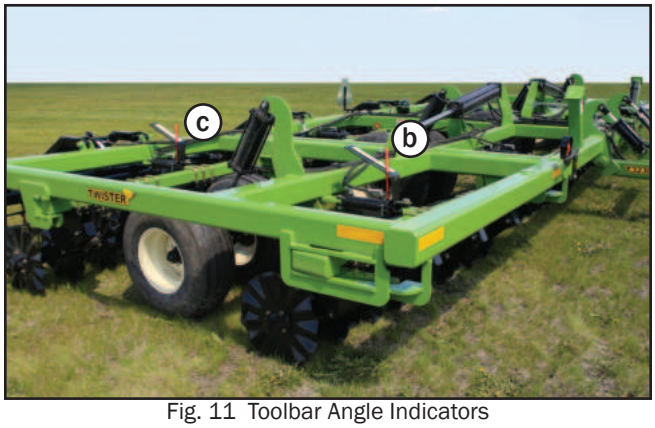


Fig. 11 Toolbar Angle Indicators

   c. Rear Tool Bar Position (Red):
   This red toggle switch controls the power to the solenoid providing oil to the rear tool bar position cylinder. Move the toggle to activate the circuit. Use the hydraulic control lever in the tractor cab to move the rear tool bar.
   Watch the scale on the left side of the frame to monitor the position of the tool bar.
   Move the hydraulic lever for and aft as appropriate to move and position the rear tool bar.
   Move the toggle switch back into its off or neutral position when the tool bar moving (for and aft) operation is completed.

5. Single Point Depth Control:
   All Twisters are equipped with a shut off valve in the wheel lift circuit that allows the operator to set the wheel assemblies at the appropriate position to obtain the desired depth of operation of the coulters on the toolbars.

   It is the responsibility of the operator to set the fore - aft angle (hitch cylinder position), toolbar angle and the position of the wheel assemblies (coulter depth into the ground) to provide the desired performance.

   When the frame (coulters) are lowered (wheel assemblies raised), the 'return to depth' system should be set so the same type of performance is obtained throughout the field.

   The system consists of:

   a. Arm to wheel assembly frame.

   b. Shut off valve.

   c. Valve engage rod.

   d. Position adjust rod.

   e. Position adjust handle.

   f. Jam nuts.

   To adjust:

   a. Turn the handle to move the valve engage rod to the appropriate position.

   b. Monitor the machine performance and readjust as required.

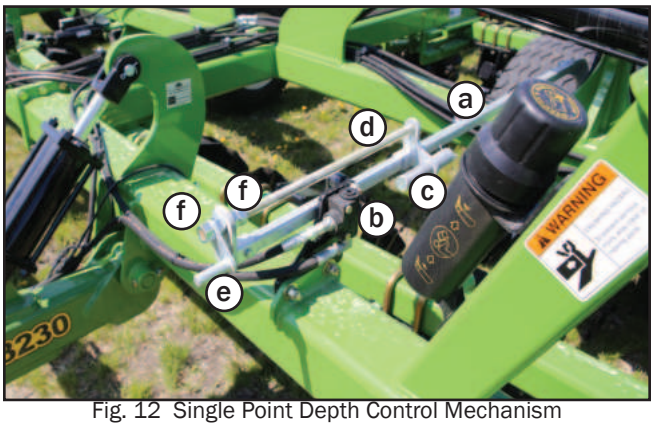


Fig. 12 Single Point Depth Control Mechanism

6. Rolling Basket Down-Pressure System (Optional):
   Each Twister can be designed with rolling baskets

behind the harrows to break up any clods or clumps of material that is produced by the coulters. To be effective, they must have a downward force that will allow them to push down on the clods and break them up.

A pressure gauge mounted on the right front corner of the hitch displays the pressure in the roller position circuit. Each operator should observe the gauge while lowering the rolling baskets to the ground. The best results are obtained when the pressure is set at 3450 to 4830 kPa (500 to 700 psi). Place the hydraulic circuit in float to retain the pressure in the system and hold the baskets down when operating. A system accumulator is mounted in the left rear area of the frame to allow the basket frame(s) to move up and down to follow the contour of the ground. The accumulator receives the excess oil when a basket goes up as it follows the contour of the ground and then feeds it back at the same pressure as the contour smooths out.

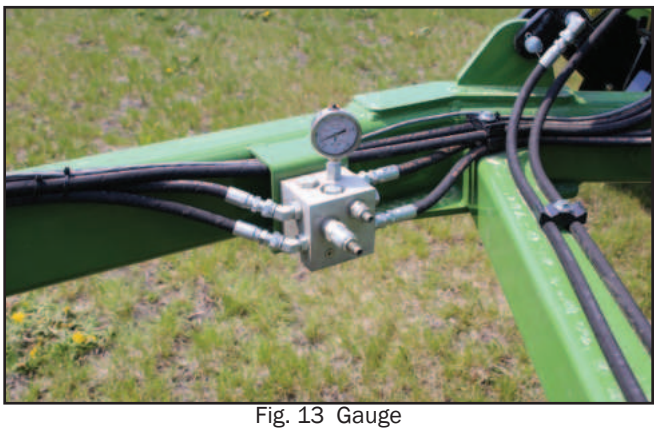


Fig. 13 Gauge

Fig. 14 Accumulator

3.6 ATTACHING TO TRACTOR

Follow this procedure when attaching the twister to a tractor:

1. Clear the area of bystanders, especially small children.

2. Make sure there is enough room and clearance to safely back up to the machine.

3. While backing up, use the jack to align the hitch and drawbar.

4. Stop tractor, set park brake, remove ignition key and wait for all moving parts to stop before dismounting.

Fig. 15 Backing Up

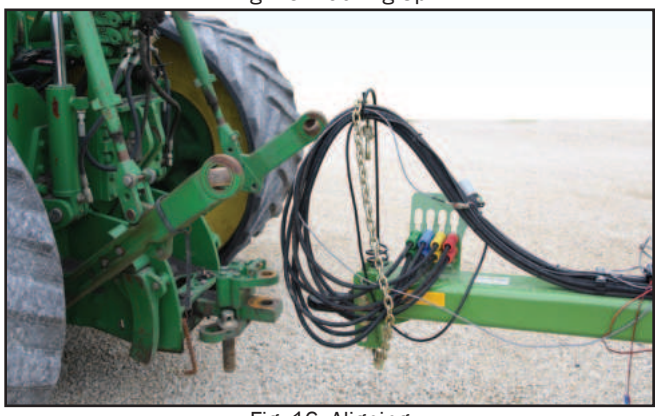


Fig. 16 Aligning

5. Use a drawbar pin with provisions for a mechanical retainer. Install the retainer.

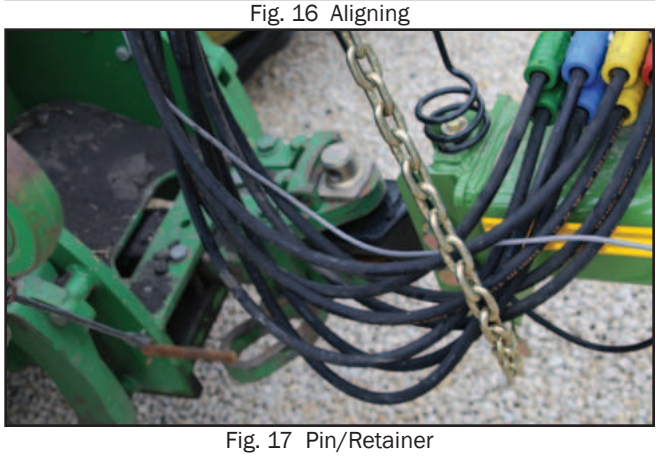


Fig. 17 Pin/Retainer

6. Safety Chain:
   Attach the safety chain around the drawbar cage to prevent unexpected separation.

Fig. 18 Safety Chain

7. Stow the jack:

   - Pull out pin.
   - Raise base.
   - Raise jack.

Fig. 19 Jack

Fig. 20 Stowed

8. Connect the wiring harness by inserting terminal into plug on tractor. Route harness through hose retainer on hitch to prevent dragging on ground.

Fig. 21 Wiring Harness

3.7 CONNECT LIGHTING AND HYDRAULIC SYSTEM

WARNING: High Pressure Fluid
Wear eye and hand protection when searching for leaks. Relieve pressure before adjusting. Keep components in good repair.

1. Use a clean cloth or paper towel to clean the dirt and build-up from around the couplers and male tips.

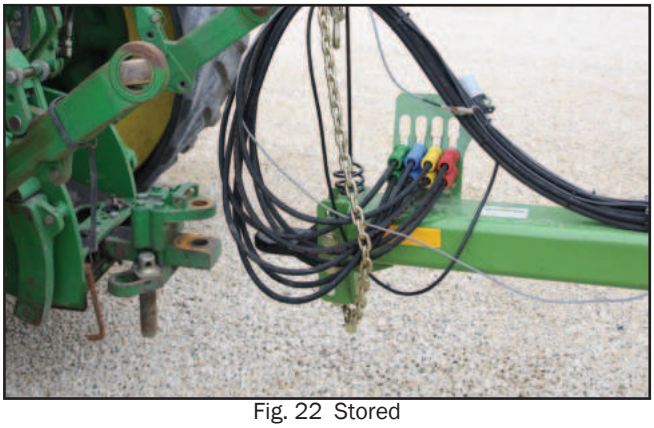


Fig. 22 Stored

2. Insert the male tips into the couplers. Be sure they are locked in place.

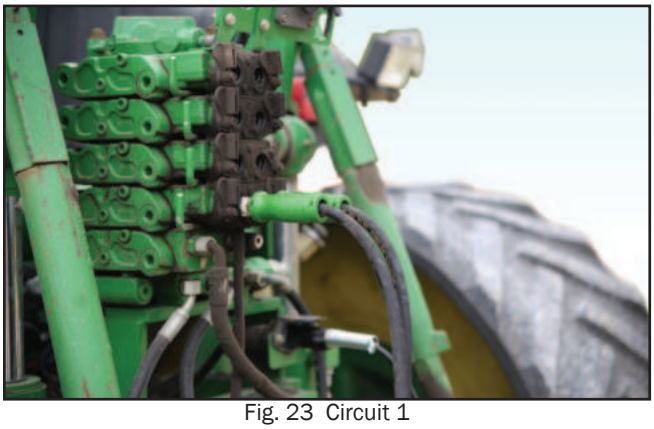


Fig. 23 Circuit 1

3. Route the hoses through the metal hose retainer on the hitch to prevent the hoses from dragging on the ground. Make sure there is enough slack to prevent hoses from being pinched when turning.

4. Check the function of each circuit. Be sure they function according to expectations. Reverse hoses if they do not.

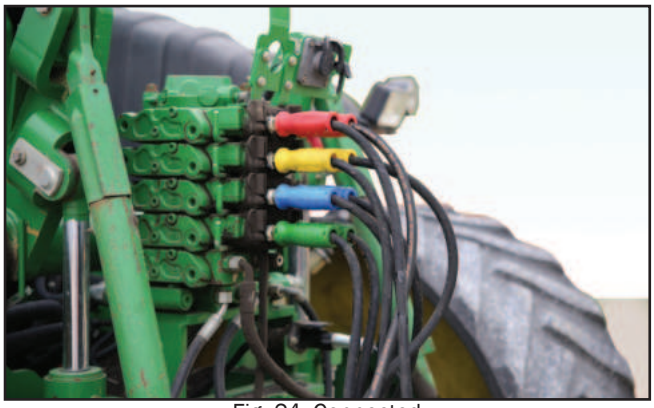


Fig. 24 Connected

3.8 CONNECT THE SELECTOR VALVE CONTROL SYSTEMS

Each Twister is designed with a 'yellow' hydraulic circuit to provide oil to the selector valve bank mounted on the front of the frame. Connect this coupler to a valve on the tractor that is equipped with a float feature that continuously supplies oil to the solenoid.

The control box is mounted in the cab and the power cord is plugged into the cigarette lighter outlet.

Follow this procedure when connecting the selector valve control switches:

1. Retrieve the switch assembly from its stored location.

   IMPORTANT:
   Tractor cabs are designed with an access opening to allow wires or the components to enter or exit the cab in a controlled manner rather than leaving a window or door open. Refer to tractor manual for its location. Place switch assembly in cab and then route wire through opening.

2. Mount switch control box in cab.

3. Connect power line to the cigarette lighter plug.

4. Route the wires out of the cab through the opening in the bottom rear edge of the cab.

   IMPORTANT:
   It is recommended that the switch assembly be removed from the tractor and Twister and stored inside in a secure location to prevent deterioration from the environment. Unplug the control wires at the terminal to remove switch assembly.

5. Plug assembly plug into terminal on control wiring harness.

6. Reverse the above procedure when unhooking.

Fig. 25 Mounted/Power

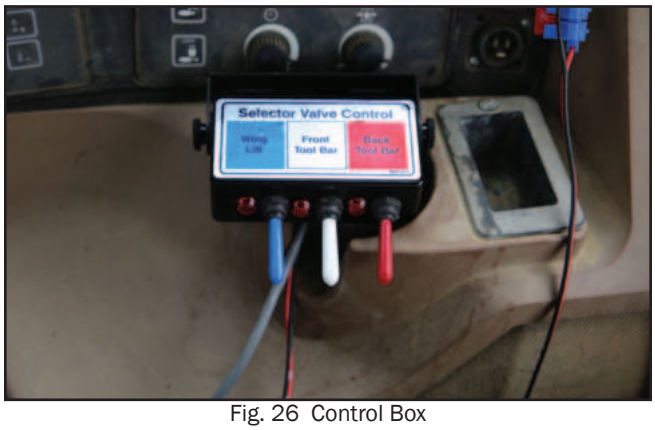


Fig. 26 Control Box

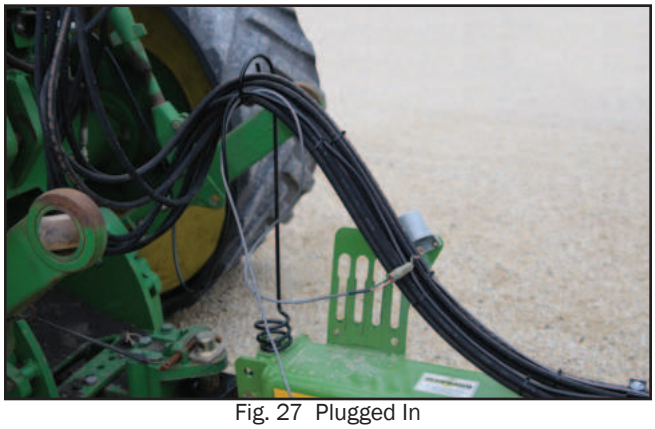


Fig. 27 Plugged In

3.9 FIELD OPERATION

Although the Twister is easy to use. Each operator should review this manual to familiarize themselves with the Safety and Operating procedures.

When using this machine, follow this procedure:

1. Clear the area of bystanders, especially small children.

2. Attach the machine to the tractor. See Section 3.6.

3. Review and follow Pre-Operation Checklist. See Section 3.4.

4. Transport to the working area.

5. Convert to field configuration. See Section 3.10.

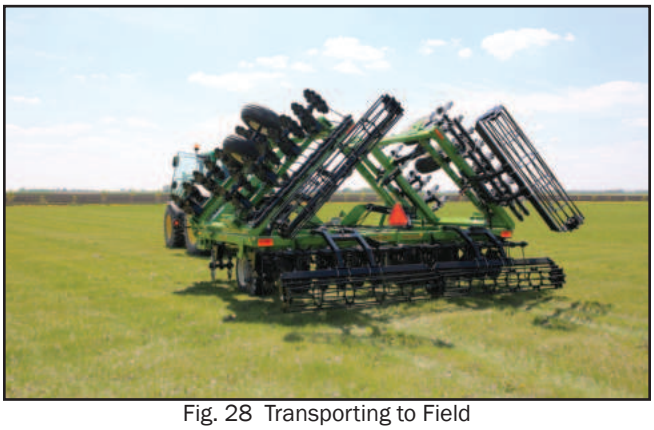


Fig. 28 Transporting to Field

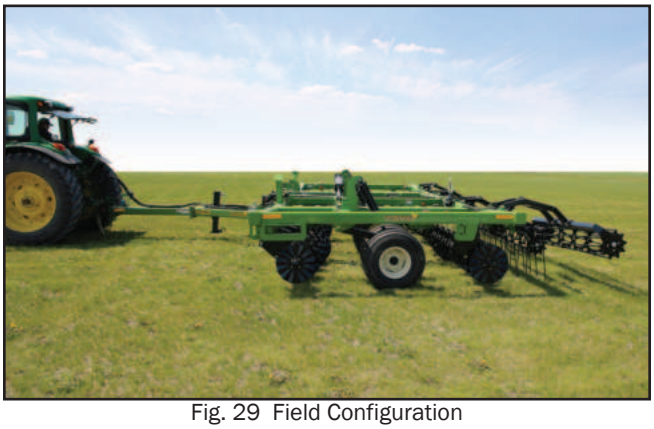


Fig. 29 Field Configuration

6. Open the valve in the hydraulic lines to the hitch cylinders by moving them parallel to lines.

Fig. 30 Valves Open

7. Use the hitch cylinders to set the fore-aft angle of the frame.

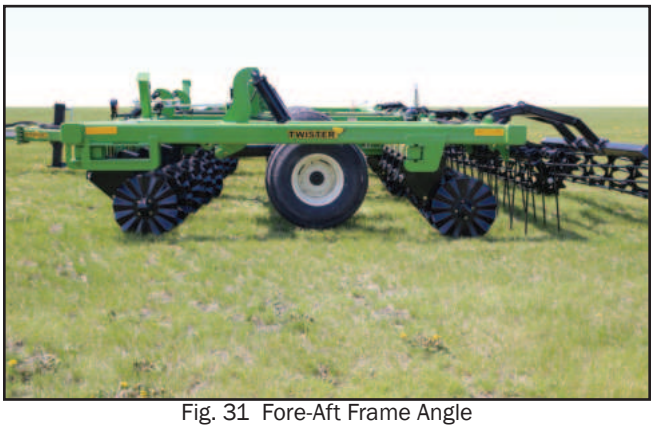


Fig. 31 Fore-Aft Frame Angle

8. Starting:

    a. With the tractor engine at approximately ⅓ throttle position, release clutch and move forward.

    b. Lower machine into ground.

    c. Increase throttle position until desired engine rpm is reached.

9. Stopping:

    a. Reduce engine rpm.

    b. Raise machine out of ground by lowering wheel frame.

    c. Depress clutch to stop forward motion of the Twister.

Fig. 32 Starting/Stopping

10. Wing Position:
    The wings are designed to float or move up and down as the machine moves across a field. Always extend the cylinders fully when lowering the wings. Each wing is designed with a slotted anchor bracket for the wing cylinder attachment. Fully extending cylinders allows the wing frames to move up and down to follow the contour of the field.

Fig. 33 Anchor Bracket Slots

11. Toolbar Angle:
    Each toolbar is pinned at the pivot and is allowed to move in a slot in the wing frame on the other end. A cylinder on the toolbar moves the end in the slot. The front toolbars are pinned at the left end of the frame and the rear toolbars at their right ends.

Fig. 34 Toolbar Angle: Front/Rear

Each toolbar angle can be adjusted up from 0° to 7.0° with a tractor hydraulic circuit and the switch in the cab. Set at 2° for minimum soil movement and residue burying action. Increase the angle to increase the soil movement and residue burying.

Adjust and set the toolbar angle appropriate for your application.

Both front and rear toolbars are designed with a scale to show the angle of the toolbar. Uses the scales as a guide when setting the toolbar angle.

Fig. 35 Toolbar Angle: 7°/0°

Use the yellow hydraulic circuit and the control box toggle switches in the cab to set the toolbar angle.

Fig. 36 Toolbar Controls: Yellow/Switches

12. Toolbar Locking Pins:
The machine is designed so the toolbar position is set by the tractor hydraulic system. To eliminate the load on the tractor hydraulic system, move the toolbar to its desired position and lock in place with the toolbar locking pins. Relieve the pressure in the toolbar position circuit.

Fig. 37 Toolbar Anchor Pins: End/Middle

13. Soil Moisture:
Although the Twister will work in most soil moisture conditions, it is the responsibility of the operator to monitor the condition of the soil after being tilled. Clay soils that are wet will compress and compact during tilling and not be satisfactory. Sandy soils are less likely to compact during tilling. Allow the soil to dry out before tilling if compacting occurs.


Fig. 38 Field

14. Coulter Wear:
All coulters will wear as the Twister moves through the fields while working. The rate of wear depends on how abrasive the soil is. Always replace the coulters when they wear down to a 38 cm (15 inch) diameter. Operating when the diameter is less will allow the coulter hub to drag on the ground, damage bearing seals and cause bearings to fail. Always replace all the coulters at the same time to keep performance the same on all toolbars.


Fig. 39 Coulter Size

15. Coulter Style:
The Mandako Twister is designed with a special fluted coulter profile to move and mix the soil as they move through the soil. This profile also provides an aggressive way to cut through surface residue and work it into the soil.


Fig. 40 Coulter Style

16. Operating Depth:
    The coulters on the toolbars cut into the soil or field as the wheels are raised off the ground. Use the position of the wheels to control the depth of the coulters / toolbars cutting into the soil. The coulter twister is designed to operate at depths of less than 12.7 cm (5 inches).

Fig. 41 Wheel Position: Up


Fig. 42 Wheel Position: Down

17. Travel Speed:
    The operator must determine the appropriate speed for the terrain and field conditions but it is not recommended to travel faster than 12 mph (20 kph) in the field to prevent bouncing. Slow down for rough, hilly or rolling terrain. To be effective, the coulters must remain on/in the ground during operation to allow for the cutting of the residue cover and working it into the soil. Select a speed that will keep the coulters on ground, however a minimum of 8 mph (12.8 kph) is required to obtain the desired performance.

Fig. 43 Travel Speed

18. Single Point Depth Control:
Each machine is designed with a shut off valve in the hydraulic line to the wheel assembly position cylinder. A mechanical linkage attached to the wheel assembly contacts the shut off valve to stop the wheel assembly motion and the coulters will always return to the same depth.

Determine the desired coulter depth for the application and set the linkage accordingly. Use the handle on the adjusting rod to change the coulter depth to fit the application.

It is not recommended to operate the Twister deeper than 125 mm (5 inches). Generally 50 to 75 mm (2 to 3 inches) deep will provide good performance.

The system consists of the following components:

a. Valve.
b. Valve contact.
c. Wheel assembly linkage.
d. Adjusting rod.
e. Handle.
f. Valve plunger.

Setting this system to the appropriate operating depth will mean the machine will return to this depth whenever the unit is lowered into the ground when operating in the field.

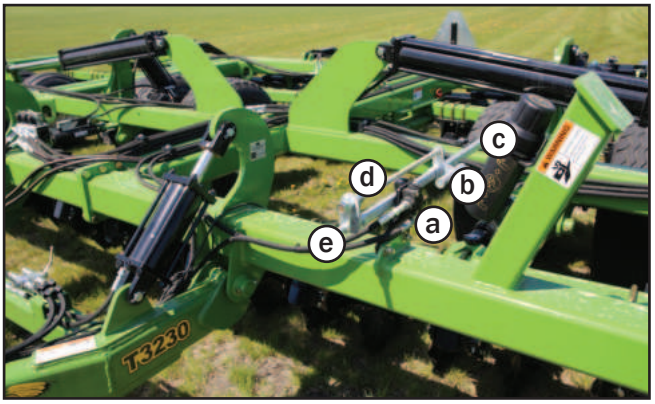


Fig. 44 Single Point Depth Control

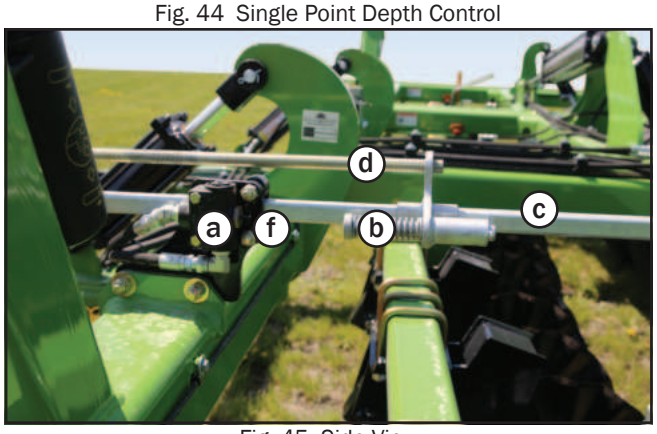


Fig. 45 Side View

19. Fore-Aft Frame Angle:
The frame can be adjusted to change which toolbar engages the soil the most. Use the hitch cylinders to adjust the angle of the frame.

Fig. 46 Fore-Aft Frame Angle Front Down

Fig. 47 Fore-Aft Frame Angle Front Up

Generally operating with a level frame provides the most consistent results.

Fig. 48 Frame Level

Close the valves in the hydraulic lines to the hitch cylinders to maintain the same frame angle when operating.

Fig. 49 Hitch Valves Closed

20. Rolling Basket Position:
Rolling baskets are mounted on the back of the frame behind the harrows to break up clods and smooth the surface of the field. Hydraulic cylinders on each rolling basket frame moves or positions them and provides a download force as appropriate for the application.

Fig. 50 Rolling Basket Position: Down/Up

Use the red hydraulic circuit to move and position the rolling baskets. Watch the gauge on the right corner of the hitch to observe the 'down pressure' on the baskets. Place this circuit into its float position to maintain the baskets in their working position.

The rolling baskets break up the clods and lumps to smooth the surface.

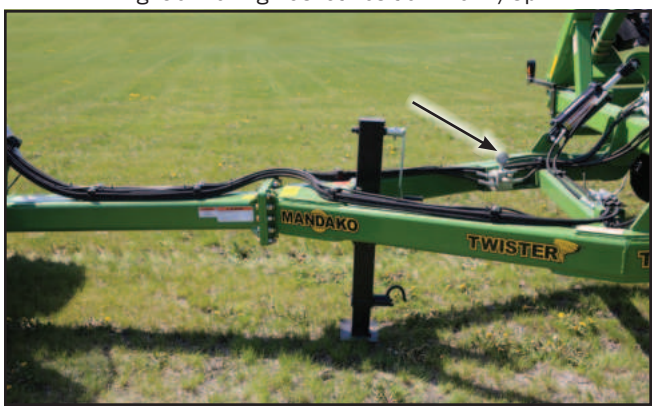


Fig. 51 Rolling Basket Position System Gauge

The system is designed with an accumulator in the circuit that allows the basket on the back of one of the sections to go up or down as required to follow the ground contour. When the basket moving is completed, the accumulator will push the basket back into its regular position with the same downward force.

Fig. 52 Rolling Basket Position Accumulator

21. Field Operation:
The following procedure should be used to monitor the tillage and residue work-up to get the best performance for the application. Monitor and adjust the machine per these steps:

a. Lower the wings and lower coulters to the ground.

b. Set the toolbars at the 0° angle.

c. Start moving across the field at 3 - 4 mph (5 - 7 kph).

d. Lower the coulters fully into the ground.

e. Drive 100 feet (30 m) and look at the ground in front of the Twister and behind it.

f. The residue on the surface should be cut/ chopped-up and mostly worked into the soil.

g. Move the coulter angle in 2 or 3 increments and monitor the job.

h. Adjust/set the angle of the toolbars in small increments to get the job done and minimize horsepower requirements.

i. Set toolbars so the machine follows directly behind tractor (not dogleg). To follow:

- Rear toolbars are set 2° less than front toolbars.
- Front and rear toolbars set the same then frame must be angled with hitch cylinder so front toolbar goes deeper than rear toolbar. The larger the toolbar angle, the deeper the front toolbar needs to be set.
- Monitor performance in the field at operating speed.

j. Move the toolbar locking pins into position to anchor/support the toolbar and relieve the load on the hydraulic system if desired or if tractor hydraulics leak and will not maintain toolbar angle.

k. Monitor the job as the conditions change and adjust the toolbar angle as required.

l. The residue should be cut up and mostly worked into the soil if soil permits.


Fig. 53 Field

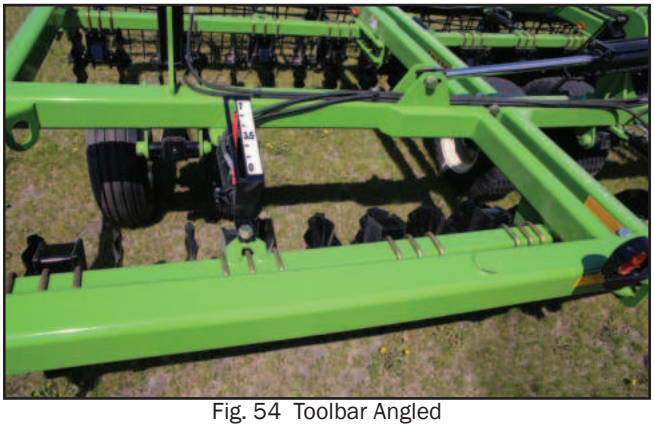


Fig. 54 Toolbar Angled


Fig. 55 Fore-Aft Frame Tilt

Fig. 56 Anchor Pin

22. Operating Hints:

a. Be sure there is sufficient space and clearance to fully extend the wings. Do not stand next to frame when extending to prevent hitting something. Keep others away.

b. Stay away from overhead power lines when raising or lowering the wings to prevent electrocution. Remember, electrocution can occur without direct contact.

c. Observe the scales on the toolbars to determine their angles. Use the scales as a guide to set their angle when adjusting to obtain the required performance.

Fig. 57 Scale

d. Always set the Single Point Depth Control linkage and valve system when the desired performance is obtained. In that way, the machine will always return to same settings when operating.

Fig. 58 Single Point Depth Control System

e. .Always replace the coulters when they wear down to a 38 cm (15 inch) diameter. Operating when the diameter is less will allow the wheel assembly to drag on the ground, damage bearing seals and cause bearings to fail. Always replace all the coulters at the same time to keep performance the same on all tool bars.

Fig. 59 Coulters (Typical)

f. Remove plug from coulter hub, install grease fitting and grease hubs at the end of the season before storing and at the start of the season. Remove fittings and install plugs before working in the field.

Fig. 60 Hubs: Plug/Grease Fitting

g. The end of the tool bars are equipped with moveable pins that can be positioned to:

- Set the tool bars in one position and keep them there and prevent movement.
- Set and relieve load on hydraulic system.

Fig. 61 Anchor Pins

h. Set the angle of the tine harrows on the back of the frame. Angle the harrows back if the field is covered with a lot of crop material. Angling back allows the material to be shed by the tines as the machine moves over the field. Use the adjustment holes in the top of the tine harrow frame to adjust and set the tine harrow angle.

Fig. 62 Tine Harrows: Adjustment/Angle

3.10 TRANSPORT TO FIELD CONVERSION

The Twister is designed to be easily converted from transport to field configuration with minimal effort.

When converting, follow this procedure:

1. Clear the area of bystanders, especially small children.

2. Move the machine into an open area large enough to have space to lower the twister wings. Do not move it into an area with overhead power lines or obstructions.

3. Raise frame into its fully up position.

4. Stop engine, set park brake, remove ignition key before dismounting.

5. Remove cylinder stops from wheel assembly cylinders and stow:

   a. Cylinder Stop

   b. Left side.

   c. Right side.

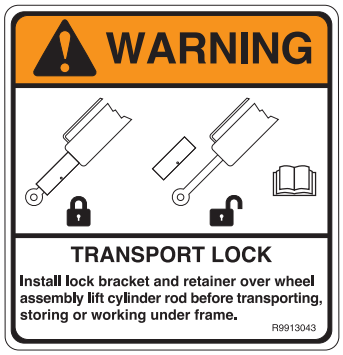



Fig. 63 Transporting

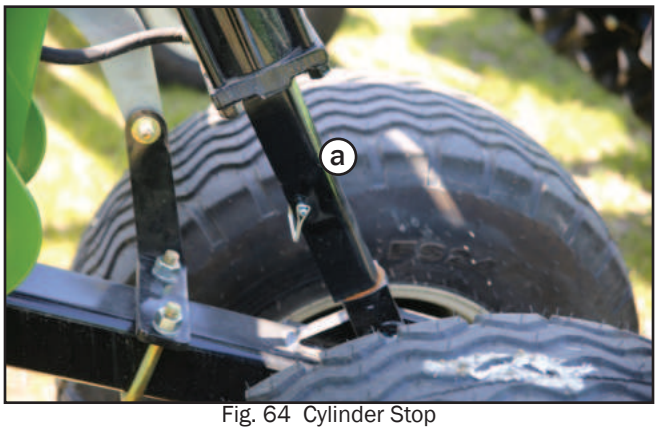


Fig. 64 Cylinder Stop

Fig. 65 Left Side Storage Location

Fig. 66 Right Side Storage Location

6. Use the yellow hydraulic circuit with the control box toggle switches to control machine functions.

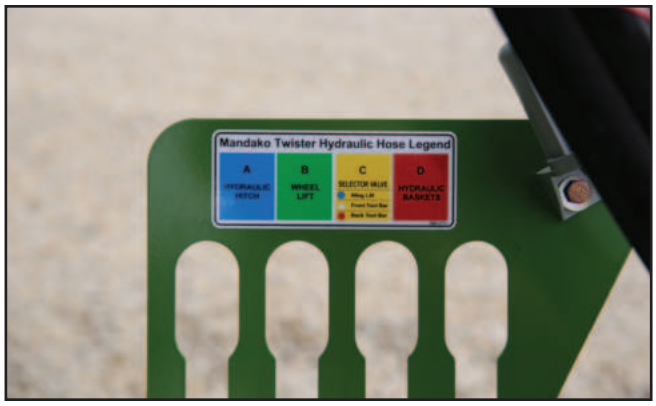


Fig. 67 Yellow Circuit

7. Use the blue toggle switch on the control box to move the wings.

8. Move the switch down to open the wing position circuit.

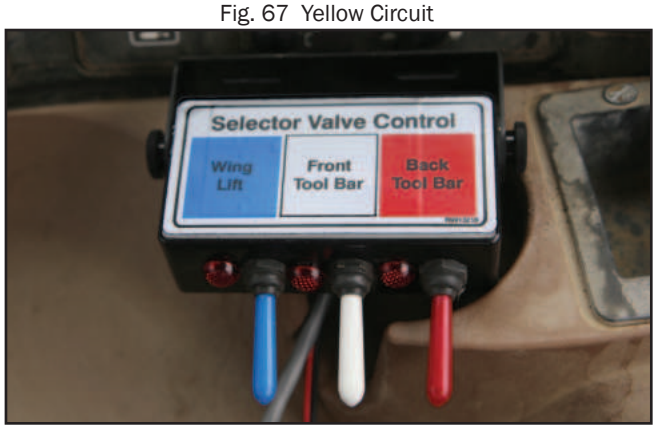


Fig. 68 Control Box

9. Use the hydraulic lever in the cab to the yellow circuit to lower one wing until it is completely down.

10. Continue to hold the hydraulic lever to lower the second wing. Hold hydraulic lever until the hydraulic system goes over relief to insure the cylinders are fully extending into the slotted bracket on each wing that allows wing to follow the ground contour.


Fig. 69 Lower Wing: Starting/Down


Fig. 70 Lower Wing: Starting/Down

11. Lower the rolling baskets to the ground if appropriate for the application.

12. Reverse this procedure when converting from field into transport configuration.

Fig. 71 Lowering Rolling Baskets

13. To prepare for field operation:

    a. Open the ball valves on the hitch frame.

Fig. 72 Ball Valves Open

    b. Use the blue circuit (hydraulic Hitch) to adjust and set the frame angle to obtain the desired field performance.

    c. Use the white and red toggle switches to move and set the toolbar angles. Observe the scales on the frame to know their angle.

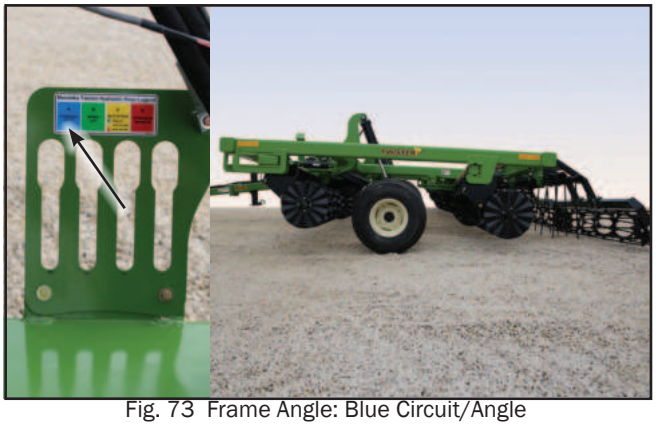


Fig. 73 Frame Angle: Blue Circuit/Angle

14. Reverse the above procedure to convert to transport configuration.

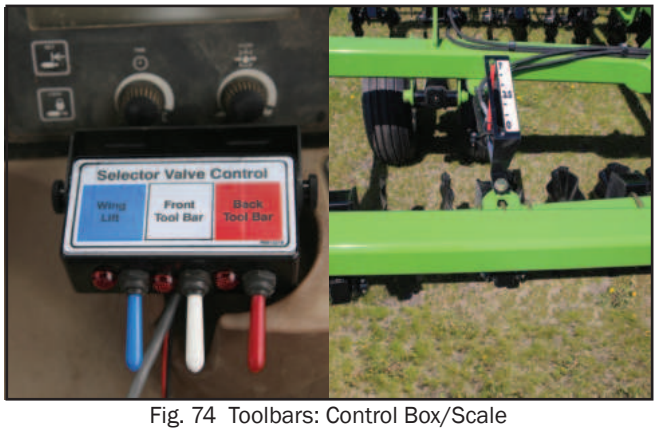


Fig. 74 Toolbars: Control Box/Scale

3.11 TRANSPORTING

Mandako Twisters are designed to be easily and conveniently moved from field to field. When transporting, follow this procedure:

1. Be sure all bystanders are clear of the machine.
2. Be sure that the machine is hitched positively to the towing vehicle. Always attach the safety chain between the machine and the tractor and install a retainer through the drawbar pin.
3. Raise wings and rest against their supports.
4. Level frame.
5. Raise frame to its fully upright position.

Fig. 75 Wing Supports

6. Install transport cylinder stops over wheel lift cylinders on both sets of wheels.

Fig. 76 Cylinder Stops

7. Close the ball valve in the front hitch cylinder hydraulic line.

Fig. 77 Hydraulic Valves

8. Keep to the right and yield right-of-way to allow faster traffic to pass. Drive on shoulder of road if permitted by law.

9. Make sure the SMV (Slow Moving Vehicle) emblem and all lights and reflectors that are required by local highway and transport authorities are in place, clean and can be seen clearly by all overtaking and on-coming traffic.


Fig. 78 Transporting

10. It is not recommended that the machine be transported faster than 20 mph (32 kph). Table 2 gives acceptable transport speed as the ratio of tractor weight to Twister weight.

11. Do not allow riders on the machine.

12. During periods of limited visibility, use pilot vehicles and extra lights on the machine.

13. Always use hazard flashers on the tractor when transporting unless prohibited by law.

Road Speed	Weight of fully equipped or loaded implement(s) relative to weight of tow vehicle
Up to 32 kph (20 mph)	1 to 1, or less
Up to 16 kph (10 mph)	2 to 1, or less
Do not tow	More than 2 to 1

Table 2 - Travel Speed vs. Weight Ratio

3.12 STORAGE

3:12:1 PLACE IN STORAGE:
At the end of the season, the unit should be thoroughly inspected and prepared for storage. Repair or replace any worn or damaged components to prevent any unnecessary down time at the beginning of the next season.

Follow this procedure before storing:

1. Remove all entangled material.
2. Thoroughly wash the unit with a pressure washer or water hose to remove all dirt, mud or debris.
3. Lubricate all grease points. Make sure all grease cavities have been filled with grease to remove any water residue from washing.
4. Install grease fittings in each hub and lubricate to remove water and dirt from around seals.

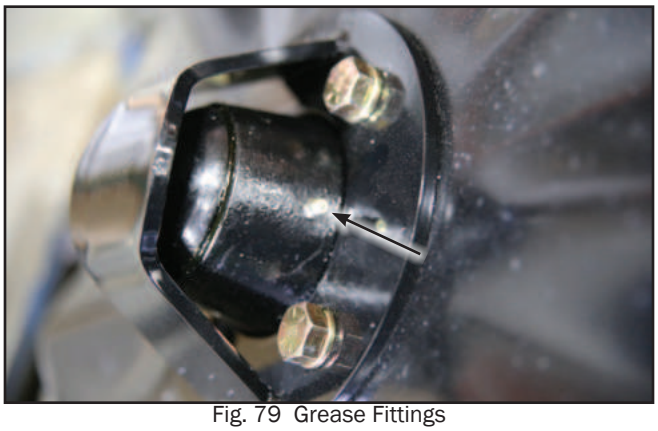


Fig. 79 Grease Fittings

5. Grease coulter bearings until grease comes out around hub.

IMPORTANT
Remove the plug from the coulter hub and install grease fitting. Grease coulter bearing. Remove fitting and store in a clean, secure location. Re-install plug. Coulter operates in a dirt-filled environment that can damage grease fittings and allow dirt to get into the hub. Dirt will damage bearings very quickly. Always install plugs in hub before operating.

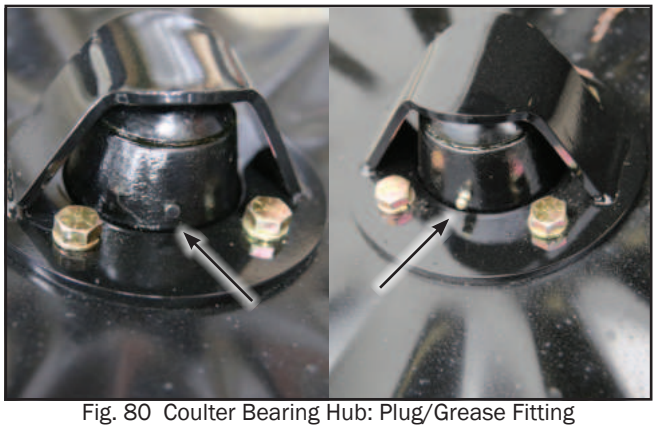


Fig. 80 Coulter Bearing Hub: Plug/Grease Fitting

IMPORTANT
Grease fittings for the hubs are placed in the manual cannister when the machine is new from the factory. The fittings can be stored in the cannister when removed or placed in a secure location.

Fig. 81 Cannister

6. Inspect all hydraulic hoses, couplers and fittings. Tighten any loose fittings. Replace any hose that is badly cut, nicked, abraded or is separating from the crimped end of a fitting.

7. Touch up all paint nicks and scratches to prevent rusting.

8. Move the unit to its storage area. Inside a building is ideal.

9. Place the machine into its transport configuration or rest the machine on the ground to relieve pressure in the hydraulic system.

10. Place planks under the jack for added support if required.

11. Unhook the twister from the tow vehicle (refer to section 3.6).

12. Store unit in an area away from human activity.

13. Do not allow children to play on or around stored Twister.

14. Apply a rust inhibitor or heavy grease to the exposed hydraulic cylinder rams to prevent rusting. Remove inhibitor or grease before using machine again.

Fig. 83 Transport

Fig. 82 Field

3:12:2 REMOVING FROM STORAGE:
When removing this unit from storage, follow this procedure:

1. Clear the area of bystanders, especially small children.

2. Attach the unit to the tractor (see section 3.5.2).

3. **Check:**

   a. Electrical harness connections and components.

   b. All hardware. Tighten as required.

   c. Tire pressure.

   d. All hydraulic lines, fittings and connections. Tighten as required.

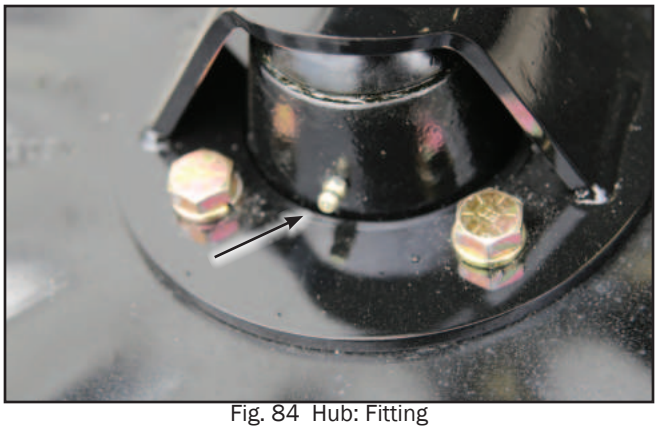


Fig. 84 Hub: Fitting

4. Remove grease fittings and install plugs in each coulter hub to prevent dirt from entering.

5. Lubricate all grease fittings.

6. Clean rust inhibitor or grease from exposed cylinder ram ends.

7. Replace any worn or defective parts.

8. Go through the pre-operation checklist (See section 3.4) before using unit.

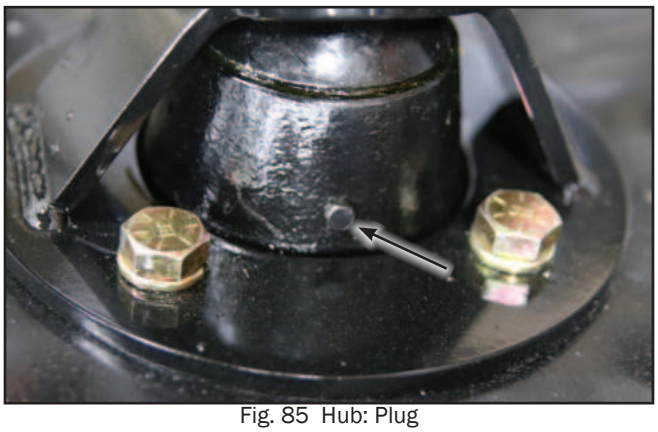


Fig. 85 Hub: Plug

Section 4: SERVICE AND MAINTENANCE

- Good maintenance is your responsibility. Poor maintenance is an invitation to trouble.
- Follow good shop practices.
  - Keep service area clean and dry.
  - Be sure electrical outlets and tools are properly grounded.
  - Use adequate light for the job at hand.
- Place all controls in neutral, stop engine, set the park brake, remove ignition key, and wait for all moving parts to stop before servicing, adjusting, repairing or unplugging.
- Place stand or blocks under the frame before working beneath the machine or when changing tires.
- Always use personal protective devices such as safety glasses, gloves and hearing protection, when performing any service or maintenance work.
- Where replacement parts are necessary for periodic maintenance and servicing, genuine factory replacement parts must be used to restore your equipment to original specifications.
- A fire extinguisher and first aid kit should be kept readily accessible while performing maintenance on this equipment.
- Relieve pressure on hydraulic system before servicing or coulteronnecting from tractor.
- Before applying pressure to a hydraulic system, make sure all components are tight and that steel lines, hoses and couplings are in good condition.
- When completing a maintenance or service function, make sure all safety shields and devices are installed before placing unit in service.

4.1 FLUIDS AND LUBRICANTS

4:1:1 GREASE:
Use an SAE multipurpose high temperature grease with extreme pressure (EP) performance. Also acceptable is an SAE multipurpose lithium base grease.

4:1:2 STORING LUBRICANTS:
Your machine can operate at top efficiency only if clean lubricants are used. Use clean containers to handle all lubricants. Store them in an area protected from dust, moisture and other contaminants.

4:1:3 GREASING:
Refer to Section 4.1.1 for the type of recommended grease.

Use the Maintenance Checklist provided to keep a record of all scheduled maintenance.

1. Use a hand-held grease gun for all greasing.
2. Wipe grease fitting with a clean cloth before greasing, to avoid injecting dirt and grit.
3. Replace and repair broken fittings immediately.
4. If fittings will not take grease, remove and clean thoroughly. Also, clean lubricant passageway. Replace fittings if necessary.

4.2 SERVICING INTERVALS

The periods recommended is based on normal operating conditions. Severe or unusual conditions may require more frequent checks of the equipment and lubrication.

4:2:1 EVERY 40 HOURS OR WEEKLY:

1. Grease the wheel pivot (1 location each wheel) assembly.

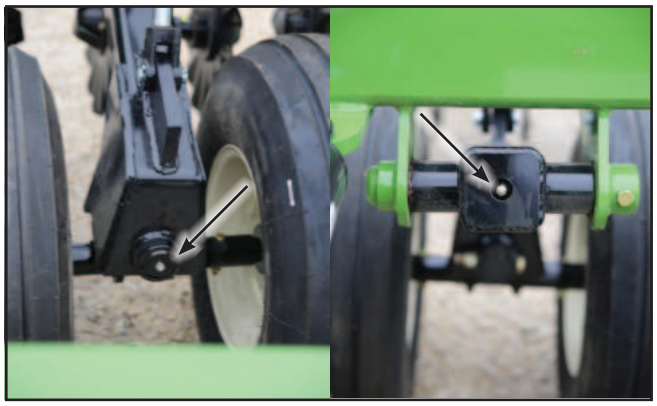


Fig. 86 Wheel Pivot: Center/Wing

2. Grease rolling basket bearings (both ends of each basket).

Fig. 87 Rolling Basket Bearings

4:2:2 ANNUALLY.

1. Grease coulter bearings until grease is expelled from bearings.

Fig. 88 Coulter Bearings

2. Grease jack with one shot of grease (2 locations).

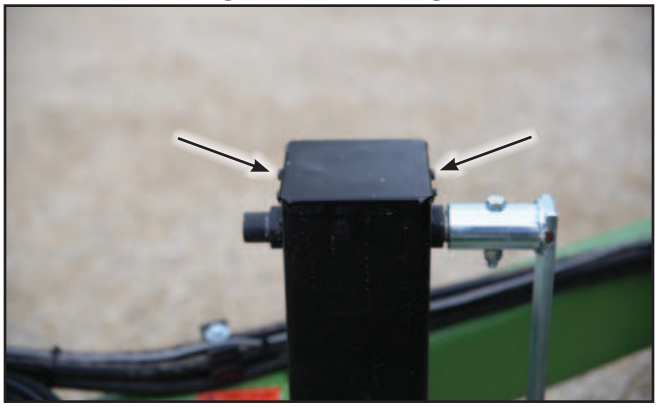


Fig. 89 Jack

3. Repack wheel bearings.

Fig. 90 Wheel Bearings

4. Clean and wash machine.

Fig. 92 Machine: Transport Configuration

Fig. 91 Machine: Field Configuration

4.3 SERVICE RECORD

The Servicing Intervals section is only a guide under good conditions. Under extreme, or unusual circumstances adjust service timing accordingly.

Copy this page to continue record.

Maintenance / Date														
Serviced By														
EVERY 40 HOURS OR WEEKLY														
Grease Wheel Pivots														
Grease Rolling Basket Bearings														
ANNUALLY														
Grease Coulter Bearings														
Grease Jack														
Repack Wheel Bearings														
Clean and Wash Machine														

Maintenance / Date														
Serviced By														
EVERY 40 HOURS OR WEEKLY														
Grease Wheel Pivots														
Grease Rolling Basket Bearings														
ANNUALLY														
Grease Coulter Bearings														
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Clean and Wash Machine														
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Grease Rolling Basket Bearings														
ANNUALLY														
Grease Coulter Bearings														
Grease Jack														
Repack Wheel Bearings														
Clean and Wash Machine														
Clean and Wash Machine														

Section 5: TROUBLE SHOOTING

This Twister is a simple and reliable system that requires minimal maintenance.

The problems which you may encounter, their causes and solutions, are listed below.

If you encounter a problem which is difficult to solve, even after having read through this section, please contact your local distributor or dealer. Before you call, please have this Operator's Manual and the unit's serial number ready.

Problem

Possible Cause	Possible Solution

Residue not cut up.

Coulter toolbar angle too small.	Increase coulter toolbar angle.
Machine not deep enough.	Increase depth of coulters.
	Replace worn coulters.
Coulter toolbar angle decreasing.	Tractor hydraulics leaking - use toolbar anchor pins to maintain toolbar angle.
Dull, worn coulters.	Replace coulters.

Wing not following ground contours.

Cylinder not fully extended.	Fully extend lift cylinder.

Machine lifts unevenly.

Cylinders not in phase.	Extend re-phasing lift cylinders fully for 5 - 30 seconds to allow resetting of cylinders (can be done regularly during operation). Important with new machine to purge air from hydraulic system.

Not cutting evenly or "dog legging"

Rear coulters set at too aggressive an angle.	Set rear coulters at 2° - 4° less than front coulters.
	Use machine hitch cylinders to set front coulters to cut deeper than rear.

Clods behind machine.

Insufficient down pressure on rolling baskets.	Increase down pressure on baskets.

Harrows plugging

Harrows set too straight.	Increase harrow angle.
	Increase coulter action to bury more trash.

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Section 6: SIGN-OFF FORM

Mandako follows the general Safety Standards specified by the American Society of Agricultural and Biological Engineers (ASABE), and the Occupational Safety and Health Administration (OSHA). Anyone who will be operating and/or maintaining the unit must read and clearly understand all Safety, Operating and Maintenance information presented in this manual.

Do not operate, or allow anyone else to operate, this equipment until this document has been read.
Review this information annually, before the season start-up.

Make periodic reviews of SAFETY and OPERATION a standard practice for all of your equipment.

The following Sign-Off Form is provided for your record keeping. Use it to show that all personnel who will be working with the equipment have read and understand the provided information. They also have been instructed in the operation of the equipment. Copy this page to continue the record.

DATE	EMPLOYEE'S SIGNATURE	EMPLOYER'S SIGNATURE

Sign Off Form (Continued)

DATE	EMPLOYEE'S SIGNATURE	EMPLOYER'S SIGNATURE

Section 7: REFERENCE

For information not included here, or for a digital copy of this manual, please call your dealer, or Mandako Agri Marketing (2010) Ltd. directly for assistance (1-888-525-5892).

Specifications may change without notice.

7.1 MECHANICAL SPECIFICATIONS

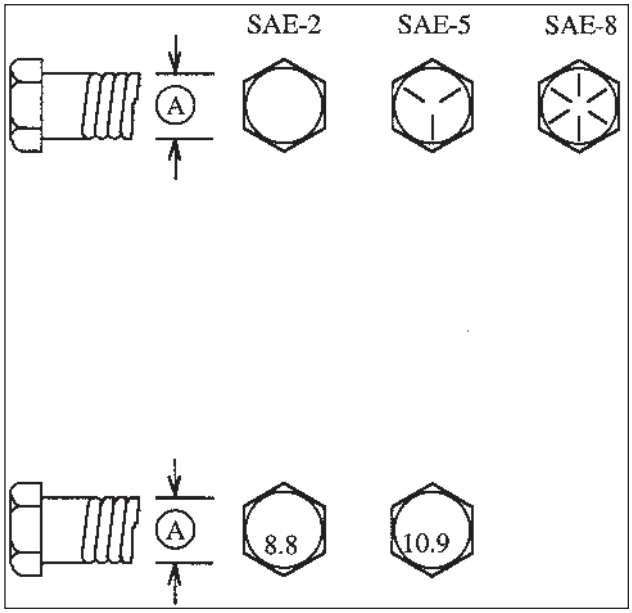
7.2 BOLT TORQUE

CHECKING BOLT TORQUE

The tables shown below give correct torque values for various bolts and capscrews. Tighten all bolts to the torques specified in chart unless otherwise noted. Check tightness of bolts periodically, using bolt torque chart as a guide. Replace hardware with the same strength bolt.

IMPERIAL BOLT TORQUE SPECIFICATIONS

Bolt Diameter "A"	Bolt Torque •					
	SAE 2		SAE 5		SAE 8	
	(N.m)	(lb-ft)	(N.m)	(lb-ft)	(N.m)	(lb-ft)
1/4"	8	6	12	9	17	12
5/16"	13	10	25	19	36	27
3/8"	27	20	45	33	63	45
7/16"	41	30	72	53	100	75
1/2"	61	45	110	80	155	115
9/16"	95	60	155	115	220	165
5/8"	128	95	215	160	305	220
3/4"	225	165	390	290	540	400
7/8"	230	170	570	420	880	650
1"	345	225	850	630	1320	970



Torque figures indicated above are valid for non-greased or non-oiled threads and heads unless otherwise specified. Therefore, do not grease or oil bolts or capscrews unless otherwise specified in this manual. When using locking elements, increase torque values by 5%.

- Torque value for bolts and capscrews are identified by their head markings.

7.3 HYDRAULIC FITTING TORQUE

Tightening Flare Type Tube Fittings *

1. Check flare and flare seat for defects that might cause leakage.
2. Align tube with fitting before tightening.
3. Lubricate connection and hand tighten swivel nut until snug.
4. To prevent twisting the tube(s), use two wrenches. Place one wrench on the connector body and with the second tighten the swivel nut to the torque shown.

• The torque values shown are based on lubricated connections as in reassembly.

Tube Size OD (in.)	Nut Size Across Flats (in.)	Torque Value • (N.m)	(lb-ft)	Recommended Turns To Tighten (After Finger Tightening) (Flats)	(Turn)
3/16	7/16	8	6	1	1/6
1/4	9/16	12	9	1	1/6
5/16	5/8	16	12	1	1/6
3/8	**11/16**	**24**	**18**	**1**	**1/6**
1/2	7/8	46	34	1	1/6
5/8	1	62	46	1	1/6
3/4	1-1/4	102	75	3/4	1/8
7/8	1-3/8	122	90	3/4	1/8

SECTION 8: INDEX

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MANDAKO AGRI MARKETING (2010) LTD.

Box 379 | 12159B Hwy 306
Plum Coulee, MB R0G 1R0
(888) 525-5892
info@mandako.com
www.mandako.com

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