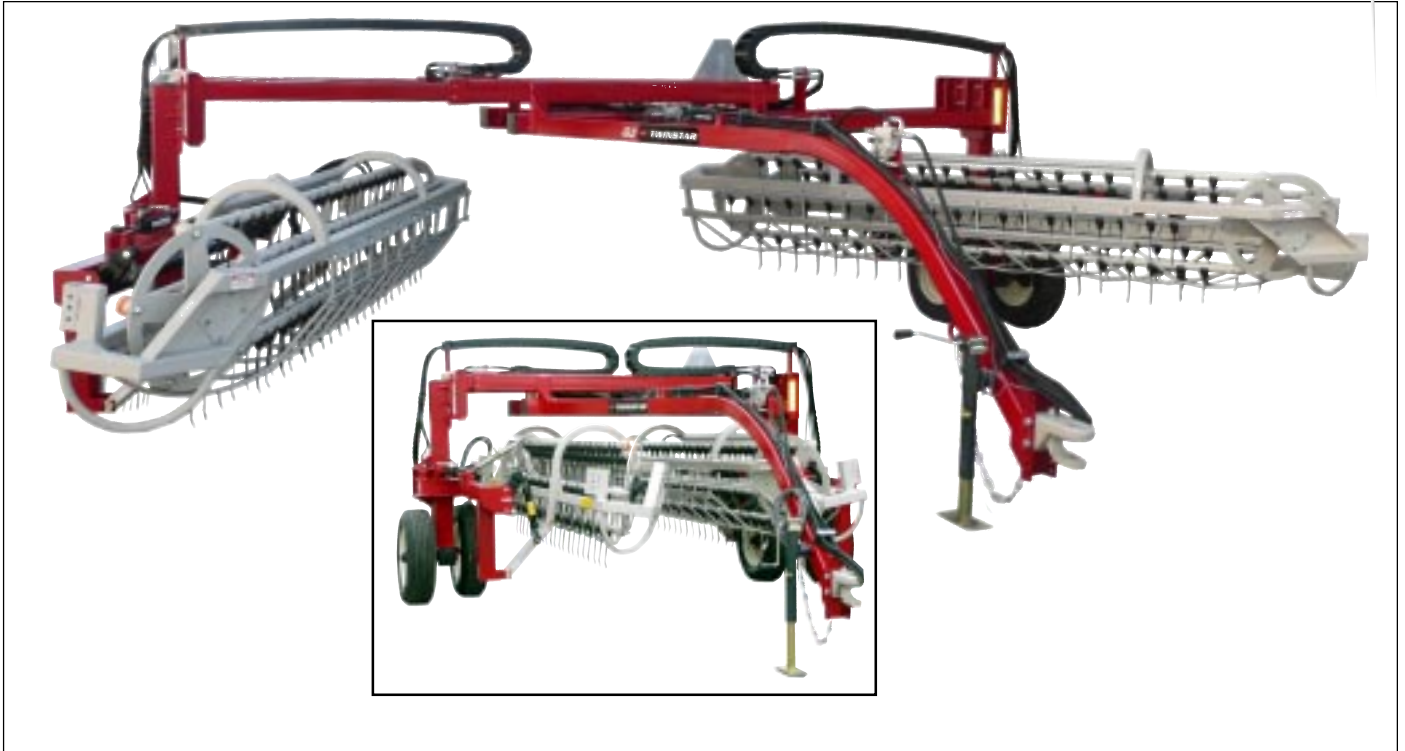




BASKET RAKE



◆ **MODEL 2024-G2** ◆

OPERATOR'S MANUAL

October 2011



LIMITED WARRANTY

NORTHSTAR expressly warrants each new Twinstar Rake to be free from defects in material and workmanship under normal use and service for a period of one year after delivery to the original retail purchaser or first user of the product.

Our obligation under this warranty is limited to repairing and/or replacing, at our option, any part or parts within the applicable one year period, as set out above, which shall be returned by the owner to any Twinstar authorized dealer or to the factory and which upon examination shall disclose to our satisfaction to be defective.

We may, as an option, elect to grant adjustments in the field through an authorized representative and may thereby elect to waive the requirement that parts be returned to our factory.

A new warranty period is not established for replacements. Replacements are warranted for the remaining portion of the one-year original warranty period. The repair or replacement of defective parts under this warranty will be made without charge to the owner except for transportation.

Warranty does not cover tires, hydraulic valves, hydraulic cylinders, electric switches, or accessories and other parts not manufactured by us but supplied with or as a part of our product. We will, however, obtain and pass on any adjustments provided by the manufacturers of such parts under those manufacturer's warranties.

The provisions of this warranty do not apply to any product or parts, which have been subject to misuse, negligence or accident, or which have been repaired or altered outside of an authorized dealer in any way so as in the judgment would adversely affect its performance and reliability. Neither does this warranty apply to normal maintenance service and parts, or to normal deterioration due to wear and exposure.

**WARRANTY VOID IF NOT REGISTERED
WITHIN 30 DAYS OF PURCHASE DATE**

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SERIAL NUMBER LOCATION

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

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



Model Number _____

Serial Number _____

INTRODUCTION

Congratulations on your choice of a Twinstar Basket Rake to complement your farming operation. This equipment has been designed and manufactured to meet the needs of a discriminating buyer for the efficient raking of hay, grass or forage.

Safe, efficient and trouble free operation of your Twinstar Basket Rake requires that you and anyone else who will be operating or maintaining the machine, read and understand the Safety, Operation, Maintenance and Trouble Shooting information contained within the Operator's Manual.



This manual covers the Basket Rake Model 2024-G2 manufactured by NORTHSTAR ATTACHMENTS LLC. Differences are explained where appropriate. Use the Table of Contents and Index as a guide to locate required information.

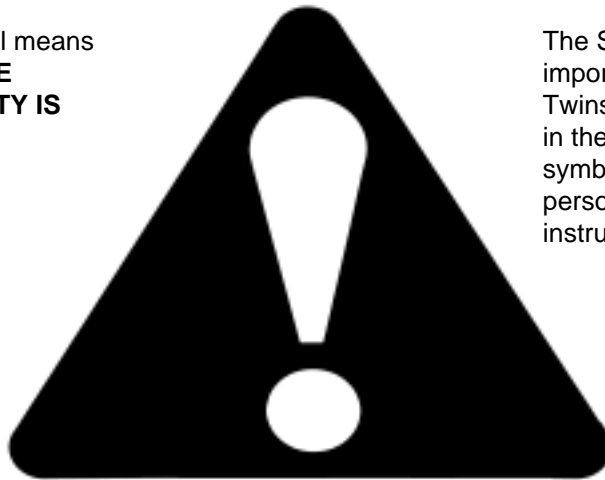
Keep this manual handy for frequent reference and to pass on to new operators or owners. Call your dealer if you need assistance, information or additional copies of the manuals.

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

SAFETY

SAFETY ALERT SYMBOL

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



The Safety Alert symbol identifies important safety messages on the Twinstar Unitized Basket Rake and in the manual. When you see this symbol, be alert to the possibility of personal injury or death. Follow the instructions in the safety message.

Why is SAFETY important to you?

3 Big Reasons

Accidents Disable and Kill
Accidents Cost
Accidents Can Be Avoided

SIGNAL WORDS:

Note the use of the signal words **DANGER**, **WARNING** and **CAUTION** with the safety messages. The appropriate signal word for each message has been selected using the following guide-lines:

SI NO LEE INGLES, PIDA AYUDA A AIGUIEN QUE SI LO LEA PARA QUE LE TRADUZCA LAS MIDIDAS DE SEGURIDAD.

DANGER □ Indicates an imminently hazardous situation that, 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 that, if not avoided, could result in death or serious injury, and includes hazards that are exposed when guards are removed. It may also be used to alert against unsafe practices.

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

If you have any questions not answered in this manual or require additional copies or the manual is damaged, please contact your dealer or NORTHSTAR ATTACHMENTS LLC, P.O. Box 1937, Yakima, WA, 98907-1937. (Telephone) 509-452-1651, (FAX) 509-457-6601.

SAFETY

YOU are responsible for the **SAFE** operation and maintenance of your Twinstar Basket Rake. **YOU** must ensure that you and anyone else who is going to operate, maintain or work around the rake be familiar with the operating and maintenance procedures and related **SAFETY** information contained 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 adhered to while operating the Basket Rake.

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** operating this equipment is familiar with the recommended operating and maintenance procedures and follows all the safety precautions. Most accidents can be prevented. Do not risk injury or death by ignoring good safety practices.

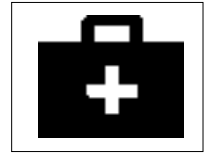
- Basket Rake owners must give operating instructions to operators or employees before allowing them to operate the machine, and at least annually thereafter per OSHA (Occupational Safety and Health Administration) regulation 1928.57.
- The most important safety feature on this equipment is a **SAFE** 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 operating and safety instructions is not qualified to operate 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!**

GENERAL SAFETY

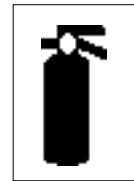
1. Read and understand the Operator's Manual and all safety signs before operating, maintaining, adjusting or unplugging the Basket Rake.



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



3. Have a fire extinguisher available for use should the need arise and know how to use it.



4. Wear appropriate protective gear. This list includes but is not limited to:

- A hard hat
- Protective shoes with slip resistant soles
- Protective goggles, glasses or face shield
- Heavy gloves
- Protective clothing



5. Install and secure all guards before starting.
6. Do not allow riders.
7. Wear suitable ear protection for prolonged exposure to excessive noise.



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

EQUIPMENT SAFETY GUIDELINES

1. Safety of the operator and bystanders is one of the main concerns in designing and developing a machine. 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 observing the following precautions in this section. To avoid personal injury or death, study the following precautions and insist those working with you, or for you, follow them.
2. In order to provide a better view, certain photographs or illustrations in this manual may show an assembly with a safety shield removed. However, equipment should never be operated in this condition. Keep all shields in place. If shield removal becomes necessary for repairs, replace the shield prior to use.
3. Replace any safety sign or instruction sign that is not readable or is missing. Location of such safety signs is indicated in this manual.
4. Never use alcoholic beverages or drugs which can hinder alertness or coordination while operating this equipment. Consult your doctor about operating this machine while taking prescription medications.
5. **Under no circumstances should young children be allowed to work with this equipment. Do not allow persons to operate or assemble this unit until they have read this manual and have developed a thorough understanding of the safety precautions and of how it works.** Review the safety instructions with all users annually.
6. This equipment is dangerous to children and persons unfamiliar with its operation. The operator should be a responsible, properly trained and physically able person familiar with farm machinery and trained in this equipment's operations. If the elderly are assisting with farm work, their physical limitations need to be recognized and accommodated.
7. Use a tractor equipped with a Roll Over Protective Structure (ROPS) and a seat belt.
8. Never exceed the limits of a piece of machinery. If its ability to do a job, or to do so safely, is in question - **DON'T TRY IT.**
9. Do not modify the equipment in any way. Unauthorized modification result in serious injury or death and may impair the function and life of the equipment.
10. In addition to the design and configuration of this implement, including Safety Signs and Safety Equipment, hazard control and accident prevention are dependent upon the awareness, concern, prudence, and proper training of personnel involved in the operation, transport, maintenance, and storage of the machine. Refer also to Safety Messages and operation instruction in each of the appropriate sections of the Tractor and machine Manuals. Pay close attention to the Safety Signs affixed to the Tractor and the machine.

SAFETY TRAINING

1. 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.
2. In addition to the design and configuration of equipment, hazard control and accident prevention are dependent upon the awareness, concern, prudence and proper training of personnel involved in the operation, transport, maintenance and storage of this equipment.
3. It has been said, "The best safety feature is an informed, careful operator." We ask you to be that kind of an operator. It is the operator's responsibility to read and understand ALL Safety and Operating instructions in the manual and to follow these. Accidents can be avoided.
4. Working with unfamiliar equipment can lead to careless injuries. Read this manual, and the manual for your tractor, before assembly or operating, to acquaint yourself with the machines. If this machine is used by any person other than yourself, or is loaned or rented, it is the machine owner's responsibility to make certain that the operator, prior to operating:
 - a. Reads and understands the operator's manuals.
 - b. Is instructed in safe and proper use.
5. Know your controls and how to stop tractor, engine, and machine quickly in an emergency. Read this manual and the one provided with your tractor.
6. Train all new personnel and review instructions frequently with existing workers. Be certain only a properly trained and physically able person will operate the machinery. A person who has not read and understood all operating and safety instructions is not qualified to operate the machine. An untrained operator exposes himself and bystanders to possible serious injury or death. If the elderly are assisting with farm work, their physical limitations need to be recognized and accommodated.



SAFETY SIGNS

1. Keep safety signs clean and legible at all times.
2. Replace safety signs that are missing or have become illegible.
3. Replaced parts that displayed a safety sign should also display the current sign.
4. Safety signs are available from your authorized Distributor or Dealer Parts Department or the factory.

How to Install Safety Signs:

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

PREPARATION

1. Never operate the tractor and machine until you have read and completely understand this manual, the Tractor Operator's Manual, and each of the Safety Messages found on the safety signs on the tractor and machine.

2. Personal protection equipment including hard hat, safety glasses, safety shoes, and gloves are recommended during assembly,




ably, installation, operation, adjustment, maintaining, repairing, removal, or moving the implement. Do not allow long hair, loose fitting clothing or jewellery to be around equipment.

3. **PROLONGED EXPOSURE TO LOUD NOISE MAY CAUSE PERMANENT HEARING LOSS!**

Tractors 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.



4. Operate the machine only with a tractor equipped with an approved Roll-Over-Protective Structure (ROPS). Always wear your seat belt. Serious injury or even death could result from falling off the tractor ---particularly during a turnover when the operator could be pinned under the ROPS or the tractor.
- 
5. Clear working area of stones, branches or hidden obstacles that might be hooked or snagged, causing injury or damage.
 6. Operate only in daylight or good artificial light.
 7. Be sure machine is properly mounted, adjusted and in good operating condition.
 8. Ensure that all safety shielding and safety signs are properly installed and in good condition.
 9. Before starting, give the machine a "once over" for any loose bolts, worn parts, cracks, leaks, frayed hoses and make necessary repairs. Always follow maintenance instructions.
 10. Check hydraulic components. Tighten all leaking fittings. Replace any damaged parts.

OPERATING SAFETY

1. Please remember it is important that you read and heed the safety signs on the Twinstar Basket Rake. Clean or replace all safety signs if they cannot be clearly read and understood. They are there for your safety, as well as the safety of others. The safe use of this machine is strictly up to you, the operator.
2. All things with moving parts are potentially hazardous. There is no substitute for a cautious, safe-minded operator who recognizes potential hazards and follows reasonable safety practices. The manufacturer has designed this rake to be used with all its safety equipment properly attached, to minimize the chance of accidents. Study this manual to make sure you have all safety equipment attached.
3. If a safety shield or guard is removed for any reason, it must be replaced before the machine is again operated.
4. When the use of hand tools is required to perform any part of assembly, installation, adjustment, maintaining, repairing, removal, or moving, be sure the tools used are designed and recommended by the tool manufacturer for that specific task.
5. Personal protection equipment including hard hat, safety glasses, safety shoes, and gloves are recommended during assembly, installation, operation, adjustment, maintaining, repairing, removal, or moving. Do not allow long hair, loose fitting clothing, or jewellery to be around moving parts.
6. Always use two people to handle heavy, unwieldy components during assembly, installation, removal or moving.
7. Never place any part of your body where it would be in danger if movement should occur during assembly, installation, operation, maintaining, repairing, removal or moving.
8. Never place yourself between the tractor and machine while implement is in operation.
9. Place all controls in neutral, stop engine, set park brake, remove ignition key and wait for all moving parts to stop before servicing, repairing or unplugging.
10. Do not walk or work under a raised machine or attachment unless it is securely blocked or held in position. Do not depend on the tractor hydraulic system to hold the machine or attachment in place.
11. Install safety locks before transporting or working under components.
12. A heavy load can cause instability of the tractor. Use extreme care during travel. Slow down on turns and watch out for bumps. The tractor may need front counterweights to counterbalance the weight of the machine.
13. Never use alcoholic beverages or drugs which can hinder alertness or coordination while operating this equipment. Consult your doctor about operating this machine while taking prescription medications.
14. Do not allow riders on the machine or tractor at any time. There is no safe place for any riders.
15. Before you operate the machine, check over all pins, bolts, and connections to be sure all are securely in place. Replace any damaged or worn parts immediately.
16. Keep all hydraulic lines, fittings and couplers tight and free of leaks before using.
17. Do not allow anyone who is not familiar with the safety rules and operation instructions to use this machine.
18. Never allow children to operate or be around this machine.
19. Clear the work area of objects which might be picked up and snagged or entangled in the machine.
20. Keep hands, feet, hair, jewellery, and clothing away from all moving and/or rotating parts.

TRANSPORT SAFETY

1. Comply with state and local laws governing highway safety and movement of farm machinery on public roads.
2. The use of flashing amber lights is acceptable in most localities. However, some localities prohibit their use. Local laws should be checked for all highway lighting and marking requirements.
3. At all times, when driving the tractor and equipment on the road or highway under 20 mph (32 kph) use flashing amber warning lights and a slow moving vehicle (SMV) identification emblem. Do not exceed 20 mph (32 kph). Reduce speed on rough roads and surfaces.
4. Plan your route to avoid heavy traffic.
5. Always install transport locks, pins or brackets before transporting.
6. Always use a drawbar pin with retainer and a safety chain.
7. Do not drink and drive.
8. Be a safe and courteous driver. Always yield to oncoming traffic in all situations, including narrow bridges, intersections, etc. Watch for traffic when operating near or crossing roadways.
9. Turn into curves or go up or down hills only at a low speed and at a gradual steering angle. Make certain that at least 20% of the tractor's weight is on the front wheels to maintain safe steering. Slow down on rough or uneven surfaces.
10. Never allow riders on either tractor or machine.

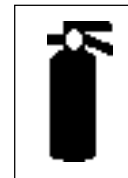
MAINTENANCE SAFETY

1. Good maintenance is your responsibility. Poor maintenance is an invitation to trouble.
2. 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.



3. Make sure there is plenty of ventilation. Never operate the engine of the towing vehicle in a closed building. The exhaust fumes may cause asphyxiation.
4. Before working on this machine, shut off the engine, set the brakes, and remove the ignition keys.
6. Never work under equipment unless it is blocked securely.
7. Use personal protection devices such as eye, hand and hearing protectors, when performing any service or maintenance work.
8. Where replacement parts are necessary for periodic maintenance and servicing, genuine factory replacement parts must be used to restore your equipment to original specifications. The manufacturer will not be responsible for injuries or damages caused by use of unapproved parts and/or accessories.
9. A fire extinguisher and first aid kit should be kept readily accessible while performing maintenance on this equipment.

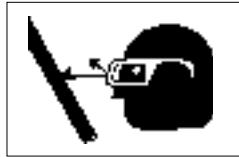


10. Periodically tighten all bolts, nuts and screws and check that all cotter pins are properly installed to ensure unit is in a safe condition.
11. When completing a maintenance or service function, make sure all safety shields and devices are installed before placing unit in service.

HYDRAULIC SAFETY

1. Always place all tractor hydraulic controls in neutral before disconnecting from tractor or working on hydraulic system.
2. Make sure that all components in the hydraulic system are kept in good condition and are clean.
3. Replace any worn, cut, abraded, flattened or crimped hoses.
4. Do not attempt any makeshift repairs to the hydraulic 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.

5. Wear proper hand and eye protection when searching for a high-pressure hydraulic leak. Use a piece of wood or cardboard as a backstop instead of hands to isolate and identify a leak.



6. 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.

STORAGE SAFETY

1. Store the unit in an area away from human activity.
2. Do not permit children to play on or around the stored machine.
3. Store the unit in a dry, level area. Support the frame with planks if required.

TIRE SAFETY

1. 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.
2. Do not attempt to mount a tire unless you have the proper equipment and experience to do the job.
3. Have a qualified tire dealer or repair service perform required tire maintenance.
4. When replacing worn tires, make sure they meet the original tire specifications. Never undersize.

SAFETY SIGN LOCATIONS

The types of safety signs on the equipment are shown in the illustration below. Good safety requires that you familiarize yourself with the various safety signs, the type of warning and the area, or particular function related to that area, that requires your SAFETY AWARENESS.

CAUTION

- Read Operator's Manual before using machine.
- Place all controls in neutral, stop engine, set park brake, remove ignition key and wait for all moving parts to stop before servicing, repairing or unplugging.
- Install and secure all guards before starting.
- Keep hands, feet, hair and clothing away from moving parts.
- Do not allow riders.
- Keep all hydraulic lines, fittings and couplers tight and free of leaks before using.
- Clean reflectors, SMV and lights before transporting.
- Add extra lights and use pilot vehicle when transporting during times of limited visibility.
- Use hazard flashers in tractor when transporting.
- Install safety chain when attaching to tractor.
- Keep away from overhead power lines. Electrocutation can occur without direct contact.
- Review safety instructions annually.

CAUT007

WARNING

ROTATING TINE HAZARD

To prevent serious injury or death from rotating tines:

- Keep away from rake when rotating elements are turning or the engine is running. Keep others away.
- Place controls in neutral, stop engine, set park brake, remove ignition key and wait for all moving parts to stop before servicing, repairing or unplugging.
- Relieve pressure before working on hydraulic system/components.

WARN003

WARNING

HIGH-PRESSURE FLUID HAZARD

To prevent serious injury or death from high-pressure fluid hazard:

- Relieve pressure on system before repairing or adjusting.
- Wear proper hand and eye protection when searching for leaks. Use wood or cardboard instead of hands.
- Keep all components in good repair.

WARN004

REMEMBER - If safety signs have been damaged, removed, become illegible or parts replaced without signs, new signs must be applied. New signs are available from your authorized dealer.

OPERATION



OPERATING SAFETY

1. Read and understand the Operator's Manual and all safety signs before operating, servicing, adjusting, repairing or unplugging.
2. Do not allow riders.
3. Install and secure all guards and shields before starting or operating.
4. Keep hands, feet, hair and clothing away from moving parts.
5. Place all controls in neutral, stop tractor engine, set park brake, remove ignition key and wait for all moving parts to stop before servicing, adjusting, repairing or unplugging.
6. Place all tractor and machine controls in neutral before starting.
7. Never start or operate machine unless sitting on tractor seat.
8. Clear the area of bystanders, especially small children, before starting.
9. Clean reflectors, SMV and lights before transporting.
10. Use hazard flashers on tractor when transporting.
11. Do not put hands or feet under machine while tractor engine is running.
12. Review safety instructions with all operators annually.

TO THE NEW OPERATOR OR OWNER

Twinstar Basket Rakes are designed as a rake for windrowing hay, grass or forage. Be familiar with the machine before starting.

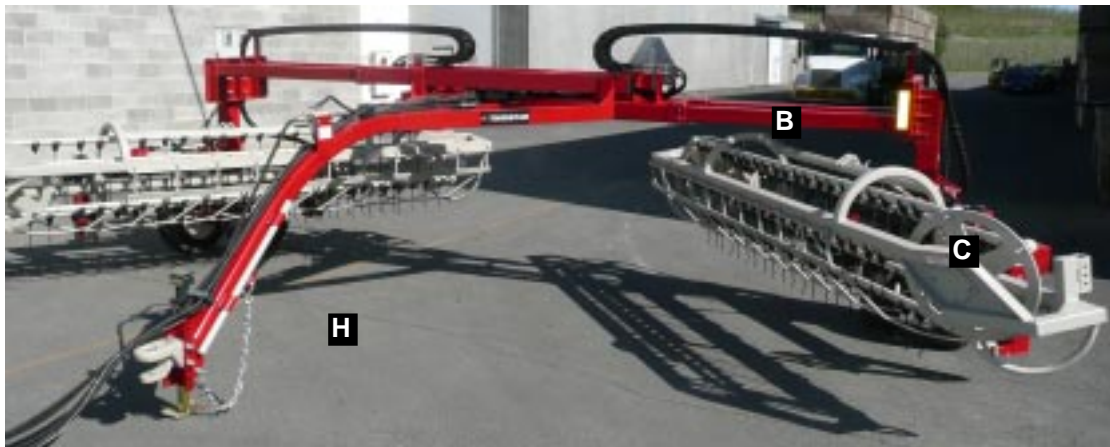
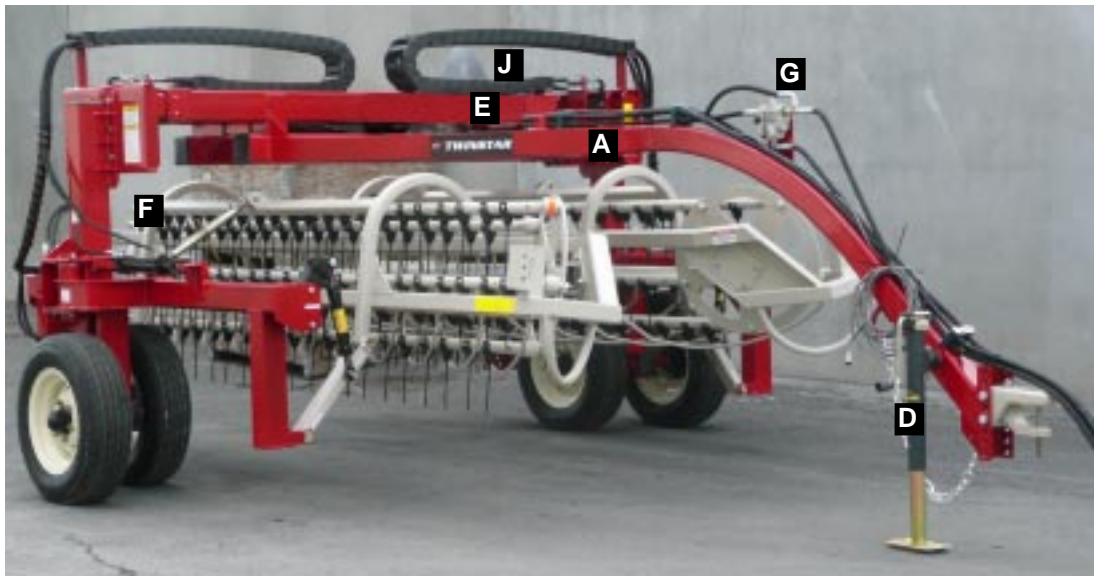
It is the responsibility of the owner or operator to read this manual and to train all other operators before they start working with the machine. Follow all safety instructions exactly. Safety is everyone's business. By following recommended procedures, a safe working environment is provided for the operator, bystanders and the area around the worksite. Untrained operators are not qualified to operate the machine.

Many features incorporated into this machine are the result of suggestions made by customers like you. Read this manual carefully to learn how to operate the machine safely and how to set it to provide maximum field efficiency. By following the operating instructions in conjunction with a good maintenance program, your rake will provide many years of trouble-free service.

MACHINE COMPONENTS

Twinstar Basket Rakes consist of 2 hydraulically powered turning rake assemblies contained within a basket for picking up, sliding over and windrowing crop material. The frame can extend to spread the

baskets out to match the crop material spacing. The baskets can be raised or lowered and angled appropriate for the application.



- A Main Frame
- B Extension Frames
- C Basket Rake Assembly
- D Tongue Jack
- E Control Valve
- F Drive Motors
- G Flow Control Valve
- H Safety Chains
- J SMV Sign

BREAK-IN

Although there are no operational restrictions on the Basket Rake when it is used for the first time, it is recommended that the following mechanical items be checked:

A. After operating for 1 hour:

1. Check alignment of rake tines and baskets. Align as required.
2. Check all hydraulic lines, hoses, fittings and couplers. Tighten all leaking fittings. Replace any damaged components.
3. Torque all fasteners and hardware.
4. Check the rake tines and baskets for entangled material. Remove any entangled material.
5. Check tire pressure. Inflate as required.

B. After operating for 10 hours:

1. Repeat steps 1 through 5 listed above.
2. Go to the normal servicing and maintenance schedule as defined in the Maintenance Section.

PRE-OPERATION CHECKLIST

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

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

1. Lubricate the machine per the schedule outline in the Maintenance Section.
2. Check alignment of rake tines and baskets. Align as required.
3. Check the rake tines and baskets. Remove any twine, wire or other material that has become entangled.
4. Make sure that all guards and shields are in place, secured and functioning as designed.
5. Check for hydraulic leaks. Tighten any leaking fittings.
6. Clean the SMV emblem to ensure that it can be seen by other vehicles.

ATTACHING/UNHOOKING

The rake should always be located on a level, dry area that is free of debris and other foreign objects. When attaching the machine to a tractor or a utility cart, follow this procedure:

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, align the hitch with the drawbar.
4. Stop tractor, set park brake, remove ignition key and wait for all moving parts to stop before dismounting.
5. Use the hitch clevis to level the frame. The frame must be level for both ends of the baskets to be the same height above the ground.
6. Use a drawbar pin with provisions for a mechanical retainer. Install the retainer.
7. Attach the safety chain securely around the tractor drawbar to prevent unexpected separation and store tongue jack in its transport position.



DRAWBAR PIN

Connect the Hydraulics:

The 2024-G2 has a hydraulic requirement of 12 GPM @ 2000 PSI. Two hydraulic remote outlets are required on the tractor capable of producing at least 8 GPM to the flow control and basket motor circuit through one set of hoses and 4 GPM to the rake selector valve which operates the spread, angle, and lift functions.



HYDRAULIC SYSTEM



WARNING



Use extreme care when working around a high-pressure hydraulic system. Make sure all connections are tight and all components are in good repair. Wear hand and eye protection when searching for suspected leaks.

1. Use a clean rag or paper towel to clean the dirt from couplers on the hose ends and the tractor.
2. Connect the hoses to the tractor couplers. Be sure the couplers are securely seated.
3. Route and secure the hoses along the hitch with clips, tape or plastic ties to prevent binding and pinching. Be sure to provide slack for turning.

CONTROLS

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

Control Box:

A control box is provided with each rake and includes the spread, angle and height position control switches.

The control box is equipped with velcro mounting tape to allow for easy installation. Position the box on the tractor or in the cab for easy access and viewing during operation.

A pair of wires on a harness is used to provide 12 volt power to the box. Connect the black wire to ground and the red wire to a 12 volt power source.



CONTROL BOX

- 1. Basket Extend/Retract:**
Select spread switch and activate appropriate tractor valve to enable this function. It is important to drive the tractor and rake forward during this process to extend the rake extension frames and tires. Failure to function this circuit without forward progress can potentially cause flats as the tires may be separated from the bead of the wheels. Repeat this process to retract the extension arms and wheels to the transport position. Basket angle cylinders will need to be retracted prior to this adjustment being made.
- 2. Basket Angle:**
Select angle switch and activate appropriate tractor valve to angle baskets to meet desired crop widths. This function activates both angle cylinders simultaneously. Repeat process to return baskets to transport position.

- 3. Basket Lift:**
Select lift switch and activate appropriate tractor valve to raise and lower baskets to operating height.

NOTE: All three functions will be controlled by the same tractor valve through one set of remote outlets

SELECTOR VALVE

Hydraulic System:

1. The rake will operate on either a closed center or open centered system.
2. Set the tractor flow at a maximum of 14GPM; 8 GPM for basket motors and 6 GPM for selector valve and rake functions.



SELECTOR VALVE

FLOW CONTROL

1. The basket circuit is designed with a variable flow control that can be used to control the amount of oil flowing through the basket motors. Turn the handle of the flow control clockwise to increase the flow and counter clockwise to decrease the flow. This flow control regulates 4 to 8 GPMs to the basket motors. Do not exceed the basket speed of 90 RPM



FLOW CONTROL

FIELD OPERATION

1. Engage the hydraulic circuit(s). Place the lever in detent or tie open for the basket motor circuit.
2. Extend the frame while approaching the working area.



BASKETSEXTENDED

3. Angle the baskets so they cover the material to be raked, turned or windrowed.
4. Lower the baskets until the tines are about 1/2 inch above the ground.
5. Pull into the field to start working.



BASKETS ANGLED AND LOWERED



OPERATING

OPERATING HEIGHT

The best results are obtained when the basket is set so the tines are approximately 1/2 inch above the ground. To set the height:

1. Position the rake on a firm level area.
2. Lower the baskets as far as they will go.
3. With the wrenches provided turn the adjusting links to make the fine tine height adjustments. After adjustments are made on all four links lock the jam nut to maintain adjustments made. Do not extend adjusting links beyond the 20" maximum length.



TINE HEIGHT ADJUSTMENT LINK

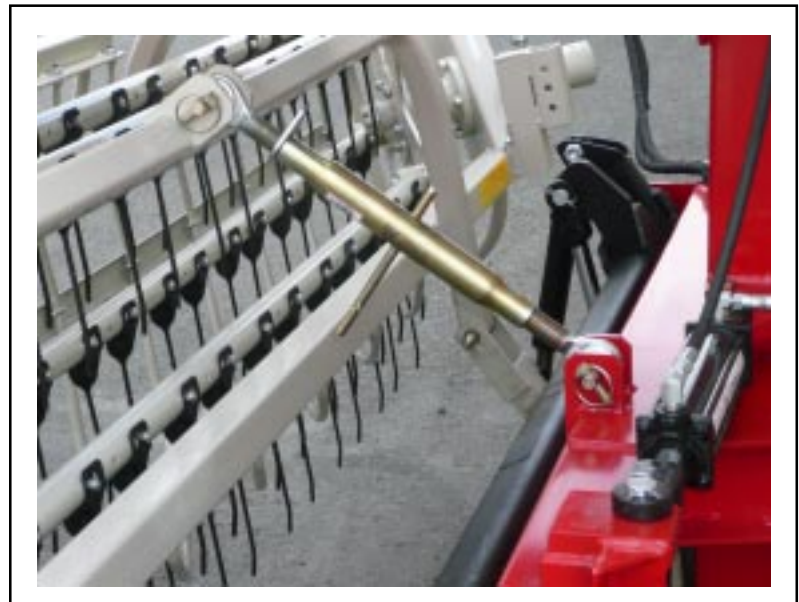
BASKET TILT

The basket tilt can be adjusted to fit the application. To adjust:

1. Loosen the jam nut on the turnbuckle.
2. Adjust the turnbuckle to set the basket tilt.
3. Tighten the jam nut.
4. Set both turnbuckles the same.
5. As a general guide:
 - Set the basket perpendicular for a loose, fluffy windrow.
 - Set the basket tilted forward for a tight, compact windrow.



Adjustment Link Wrench



BASKET TILT

STRIPPER BAR ALIGNMENT

The basket is equipped with formed stripper bars that must keep their shape and clearance to function properly. There should always be at least 1/2 inch clearance between the stripper bars and tines.

Use the stripper bar tool to set and adjust the position of the stripper bar.



TOOL STORAGE



ADJUSTING

GAUGE WHEELS

An optional gauge wheel package is available to mount to the end of each basket to stabilize the basket if operating over rough terrain.

Operating Hints:

1. Use the hitch clevis to level the frame. The frame must be level for both ends of the baskets to be the same height above the ground.
2. It is the responsibility of the operator to monitor the condition of the crop material and set the rake parameters to obtain the best results. Always check during the day to know how the material changes.



OPTIONAL GAUGE WHEEL



OPERATING

TRANSPORTING



TRANSPORT SAFETY

1. Make sure you are in compliance with all local regulations regarding transporting equipment on public roads and highways.
2. Make sure the SMV (Slow Moving Vehicle) emblem and all the lights and reflectors that are required by the local highway and transport authorities are in place, are clean and can be seen clearly by all overtaking and oncoming traffic.
3. Do not allow anyone to ride on the Unitized Basket Rake or tractor during transport.
4. Do not exceed 20 mph (32 kph). Reduce speed on rough roads and surfaces.
5. Always use hazard flashers on the tractor when transporting unless prohibited by law.

7. Do not allow riders.
8. Always use hazard flashers on the tractor when transporting unless prohibited by law.
9. Never transport the machine faster than 20 mph (32 km/h). The ratio of the tractor weight to the Rake weight plays an important role in defining acceptable travel speed. Table 1 summarizes the recommended travels speed to weight ratio.

Table 1 Travel Speed vs. Weight Ratio

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

When transporting the machine, review and follow these instructions:

1. Be sure all bystanders are clear of the machine.
2. Be sure the hydraulic circuit(s) are disengaged and all components have stopped running.
3. Be sure that the machine is securely attached to the tractor and a retainer pin and safety chain are installed.
4. Clean the SMV emblem, reflectors and lights and make sure they are working.
5. Be sure you are in compliance with all applicable lighting and marking regulations when transporting. Check with your local authorities.
6. Keep to the right and yield the right-of-way to allow faster traffic to pass. Drive on the road shoulder if permitted by law.



TRANSPORT POSITION

STORAGE



STORAGE SAFETY

1. Store the unit in an area away from human activity.
 2. Do not permit children to play on or around the stored machine.
 5. Lubricate all grease fittings. Make sure that all grease cavities have been filled with grease to remove any water residue from the washing. This also protects the bearing seals.
 6. Touch up all paint nicks and scratches to prevent rusting.
 7. Move to storage area.
 8. Select an area that is dry, level and free of debris.
 9. Unhook from tractor.
 10. Place blocks under the stands and tire if required.
 11. If the machine cannot be placed inside, cover with a waterproof tarpaulin and tie securely in place.
 12. Store the machine in an area away from human activity.
 13. Do not allow children to play on or around the stored machine.
- After the season's use, the machine should be thoroughly inspected and prepared for storage. Repair or replace any worn or damaged components to prevent any unnecessary down time at the start of next season. To insure a long, trouble free life, this procedure should be followed when preparing the unit for storage:
1. Clear the area of bystanders, especially small children.
 2. Thoroughly wash the machine using a pressure washer to remove all dirt, mud, debris and residue.
 3. Inspect the tines and pivot for damage or entangled material. Repair or replace damaged parts. Remove all entangled material.
 4. Inspect all hydraulic hoses, lines, 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.



STORED

SERVICE AND MAINTENANCE



MAINTENANCE SAFETY

- Follow ALL the operating, maintenance and safety information in the manual.
- Support the machine with blocks or safety stands when changing tires or working beneath it.
- 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.
- Use only tools, jacks and hoists of sufficient capacity for the job.
- Never work on the baskets or under the machine unless the tractor engine is off and the hydraulic hoses are disconnected.
- Make sure all guards are in place and properly secured when maintenance work is completed.
- Never wear ill-fitting, baggy or frayed clothing when working around or on any of the drive system components.
- Before applying pressure to a hydraulic system, make sure all lines, fittings and couplers are tight and in good condition.
- Relieve pressure from hydraulic circuit before servicing or disconnecting from tractor.
- Keep hands, feet, hair and clothing away from all moving and/or rotating parts.
- Clear the area of bystanders, especially children, when carrying out any maintenance and repairs or making any adjustments.

SERVICE

FLUIDS AND LUBRICANTS

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

GREASING

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

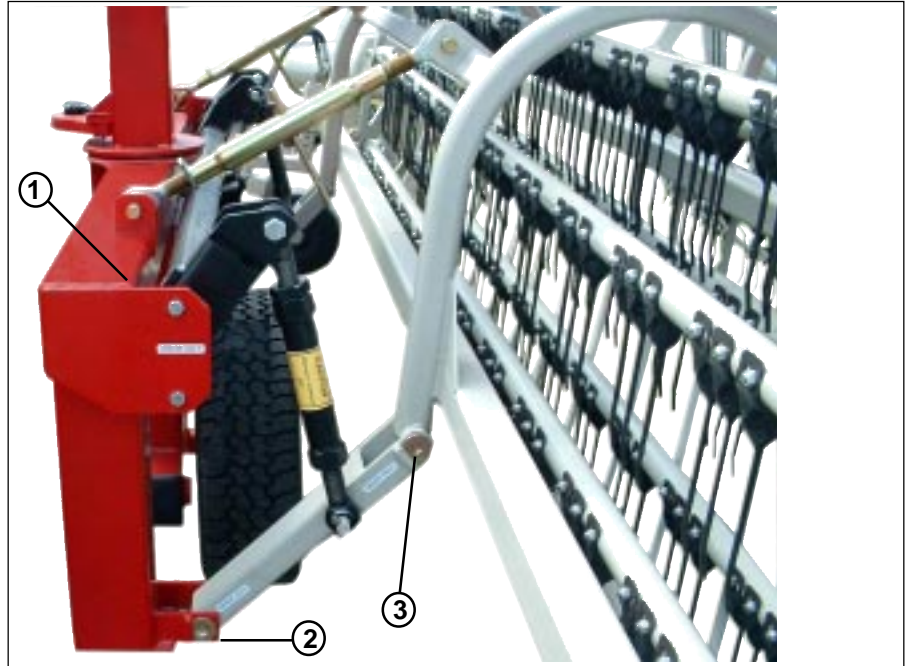
1. Use a hand-held grease gun for all greasing.
2. Wipe grease fitting with a clean cloth before greasing, to avoid injecting dirt and grit.
3. Replace and repair broken fittings immediately.
4. If fittings will not take grease, remove and clean thoroughly. Also clean lubricant passageway. Replace fitting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

SERVICING INTERVALS

The period recommended is based on normal operating conditions. Severe or unusual conditions may require more frequent lubrication or oil changes.

8 Hours or Daily

1. Grease Parallel linkage pivots (3 locations each linkage) 4 linkages on machine.



PARALLEL LINKAGE

2. Grease pivot point both sides of rake.



PIVOT POINT

3. Lubricate idler knuckles and basket idler hubs every 40 hours of operation.



IDLER KNUCKLE & HUB

4. Lubricate basket motor drive housings every 40 hours of operation.



MOTOR DRIVE HOUSING

Annually

1. Repack wheel bearings.
2. Repack basket idler hub.
3. Wash and clean machine.



HUB AND SPINDLE ASSEMBLIES

TROUBLE SHOOTING

Twinstar Unitized Basket Rake consists of 2 sets of hydraulically powered rake assemblies turning in a basket for turning or windrowing hay or crop material. It is a simple and reliable system that requires minimal maintenance.

In the following section, we have listed many of the problems, causes and solutions to the problems that you may encounter.

If you encounter a problem that is difficult to solve, even after having read through this trouble shooting section, please call your local dealer or Northstar Manufacturing. Before you call, please have this Operator's Manual and the serial number from your basket rake ready.

PROBLEM	CAUSE	SOLUTION
Crop material isn't picked up by tines.	Material goes between tines.	Increase rake turning speed
	Material goes between tines.	Driving too fast. Slow down.
	Wrong frame angle.	Change frame angle until material is picked up.
Windrow too tight.	Wrong basket angle.	Change basket angle to vertical.
Windrow too loose	Wrong basket angle.	Tilt basket forward.
Frame won't move	No power to valve.	Check and clean all terminals. Provide power to control box.
	Inline fuse blown	Replace parts as needed
Baskets do not revolve.	Hoses incorrectly hooked into tractor remote .	Check and switch hoses as needed.
	Flow restriction in hydraulic system.	Find restriction and eliminate.
	Damaged bypass check valve.	Replace parts as needed.
	Damaged remote connections.	Replace parts as needed.
	Damaged flow control manifold.	Replace parts as needed.
	Damaged basket hydraulic motors.	Replace parts as needed.
Insufficient basket RPM	Flow control manifold not properly adjusted.	Adjust lever until desired RPM is achieved.
	Flow restriction in hydraulic motor circuit.	Find restriction and eliminate.
	Damaged remote connectors.	Replace parts as needed.
	Insufficient oil flow from tractor.	Raise tractor idle to increase oil flow.

PROBLEM	CAUSE	SOLUTION
Insufficient basket RPM	Insufficient oil from tractor.	Install rake to a tractor with sufficient flow capabilities.
		Service tractor's hydraulic system.
	Damaged flow control manifold	Replace parts as needed.
	Damaged basket hydraulic motors.	Replace parts as needed.
	Damaged relief cartridge at flow control manifold.	Replace parts as needed.
Rake functions won't operate.	Insufficient oil flow from tractor.	Raise tractor idle to increase oil flow.
		Install rake to a tractor with sufficient flow capabilities.
		Service tractor's hydraulic system.
	Low voltage to rake control valve.	Test voltage running to the coils at the valve and refer to the electrical installation information in the operator's manual.
	Short in electrical system.	Locate and repair or replace damaged components.
	Blown fuse at control box.	Replace parts as needed.
	Damaged control box and/or wiring harness	Replace parts as needed.
	Damaged coils and/or valve cartridges.	Replace parts as needed.
Rake functions are operating slowly.	Insufficient oil flow from tractor.	Raise tractor idle to increase oil flow.
		Install rake to a tractor with sufficient flow capabilities.
		Service tractor's hydraulic system.
	Low voltage to rake control valve.	Test voltage running to the coils at the valve and refer to the electrical installation information in the operator's manual.
	Damaged coils and/or valve cartridges.	Replace parts as needed.

PROBLEM	CAUSE	SOLUTION
Baskets raise and lower function is not operating properly.	Low voltage to coil at control valve port 1.	Test at coils and trace back to find possible short or damage to wiring or components
	Damaged coil or cartridge at control valve port 1.	Replace parts as needed
	Damaged hydraulic cylinders.	Repair or replace parts as needed.
	Damaged toggle switch at control box.	Replace parts as needed.
Basket angle in and out function is not operating properly.	Low voltage to coil at control valve port 2.	Test at coils and trace back to find possible short or damage to wiring or components
	Damaged coil or cartridge at control valve port 2.	Replace parts as needed
	Damaged hydraulic cylinders.	Repair or replace parts as needed
	Damaged toggle switch at control box.	Replace parts as needed.
Baskets extend and retract function is operating slowly	Dust or debris in or on slide tubes	Clean and lube slide tubes (user recommended lube - TERAND GEL LUBRICANT W/PTFE)
Baskets extend and retract function is not operating properly	Low voltage to coil at control valve port 3.	Test at coils and trace back to find possible short or damage to wiring or components
	Damaged coil or cartridge at control valve port 3	Replace parts as needed
	Damaged hydraulic cylinders.	Repair or replace parts as needed.
	Damaged toggle switch at control box.	Replace parts as needed.
Hydraulic system overheating.	Insufficient hydraulic oil tank capacity (primarily nontractor custom hydraulic installations.	Replace with a tank having the proper capacity. Recommendation: a ratio of 2 gallons of oil for every 1 gpm of oil flow being used.
	Running hydraulic oil pressures significantly higher than the set psi of the relief cartridges in the Twinstar's hydraulic system.	Adjust the tractor's oil pressure to meet the needs of the Twinstar's hydraulic system
	Damaged relief cartridge at flow control manifold.	Replace parts as needed

PROBLEM	CAUSE	SOLUTION
Rake tines and/or the bars rubbing or striking hay stripper bars.	Hay stripper bars have become bent or misaligned.	Adjust hay stripper bars with adjustment tool provided until contact is eliminated.
	Damaged basket frames, tine bars, or components.	Repair or replace parts as needed.
Ticking or popping sound coming from either end of baskets (around the star wheel).	Damaged or seized tine bar bearings.	Replace parts as needed.
	Damaged star wheel.	Replace parts as needed.
	Damaged or seized drive hub or idler hub bearings.	Replace parts as needed.
	Dry bearings at drive hub or idler hub	Grease as needed.
	Loose tine bar, drive hub, idler hub, or star wheel mounting bolts.	Tighten bolts to torque specifications outlined in the operator's manual.

SPECIFICATIONS

MECHANICAL

MODEL	2024-G2
MAXIMUM RAKING WIDTH	UP TO 24'
TRANSPORT WIDTH	10'-9"
OVERALL LENGTH	18'
APPROXIMATE WEIGHT	3500 LBS.
TIRE SIZE	(4) ST205/75R15 TRUCK TREAD
RUBBER MOUNTED TINES	105/BASKET, OPTIONAL 155/BASKET
BASKET REEL SPEED	MAXIMUM 90 RPM
TINE BAR BEARINGS	PRECISION SEALED BALL BEARINGS
HYDRAULIC REQUIREMENT	12 GALLONS/MINUTE @ 2000 PSI
OPERATION SPEED	4 TO 8 MPH
GAUGE WHEELS	OPTIONAL
BALL HITCH	OPTIONAL

Specifications are subject to change without notice

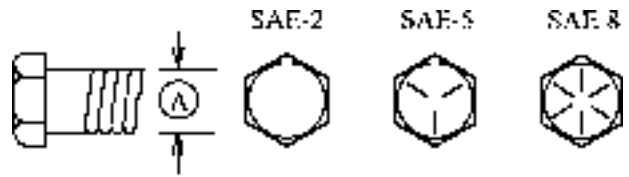
BOLT TORQUE

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.

ENGLISH TORQUE SPECIFICATIONS

Bolt Diameter "A"	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	(70)	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.



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