

OPERATION MANUAL



***WHITEMAN* SERIES**
MODEL HTN27KTCSL
MODEL HTN28KTCSL
RIDE-ON TROWEL
(KOHLER GASOLINE ENGINE)

Revision #4 (10/08/19)



THIS MANUAL MUST ACCOMPANY THE EQUIPMENT AT ALL TIMES.

PN: 21565

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PROPOSITION 65 WARNING



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SILICOSIS/RESPIRATORY WARNINGS

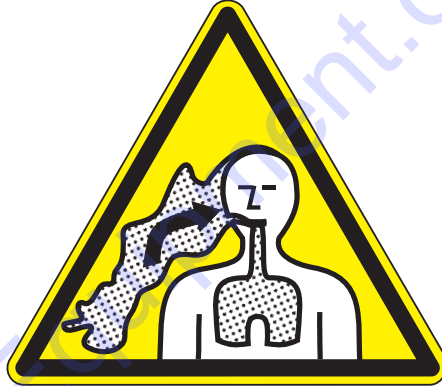
! WARNING



SILICOSIS WARNING

Grinding/cutting/drilling of masonry, concrete, metal and other materials with silica in their composition may give off dust or mists containing crystalline silica. Silica is a basic component of sand, quartz, brick clay, granite and numerous other minerals and rocks. Repeated and/or substantial inhalation of airborne crystalline silica can cause serious or fatal respiratory diseases, including silicosis. In addition, California and some other authorities have listed respirable crystalline silica as a substance known to cause cancer. When cutting such materials, always follow the respiratory precautions mentioned above.

! WARNING



RESPIRATORY HAZARDS

Grinding/cutting/drilling of masonry, concrete, metal and other materials can generate dust, mists and fumes containing chemicals known to cause serious or fatal injury or illness, such as respiratory disease, cancer, birth defects or other reproductive harm. If you are unfamiliar with the risks associated with the particular process and/or material being cut or the composition of the tool being used, review the material safety data sheet and/or consult your employer, the material manufacturer/supplier, governmental agencies such as OSHA and NIOSH and other sources on hazardous materials. California and some other authorities, for instance, have published lists of substances known to cause cancer, reproductive toxicity, or other harmful effects.

Control dust, mist and fumes at the source where possible. In this regard use good work practices and follow the recommendations of the manufacturers or suppliers, OSHA/NIOSH, and occupational and trade associations. Water should be used for dust suppression when wet cutting is feasible. When the hazards from inhalation of dust, mists and fumes cannot be eliminated, the operator and any bystanders should always wear a respirator approved by NIOSH/MSHA for the materials being used.

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HTN27/28 Ride-On Trowel

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NOTICE

Specifications are subject to change without notice.

TRAINING CHECKLIST

Training Checklist			
No.	Description	OK?	Date
1	Read operation manual completely.		
2	Machine layout, location of components, checking of engine oil level.		
3	Fuel system, refueling procedure.		
4	Operation of spray and lights.		
5	Operation of controls (machine not running).		
6	Safety controls, safety stop switch operation.		
7	Emergency stop procedures.		
8	Startup of machine, pre-heat, engine choke.		
9	Maintaining a hover.		
10	Maneuvering.		
11	Pitching.		
12	Matching blade pitch. Twin-Pitch™		
13	Concrete finishing techniques.		
14	Shutdown of machine.		
15	Lifting of machine (lift loops).		
16	Machine transport and storage.		

DAILY PRE-OPERATION CHECKLIST

Daily Pre-Operation Checklist		✓	✓	✓	✓	✓	✓
1	Engine oil level						
2	Radiator coolant level						
3	Condition of blades						
4	Blade pitch operation						
5	Safety stop switch operation						
6	Steering control operation						

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SAFETY INFORMATION

Do not operate or service the equipment before reading the entire manual. Safety precautions should be followed at all times when operating this equipment. Failure to read and understand the safety messages and operating instructions could result in injury to yourself and others.



SAFETY MESSAGES

The four safety messages shown below will inform you about potential hazards that could injure you or others. The safety messages specifically address the level of exposure to the operator and are preceded by one of four words: **DANGER**, **WARNING**, **CAUTION** or **NOTICE**.

SAFETY SYMBOLS

! DANGER

Indicates a hazardous situation which, if not avoided, **WILL** result in **DEATH** or **SERIOUS INJURY**.

! WARNING

Indicates a hazardous situation which, if not avoided, **COULD** result in **DEATH** or **SERIOUS INJURY**.

! CAUTION

Indicates a hazardous situation which, if not avoided, **COULD** result in **MINOR** or **MODERATE INJURY**.

NOTICE

Addresses practices not related to personal injury.

Potential hazards associated with the operation of this equipment will be referenced with hazard symbols which may appear throughout this manual in conjunction with safety messages.

Symbol	Safety Hazard
	Lethal exhaust gas hazards
	Explosive fuel hazards
	Burn hazards
	Rotating parts hazards
	Pressurized fluid hazards
	Hydraulic fluid hazards

SAFETY INFORMATION

SAFETY DECALS

Decals associated with the operation of this equipment are defined below.

DECAL	DEFINITION
	<p>DANGER Training</p> <p>This machine to be operated by qualified personnel only. Ask for training as needed.</p>
	<p>DANGER Inhalation Hazard</p> <p>DO NOT use this equipment in an enclosed area. The engine emits harmful levels of carbon monoxide which can cause severe bodily harm—even death!</p>
	<p>DANGER Lifting/Crush Hazard</p> <p>Keep persons clear from a lifted trowel. DO NOT stand beneath trowel. DO NOT lift trowel with pans attached.</p>
	<p>DANGER No Water Warning</p> <p>DO NOT add water to the retardant tank.</p>
	<p>DANGER Flying Objects Hazard</p> <p>To avoid injury, DO NOT disassemble spring cylinders without qualified service personnel. Possibility exists of severe bodily harm.</p>
	<p>WARNING Read Manual</p> <p>To avoid injury, you must read and understand the operator's manual before using this machine.</p>
	<p>WARNING Belt Guard Hazard</p> <p>Keep hands and fingers clear from engine belts. Moving parts can cause injury. DO NOT remove guards.</p>
	<p>WARNING Rotating Blade Hazard</p> <p>Keep hands and fingers clear from engine fan blades. Moving parts can cut. DO NOT remove guards.</p>
	<p>CAUTION Burn Hazard</p> <p>HOT PARTS can burn skin. DO NOT touch hot parts. Allow machine sufficient amount of time to cool before performing maintenance.</p>
	<p>NOTICE Protective Clothing</p> <p>Wear appropriate clothing while operating trowel.</p>

GENERAL SAFETY

⚠ CAUTION

- **NEVER** operate this equipment without proper protective clothing, shatterproof glasses, respiratory protection, hearing protection, steel-toed boots and other protective devices required by the job or city and state regulations.



- Avoid wearing jewelry or loose fitting clothes that may snag on the controls or moving parts as this can cause serious injury.

- **NEVER** operate this equipment when not feeling well due to fatigue, illness or when under medication.



- **NEVER** operate this equipment under the influence of drugs or alcohol.



- **ALWAYS** clear the work area of any debris, tools, etc. that would constitute a hazard while the equipment is in operation.

- No one other than the operator is to be in the working area when the equipment is in operation.

- **DO NOT** use the equipment for any purpose other than its intended purposes or applications.

SAFETY INFORMATION

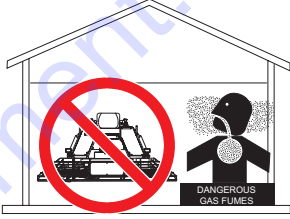

NOTICE

- This equipment should only be operated by trained and qualified personnel 18 years of age and older.
- Whenever necessary, replace nameplate, operation and safety decals when they become difficult read.
- Manufacturer does not assume responsibility for any accident due to equipment modifications. Unauthorized equipment modification will void all warranties.
- **NEVER** use accessories or attachments that are not recommended by Multiquip for this equipment. Damage to the equipment and/or injury to user may result.
- **ALWAYS** know the location of the nearest **fire extinguisher**. 
- **ALWAYS** know the location of the nearest **first aid kit**. 
- **ALWAYS** know the location of the nearest phone or **keep a phone on the job site**. Also, know the phone numbers of the nearest **ambulance, doctor and fire department**. This information will be invaluable in the case of an emergency.





TROWEL SAFETY

DANGER

- Engine fuel exhaust gases contain poisonous carbon monoxide. This gas is colorless and odorless, and can cause death if inhaled.
- The engine of this equipment requires an adequate free flow of cooling air. **NEVER** operate this equipment in any enclosed or narrow area where free flow of the air is restricted. If the air flow is restricted it will cause injury to people and property and serious damage to the equipment or engine. 
- **NEVER** operate the equipment in an explosive atmosphere or near combustible materials. An explosion or fire could result causing severe **bodily harm or even death**. 

WARNING

- If applicable, **NEVER** use your hand to find hydraulic leaks. Use a piece of wood or cardboard. Hydraulic fluid injected into the skin must be treated by a knowledgeable physician immediately or severe injury or death can occur. 
- **ALWAYS** keep clear of rotating or moving parts while operating the trowel. 
- **NEVER** disconnect any **emergency or safety devices**. These devices are intended for operator safety. Disconnection of these devices can cause severe injury, bodily harm or even death. Disconnection of any of these devices will void all warranties.

CAUTION

- **NEVER** allow passengers or riders on the trowel during operation.
- **NEVER** lubricate components or attempt service on a running machine.
- **NEVER** place your feet or hands inside the guard rings while starting or operating this equipment.

SAFETY INFORMATION



NOTICE

- **ALWAYS** keep the machine in proper running condition.
- Fix damage to machine and replace any broken parts immediately.
- **ALWAYS** store equipment properly when it is not being used. Equipment should be stored in a clean, dry location out of the reach of children and unauthorized personnel.
- A safety manual for operating and maintenance personnel of concrete power trowels produced by the Association of Equipment Manufacturers (AEM) can be obtained for a fee by ordering through their website at www.aem.org.


Order FORM PT-160

ENGINE SAFETY


WARNING

- **DO NOT** place hands or fingers inside engine compartment when engine is running.
- **NEVER** operate the engine with heat shields or guards removed.
- Keep fingers, hands hair and clothing away from all moving parts to prevent injury. 
- **DO NOT** remove the radiator cap while the engine is hot. High pressure boiling water will gush out of the radiator and severely scald any persons in the general area of the trowel.
- **DO NOT** remove the coolant drain plug while the engine is hot. Hot coolant will gush out of the coolant tank and severely scald any persons in the general area of the trowel. 
- **DO NOT** remove the engine oil drain plug while the engine is hot. Hot oil will gush out of the oil tank and severely scald any persons in the general area of the trowel.

CAUTION


- **NEVER** touch the hot exhaust manifold, muffler or cylinder. Allow these parts to cool before servicing equipment. 

NOTICE

- **NEVER** run engine without an air filter or with a dirty air filter. Severe engine damage may occur. Service air filter frequently to prevent engine malfunction.
- **NEVER** tamper with the factory settings of the engine or engine governor. Damage to the engine or equipment can result if operating in speed ranges above the maximum allowable. 

FUEL SAFETY

DANGER

- **DO NOT** start the engine near spilled fuel or combustible fluids. Fuel is extremely flammable and its vapors can cause an explosion if ignited.
- **ALWAYS** refuel in a well-ventilated area, away from sparks and open flames.
- **ALWAYS** use extreme caution when working with **flammable** liquids.
- **DO NOT** fill the fuel tank while the engine is running or hot.
- **DO NOT** overfill tank, since spilled fuel could ignite if it comes into contact with hot engine parts or sparks from the ignition system.
- Store fuel in appropriate containers, in well-ventilated areas and away from sparks and flames.
- **NEVER** use fuel as a cleaning agent.
- **DO NOT** smoke around or near the equipment. Fire or explosion could result from fuel vapors or if fuel is spilled on a hot engine. 

SAFETY INFORMATION

BATTERY SAFETY

DANGER

- **DO NOT** drop the battery. There is a possibility that the battery will explode.
- **DO NOT** expose the battery to open flames, sparks, cigarettes, etc. The battery contains combustible gases and liquids. If these gases and liquids come into contact with a flame or spark, an explosion could occur.



WARNING

- **ALWAYS** wear safety glasses when handling the battery to avoid eye irritation. The battery contains acids that can cause injury to the eyes and skin.
- Use well-insulated gloves when picking up the battery.
- **ALWAYS** keep the battery charged. If the battery is not charged, combustible gas will build up.
- **DO NOT** charge battery if frozen. Battery can explode. When frozen, warm the battery to at least 61°F (16°C).
- **ALWAYS** recharge the battery in a well-ventilated environment to avoid the risk of a dangerous concentration of combustible gases.
- If the battery liquid (dilute sulfuric acid) comes into contact with **clothing or skin**, rinse skin or clothing immediately with plenty of water.
- If the battery liquid (dilute sulfuric acid) comes into contact with **eyes**, rinse eyes immediately with plenty of water and contact the nearest doctor or hospital to seek medical attention.



CAUTION

- **ALWAYS** disconnect the **NEGATIVE** battery terminal before performing service on the equipment.
- **ALWAYS** keep battery cables in good working condition. Repair or replace all worn cables.

TRANSPORTING SAFETY

CAUTION

- **NEVER** allow any person or animal to stand underneath the equipment while lifting.
- Ride-on trowels are very heavy and awkward to move around. Use proper heavy lifting procedures and **DO NOT** attempt to lift the trowel by the guard rings.



NOTICE

- The easiest way to lift the trowel is to utilize the lift loops that are welded to the frame. These lift loops are located to the left and right sides of the operator's seat.
A strap or chain can be attached to these lift loops, allowing a forklift or crane to lift the trowel up onto and off of a slab of concrete. The strap or chain should have a minimum of 2,000 pounds (1,000 kg) lifting capacity and the lifting gear must be capable of lifting at least this amount.
- **NEVER** transport trowel with float pans attached unless safety catches are used and are specifically cleared for such transport by the manufacturer.
- **NEVER** hoist the trowel more than three feet off the ground with float pans attached.
- Before lifting, make sure that the lift loops are not damaged.
- Always make sure crane or lifting device has been properly secured to the lift loops of the equipment.
- **ALWAYS** shutdown engine before transporting.
- **NEVER** lift the equipment while the engine is running.
- Tighten fuel tank cap securely and close fuel cock to prevent fuel from spilling.
- Use adequate lifting cable (wire or rope) of sufficient strength.
- **DO NOT** lift machine to unnecessary heights.
- **ALWAYS** tie down equipment during transport by securing the equipment with rope.

SAFETY INFORMATION

TOWING SAFETY


⚠ CAUTION

- Check with your local county or state safety towing regulations, in addition to meeting **Department of Transportation (DOT) Safety Towing Regulations**, before towing your trowel. 
- In order to reduce the possibility of an accident while transporting the trowel on public roads, **ALWAYS** make sure the trailer that supports the trowel and the towing vehicle are mechanically sound and in good operating condition.
- **ALWAYS** shutdown engine before transporting
- Make sure the hitch and coupling of the towing vehicle are rated equal to, or greater than the trailer “gross vehicle weight rating.”
- **ALWAYS** inspect the hitch and coupling for wear. **NEVER** tow a trailer with defective hitches, couplings, chains, etc.
- Check the tire air pressure on both towing vehicle and trailer. **Trailer tires should be inflated to 50 psi cold.** Also check the tire tread wear on both vehicles.
- **ALWAYS** make sure the trailer is equipped with a **safety chain**.
- **ALWAYS** properly attach trailer’s safety chains to towing vehicle.
- **ALWAYS** make sure the vehicle and trailer directional, backup, brake and trailer lights are connected and working properly.
- DOT Requirements include the following:
 - Connect and test electric brake operation.
 - Secure portable power cables in cable tray with tie wraps.
- The maximum speed for highway towing is 55 MPH unless posted otherwise. Recommended off-road towing is not to exceed 15 MPH or less depending on type of terrain.
- Avoid sudden stops and starts. This can cause skidding, or jack-knifing. Smooth, gradual starts and stops will improve towing.
- Avoid sharp turns to prevent rolling.

- Trailer should be adjusted to a level position at all times when towing.
- Raise and lock trailer wheel stand in up position when towing.
- Place **chock blocks** underneath wheel to prevent rolling while parked.
- Place support blocks underneath the trailer’s bumper to prevent tipping while parked.
- Use the trailer’s swivel jack to adjust the trailer height to a level position while parked.

ENVIRONMENTAL SAFETY

NOTICE

- Dispose of hazardous waste properly. Examples of potentially hazardous waste are used motor oil, fuel and fuel filters. 
- **DO NOT** use food or plastic containers to dispose of hazardous waste.
- **DO NOT** pour waste, oil or fuel directly onto the ground, down a drain or into any water source.

LIFTING AND TRANSPORTING

WORK SAFELY!

WARNING



Failure to comply with these lifting instructions may result in **sling failure** and **severe personal injury or death**.

Only **qualified personnel** with proper training should perform this procedure. Follow all rigging and lifting safety rules when performing this procedure.

LIFTING SAFETY

CAUTION

- **NEVER** allow any person to stand underneath the equipment while lifting.
- Ride-on trowels are very heavy and awkward to move around. Use proper heavy lifting procedures and **DO NOT** attempt to lift the trowel by the guard rings.
- **NEVER** lift the trowel with the operator on the machine.

NOTICE

- **NEVER** hoist the trowel more than three feet off of the ground with float pans attached.
- Before lifting, make sure that the lift loops are not damaged.
- **ALWAYS** make sure any lifting device has been properly secured to the lift loops of the trowel.
- **DO NOT** lift the trowel to unnecessary heights.
- **ALWAYS** shut down the engine before transporting.
- **NEVER** lift the trowel while the engine is running.
- Tighten the fuel tank cap securely and close the fuel cock to prevent fuel from spilling.

SLING INSPECTION

Inspect the lifting slings provided with your trowel (Figure 1) **before each use**. If replacement slings are needed, refer to the parts manual included with your trowel for part numbers, and order from Discount-equipment.

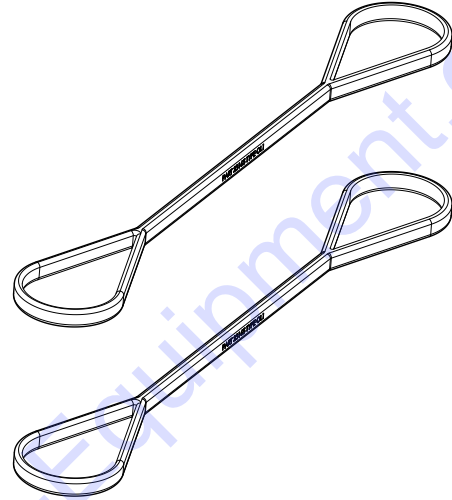
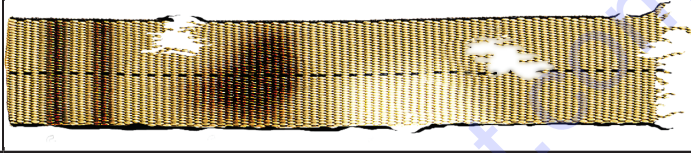

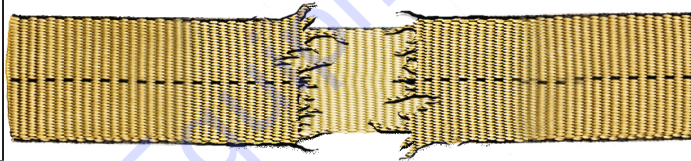
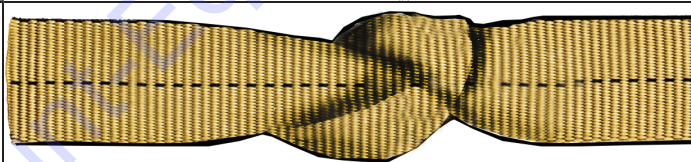


Figure 1. Lifting Slings

LIFTING AND TRANSPORTING

The Occupational Safety and Health Administration (OSHA) Regulation 29 CFR Part 1926.251 (e)(8)—*Removal from service* requires that the slings be inspected prior to each use, and **removed from service immediately** if any of the following conditions are found:

<ul style="list-style-type: none"> ■ Holes, tears, cuts, or snags ■ Embedded particles ■ Abrasive wear that exposes core fibers 	
<ul style="list-style-type: none"> ■ Missing or unreadable Rated Capacity tags ■ Melting, charring, weld spatter, or chemical burns 	
<ul style="list-style-type: none"> ■ Broken or worn stitching that exposes the core fibers 	
<ul style="list-style-type: none"> ■ Knots 	
<ul style="list-style-type: none"> ■ Any other condition which may cause doubt as to the strength of the sling 	

LIFTING AND TRANSPORTING

LIFTING PROCEDURE

The correct lifting slings (Figure 1) have been supplied with your trowel, in accordance to its weight per Occupational Safety and Health Administration (OSHA) Regulation 29 CFR Part 1926.251—*Rigging equipment for material handling*.

WARNING
ALWAYS inspect the lifting slings **before** each use.

NOTICE
MAKE SURE the forklift has adequate lifting capacity to lift the trowel.

The proper sling hitch method for connecting the lifting slings to the ride-on trowel is the **choker hitch**. The rated capacity of the slings for this method is indicated on the sling labels. **DO NOT** use any other type of sling hitch!

1. Secure the two lifting slings to the lift loops located on the left and right side of the trowel (Figure 2).

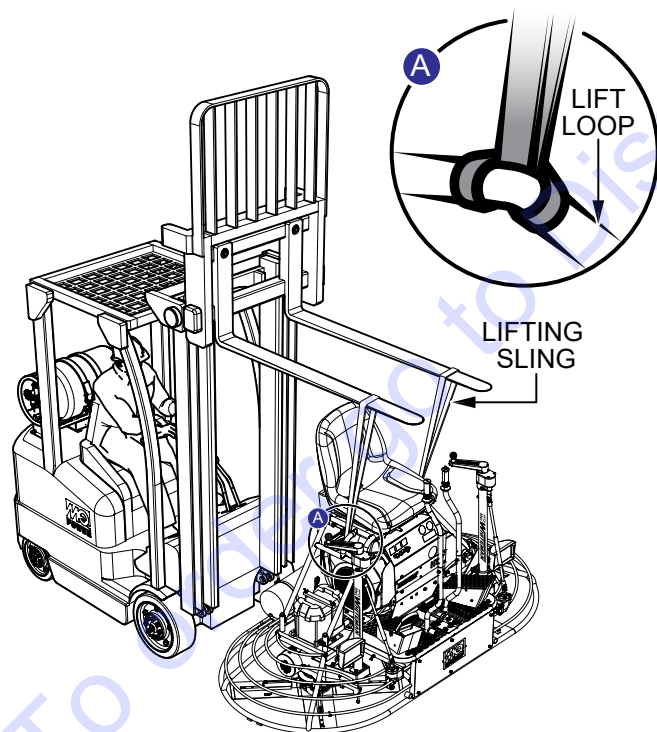


Figure 2. Lifting the Trowel

2. Insert forklift forks through the loops at the ends of the lifting slings (Figure 2). Keep the slings as close to vertical as possible. If the choke angle (Figure 3) is 120 degrees or less, the lifting strength of the slings must be de-rated as shown in Table 1, in accordance with ASME Standard B30.9.

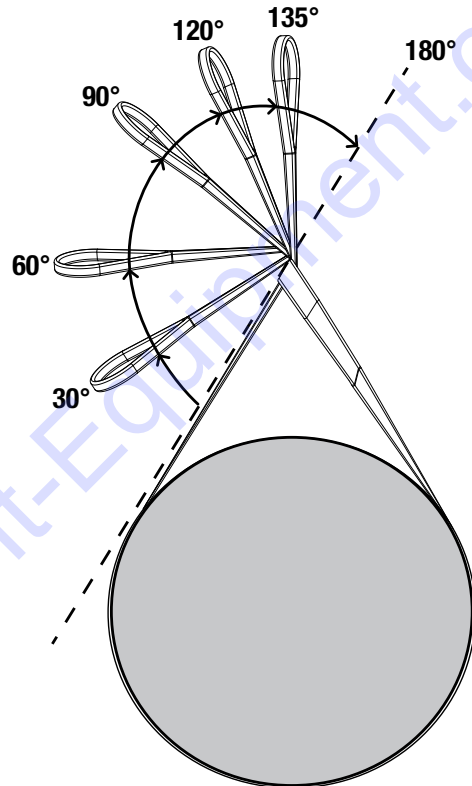


Figure 3. Choke Angle

Table 1. Choker Hitch Sling Capacity	
Choke Angle (°)	Rated Capacity (%)
Over 120	100
90–120	87
60–89	74
30–59	62
0–29	49

Table 2. HTN27-28 Trowel Specifications

Operating Weight	780 lb. (354 kg)
Shipping Weight	1,130 lb. (512.6 kg)
Max. Rotor Speed (Dry Concrete)	140 rpm
Path Width	91.0 in. (2,311 mm)
Gearbox Oil Capacity	57 oz. (1.7 liters)

Table 3. Kohler Engine Specifications

Model	Kohler CH740
Type	4-stroke, overhead valve, V-twin, gasoline engine
Displacement	44.0 in. ³ (725 cm ³)
Max. Output	25 hp (18.6 kW) @ 3,600 rpm
Max. Torque	42.7 lb-ft. @ 2,200 rpm
Cooling System	Forced air
Engine Oil Capacity	1.75 qt. (1.66 liters) 2.0 qt. (1.9 liters) with replacement oil filter
Fuel Tank Capacity	5.0 gal.(19 liters)
Fuel	Unleaded gasoline, 86 or higher octane rating
Starting System	Electric start/transistorized magneto

Table 4. HTN27KTCSL Noise and Vibration Emissions

Guaranteed ISO 11201:2010 Based Sound Pressure Level at Operator Station in dB(A)	92
Guaranteed ISO 3744:2010 Based Sound Power Level in dB(A)	116
Whole Body Vibration Per ISO 2631-1:1997 +A1:2010 in m/s ² Σ A(8)	0.17

NOTES:

1. Sound pressure and power levels are "A" weighted measures per ISO 226:2003 (ANSI S1.4-1981). They are measured with the operating conditions of the machine which generate the most repeatable but highest values of the sound levels. Under normal circumstances, the sound level will vary depending on the condition of the material being worked upon.
2. The vibration level indicated is the vector sum of the RMS (root mean square) values of amplitudes on each axis, standardized to an 8-hour exposure period, and obtained using operating conditions of the machine that generate the most repeatable but highest values in accordance with the applicable standards for the machine.
3. Per EU Directive 2002/44/EC, the daily exposure action value for whole body vibration is 0.5 m/s² Σ A(8). The daily exposure limit value is 1.15 m/s² Σ A(8).

DIMENSIONS

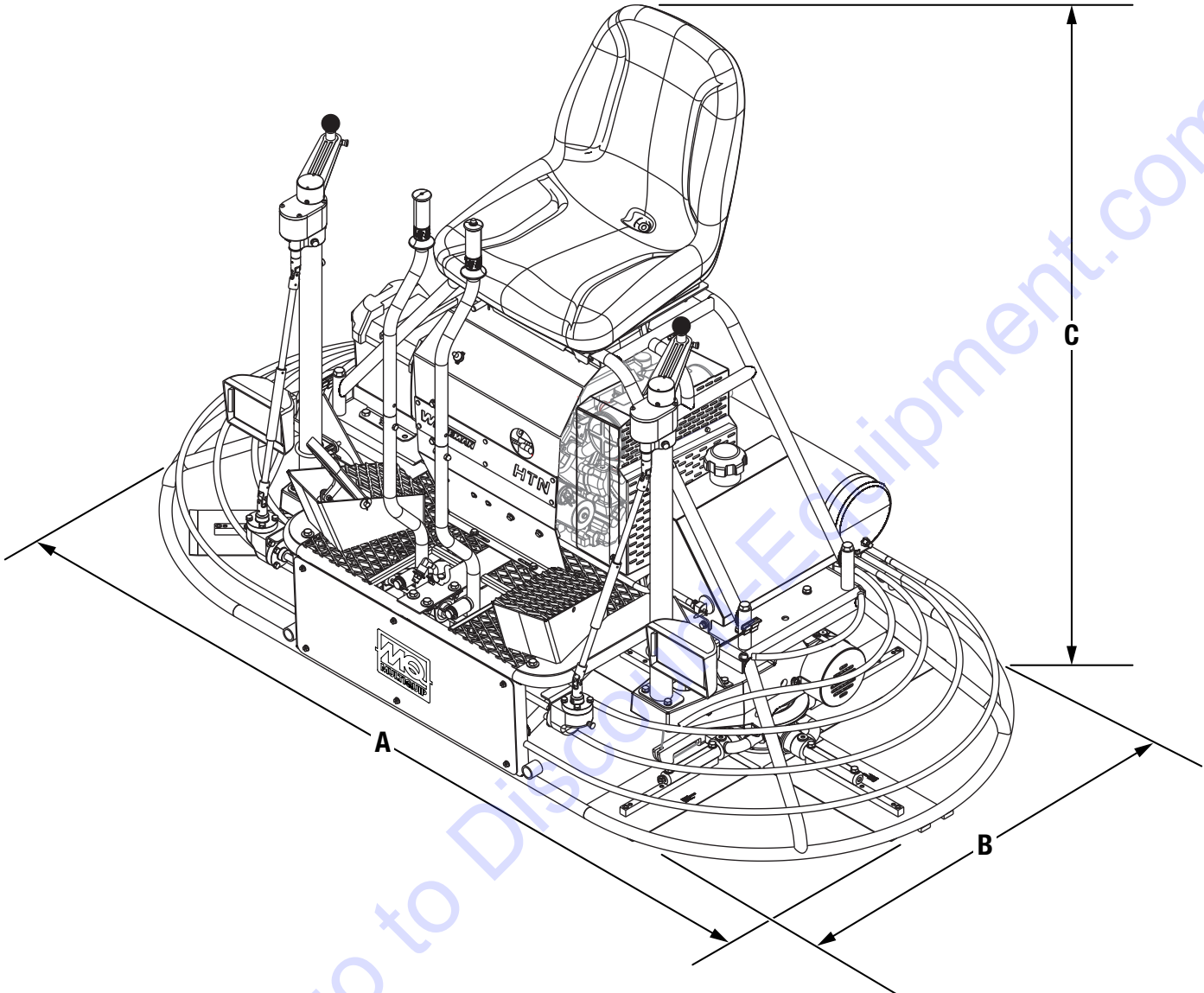


Figure 4. HTN27-28 Dimensions

Table 5. HTN27-28 Dimensions	
Measurement	in. (cm)
(A) Length	95.0 (241)
(B) Width	48.0 (122)
(C) Height	46.0 (117)

POWER TROWEL FAMILIARIZATION

The HTN27/28 series ride-on power trowel is designed for the floating and finishing of concrete slabs.

Take a walk around your trowel. Take notice of all the major components (see Figure 5 and Figure 6) like the engine, blades, air cleaner, fuel system, fuel shut-off valve, ignition switch, etc. Ensure engine and gearbox oil levels are within the proper operating range.

Read all safety information carefully. Keep all safety information in good, readable condition. Operators should be well trained on the operation and maintenance of the trowel.

Look at the operator control levers. Grasp the control levers and move them around a bit. Observe how moving the control levers causes the gearboxes and frame to move.

Notice the foot pedal which controls the engine and blade speed. Also take a look at the main driveline of the trowel. Take note of how the belts look. This is the way the belts should look when adjusted properly.

Before using your trowel, test it on a flat, watered-down section of finished concrete. This trial test run will increase your confidence in using the trowel and familiarize you with the trowel's controls and indicators. In addition, you will understand how the trowel will handle under actual conditions.

ENGINE

This trowel is equipped with an air-cooled, 25-horsepower, carbureted or EFI Kohler gasoline engine. Refer to the engine owner's manual for specific instructions regarding engine operation. This manual is included with the trowel at the time of shipping. Please contact Discount-equipment if a replacement manual is required.

BLADES

The blades of the trowel finish the concrete as they are swirled around the surface. Blades are classified as *combination* (10 or 8 inches wide) or *finish* (6 inches wide). This trowel is equipped with four blades per rotor, equally spaced in a radial pattern and attached to a vertical rotating shaft by means of a spider assembly.

TROWEL COMPONENTS

1. **Steering Control Levers** — Direct the unit forward, reverse, left, or right.
2. **Retardant Spray Control Button** — Sprays retardant through the nozzle at the front of the machine.
3. **Spark Plug** — Access the spark plug through this cutout.
4. **Left Foot Riser** — Operator foot rest.
5. **EZ-Mover Boss** — Front attachment point for EZ-Mover. Used for transporting the trowel.
6. **Spray Nozzle** — Spray nozzle for retardant.
7. **Right Foot Pedal** — Controls blade speed. Slow blade speed is obtained by slightly depressing the foot pedal. Maximum blade speed is obtained by fully depressing the foot pedal.
8. **Spiders (2)** — Consists of trowel arms, blades, wear plate, and thrust collar.
9. **Hour Meter** — Indicates the number of hours the engine has run.
10. **Choke Control (HTN27 Only)** — In cold weather, pull this knob to start the engine. After the engine warms, push the knob all the way in.
11. **Ignition Switch** — With the key inserted, turn clockwise to start the engine.
12. **Light Switch** — Turns on three halogen lights, two in front and one in rear.

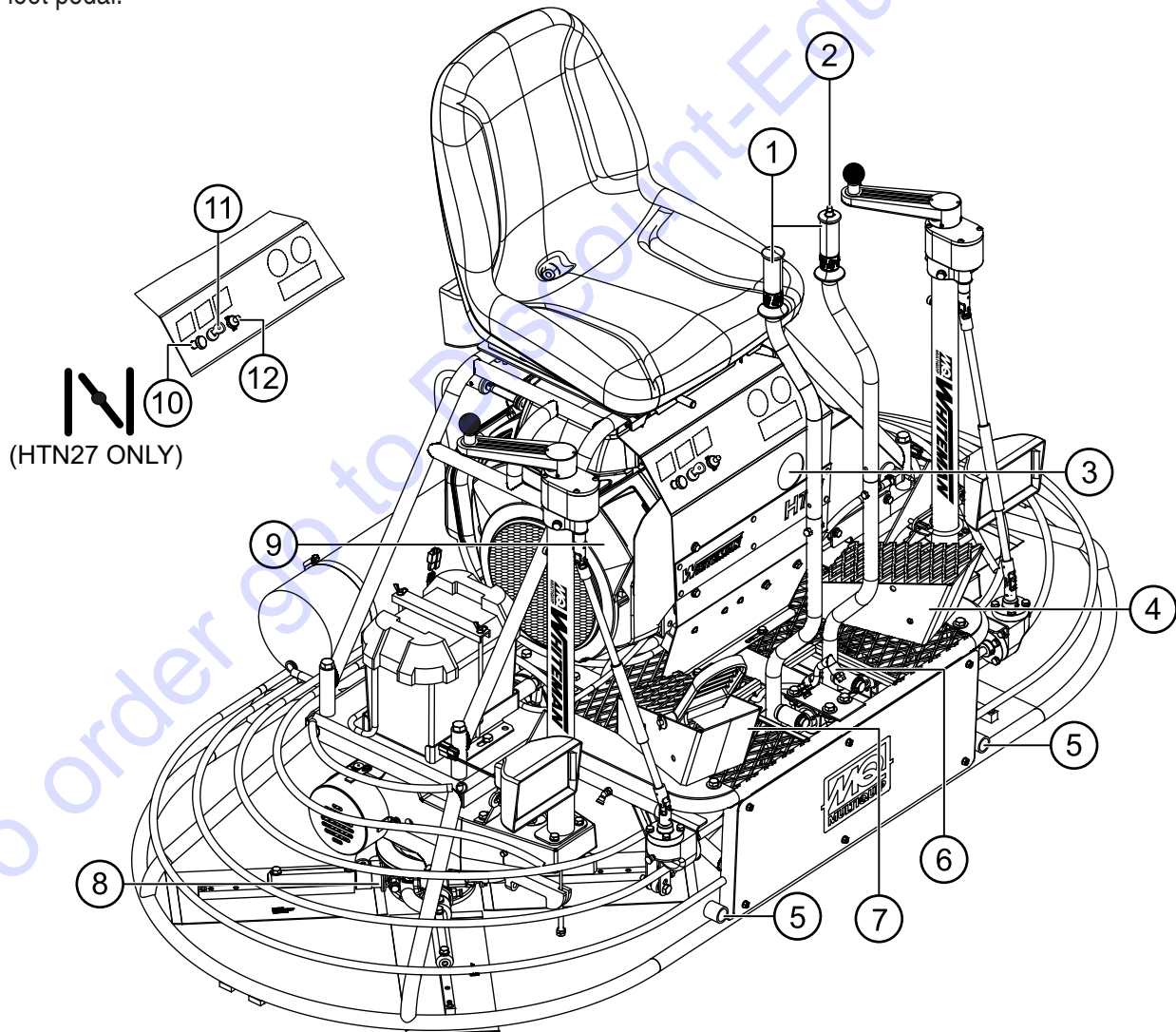


Figure 5. HTN27-28 Components (Front)

TROWEL COMPONENTS

13. **Seat** — The engine will neither start nor run unless the operator is seated.
14. **Rear Light** — Rear-facing 12-volt halogen light.
15. **Safety Stop Switch** — Shuts down the engine when the seat is empty.
16. **Lift Loops** — Located on both sides of the main frame. Used for lifting the trowel.
17. **Twin Pitch Control** — Both pitch towers are linked together. One crank may be turned to adjust blade pitch simultaneously, or individually controlled for each set of blades. Turn the crank as marked on its top surface to increase or decrease blade pitch.
18. **Battery** — Provides +12V DC power to the electrical system.
19. **EZ-Mover Boss** — Rear attachment point for EZ-Mover. Used for transporting the trowel.
20. **Belt Guard** — Encloses the drive belt used in conjunction with the clutch.
21. **Retardant Spray Tank** — Holds 5 gallons of retardant.
22. **Retardant Spray Pump** — Delivers retardant to the spray nozzle.
23. **Fuel Tank** — Holds 5 gallons of unleaded gasoline.
24. **Fuel Gauge/Filler Cap** — Indicates the amount of fuel in the fuel tank. Remove this cap to add fuel.

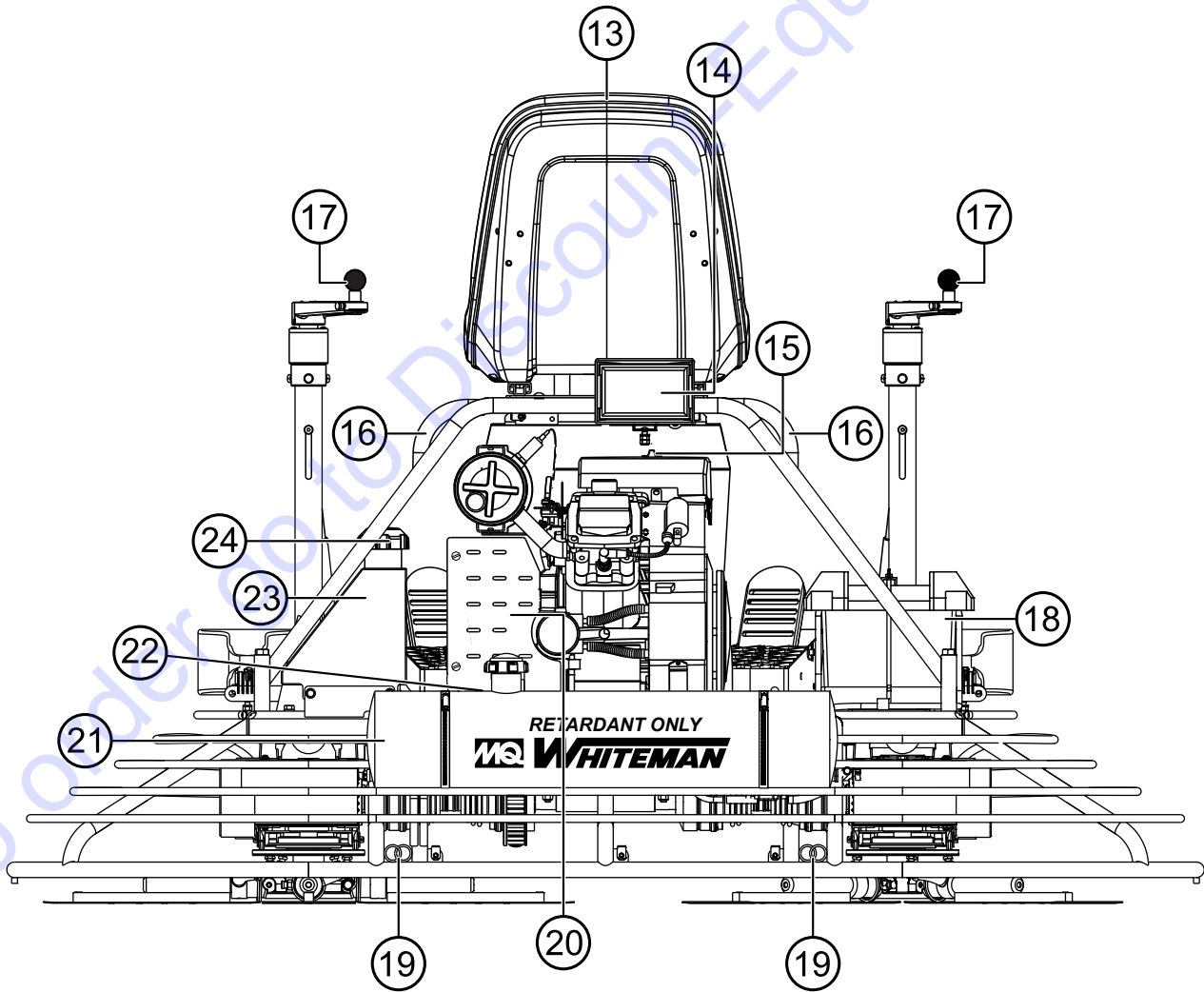


Figure 6. HTN27-28 Components (Rear)

ENGINE COMPONENTS

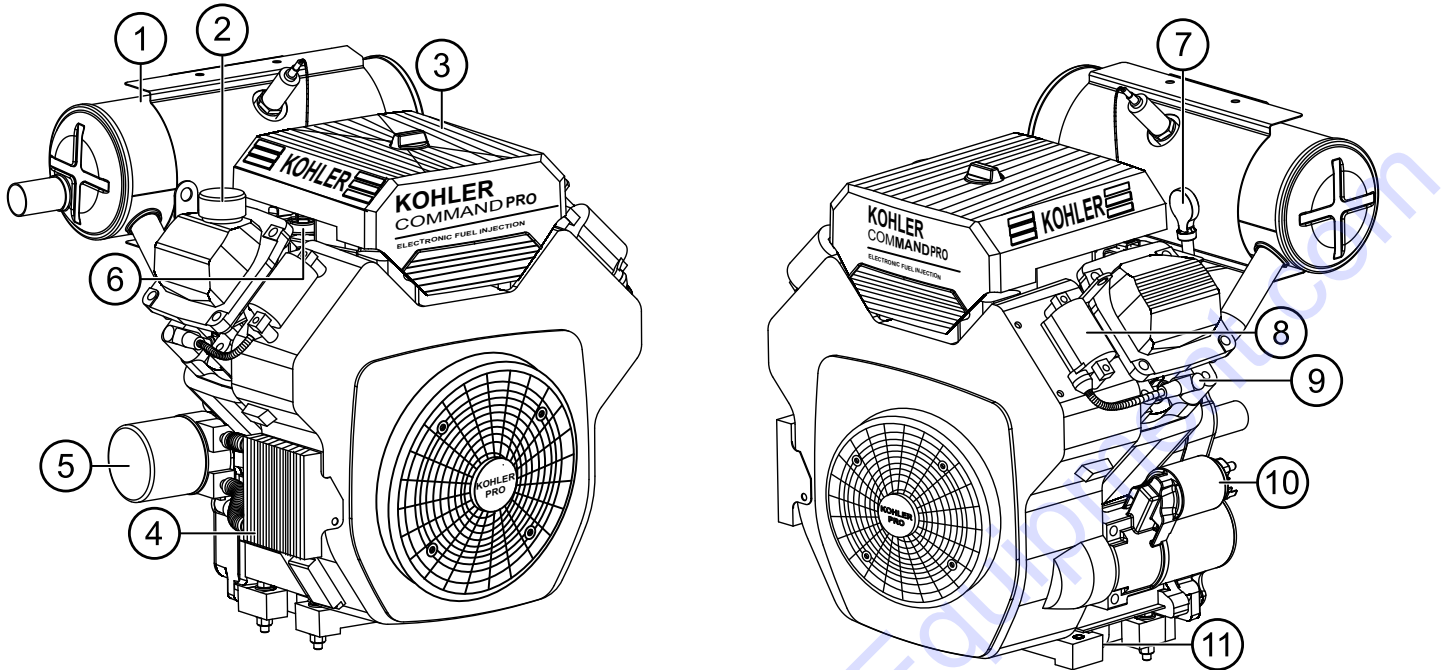


Figure 7. Kohler Engine Components

INITIAL SERVICING

The engine must be checked for proper lubrication and filled with fuel prior to operation. Refer to the engine owner's manual for engine operation and maintenance instructions.

1. **Muffler** — Reduces noise and emissions.

WARNING



Engine components can generate extreme heat. To prevent burns, **NEVER** touch these areas while the engine is running or immediately after operating. **NEVER** operate the engine with the muffler removed.

2. **Oil Filler Cap** — Remove to add engine oil.
3. **Air Cleaner** — Prevents dirt and other debris from entering the fuel system. Unsnap the air cleaner cover to gain access to the filter element.
4. **Oil Cooler** — Cools engine oil for longer engine life.

5. **Oil Filter** — Spin-on type, filters oil for contaminants.
6. **Throttle Lever** — Increases or decreases engine RPM. Controlled by the accelerator pedal.
7. **Oil Dipstick** — Remove to check the amount and condition of oil in the crankcase.
8. **Ignition Coil** — Provides spark to the ignition system.
9. **Spark Plug** — Provides spark to the combustion chamber. See the engine owner's manual for spark plug type and gap settings. Clean the spark plug once a week.
10. **Starter** — Starts the engine when the ignition key is rotated to the **START** position.
11. **Oil Drain Bolt (2)** — Remove to drain oil from the crankcase.

The purpose of this section is to assist the user in setting up a **NEW** trowel. If the trowel is already assembled (seats, handles, knobs and battery), this section can be skipped.

NOTICE

A new ride-on trowel cannot be operated until the following installation instructions are completed. These procedures only need to be completed when unpacking a **NEW** trowel.

Before packaging and shipping, this ride-on power trowel was run and tested at the factory. If there are problems, please let us know.

CONTROL HANDLE ASSEMBLY

The steering control handles are not attached to the trowel's two lower handles at the time of shipment. To attach the steering control handles to the lower handle assemblies, perform the following:

1. Remove the bolts from the plastic bag tied to the control towers.
2. Remove all protective wrapping and straps from the control handles.
3. Slip the top (loose) control handle piece into the base of the corresponding handle, making sure to line up the holes.
4. Install the bolt through the lined-up holes and tighten the acorn nut onto the threaded end.

NOTICE

Models equipped with adjustable height handles are adjusted by placing the bolt through the set of holes that brings the handle to the most comfortable height for the operator.

5. Pay close attention to any wires inside the control handles. **DO NOT** pinch or cut any wires during installation.
6. Remove the two knobs from the plastic bag for the pitch control tower cranks and install the knobs onto the tower crank levers.

SEAT ASSEMBLY

The seat is not installed on the trowel for shipping purposes. To attach the seat, perform the following:

NOTICE

HTN Series trowels have a seat that is mounted on tracks, similar to an automobile seat. This seat can be adjusted fore and aft via the control lever under the front of the seat.

1. Remove the seat from the protective wrapping.
2. Remove the bolts on the bottom of the seat, and place the seat onto the seat mounting plate. Insert the bolts through the holes on the seat mounting plate and tighten securely.

BATTERY SETUP

This trowel is shipped with a wet-charged battery. The battery may need to be charged for a brief period of time as per manufacturer's instructions.

CAUTION

Use all safety precautions specified by the battery manufacturer when working with the battery.

To install the battery (Figure 8), make sure the battery is well seated in the battery box. Connect the positive cable (**RED**) to the positive (+) terminal on the battery first, then connect the negative cable (**BLACK**) to the negative (-) terminal. Close the battery box cover and secure the battery box.

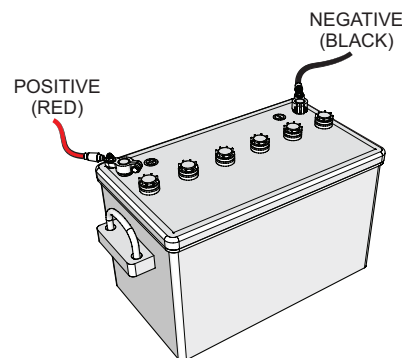


Figure 8. Battery Cable Orientation

ENGINE OIL LEVEL

NOTICE

ALWAYS check engine oil before each use.

1. Pull the engine oil dipstick (Figure 9) from its holder.

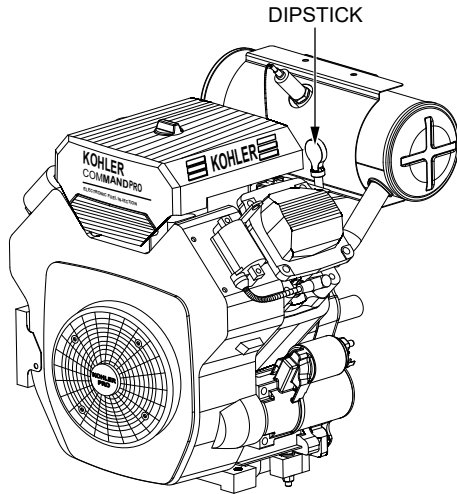


Figure 9. Engine Oil Dipstick

2. Determine if engine oil is low (Figure 10).

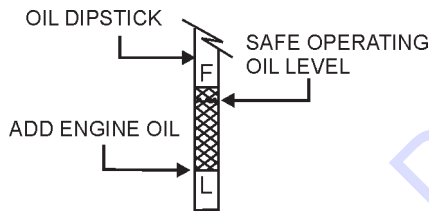


Figure 10. Engine Oil Level

NOTICE

To prevent extensive engine wear or damage, **ALWAYS** maintain the proper oil level in the crankcase. **NEVER** operate the engine with the oil level below the 'L' mark or over the 'F' mark on the dipstick.

Table 6. Recommended Viscosity Grades

5W-20, 5W-30										
10W-30, 10W-40										
°F	-20	0	20	32	40	60	80	100		
°C	-30	-20	-10	0	10	20	30	40		
TEMPERATURE RANGE EXPECTED BEFORE NEXT OIL CHANGE										

GEARBOX OIL LEVEL

1. Check the gearbox oil level in each gearbox (Figure 11) by removing the fill plug and visually confirming the oil level.

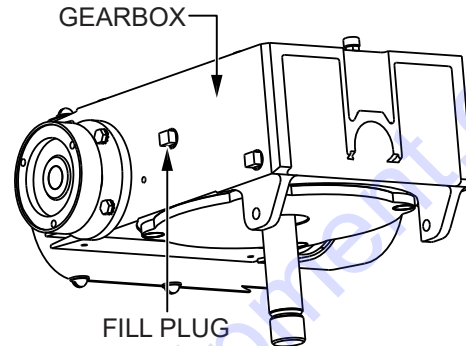


Figure 11. Gearbox Oil Plug/Sight Glass

2. Fill the gearbox to the level of the fill plug with Chevron Cetus® HiPerSYN 460 synthetic gear oil. Gearbox oil capacity is 57 oz. (1.7 liters).

FUEL

! DANGER



ALWAYS handle fuel safely. Motor fuels are **highly flammable** and can be dangerous if mishandled. **NEVER** smoke while refueling. **NEVER** attempt to refuel while the engine is hot or running. In the event of a fuel spill, **DO NOT** attempt to start the engine until all fuel residue has been completely wiped up and the area surrounding the engine is dry.

Read the fuel gauge located on top of the fuel tank (Figure 12) to determine the fuel level. If the fuel level is low, remove the fuel filler cap and fill the tank with unleaded gasoline.

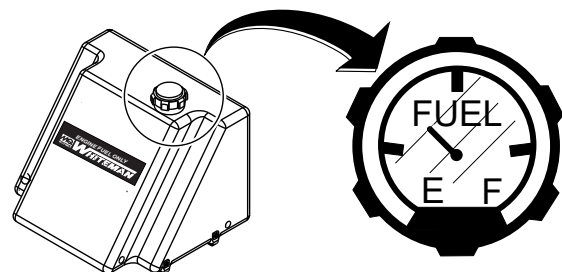


Figure 12. Fuel Gauge/Filler Cap

OPERATION

The instructions in this manual are provided as a basic guide to trowel operation, **not** a complete guide to concrete finishing. We suggest that all operators (experienced and novice) read *Slabs on Ground* published by the American Concrete Institute.

DO NOT use your ride-on power trowel until this section is thoroughly understood.

CAUTION

Failure to understand the operation of the HTN27-28 trowel could result in **severe personal injury** or damage to the machine.

See Figure 5 and Figure 6 for the location of any control or indicator referenced in this manual.

STARTING THE ENGINE

1. Place one foot on the trowel's platform and grab any part of the frame, then lift yourself onto the trowel and sit down in the operator's seat.

NOTICE

The HTN27-28 trowel is equipped with a safety stop switch that will prevent the engine from starting unless an operator is sitting in the operator's seat. The weight of the operator depresses an electrical switch which allows the engine to start.

WARNING

NEVER disable or disconnect the safety stop switch. It is provided for the operator's safety, and injury may result if it is disabled, disconnected or improperly maintained.

NOTICE

Verify that the safety stop switch is working properly by using the switch to stop the engine after each use. Remember to turn the key to the **OFF** position after stopping the machine. Failure to do so may drain the battery.

2. The right foot pedal (Figure 13) controls engine and blade speed. The position of the foot pedal determines the speed of the blade. Slow blade speed is obtained by slightly depressing the pedal. Maximum blade speed is obtained by fully depressing the pedal.

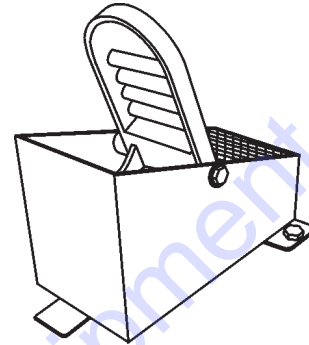


Figure 13. Blade Speed Control Foot Pedal

3. If starting a cold engine, pull the choke knob (model HTN27 only) out to the closed position. In warm weather or when the engine is warm, the unit can be started with the choke halfway or completely open. See Figure 14.

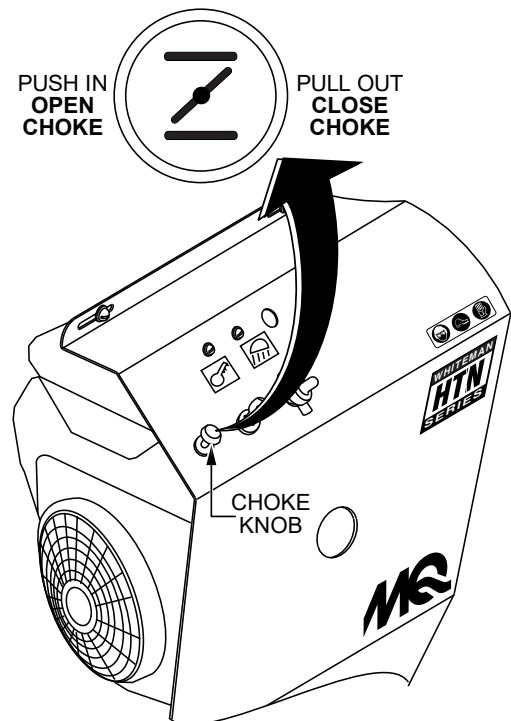


Figure 14. Choke Knob (HTN27 Only)

4. Insert the ignition key into the ignition switch.

- Keeping your foot **off** the right foot pedal, turn the ignition key (Figure 15) clockwise to start the engine. Be sure to start the engine at **idle** (without touching the foot pedal). Once the engine starts, release the ignition key.

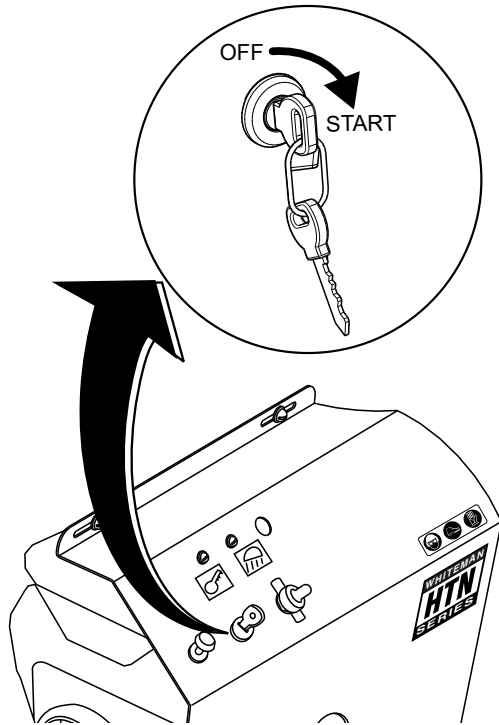


Figure 15. Ignition Key

- If the engine fails to start, consult the engine owner's manual supplied with the trowel.
- Test the safety stop switch by standing up briefly. The switch under the seat should cause the engine to stop. If the switch fails to shut down the engine, turn off the engine with the key switch and repair the safety stop switch. Refer to the **Troubleshooting** section of this manual for more information.
- Let the engine idle for 3–5 minutes. If the choke is closed, push the choke knob to the open position as soon as the engine begins to run smoothly.

STEERING

Two control levers located in front of the operator's seat provide directional control for the trowel. Table 7 illustrates the various directional positions of the joysticks and their effect on the trowel.

Table 7. Control Lever Directional Positioning

Control Lever and Direction	Result
Move left control lever forward	Trowel moves forward and to the right
Move left control lever backward	Trowel moves backward and to the left
Move right control lever forward	Trowel moves forward and to the left
Move right control lever backward	Trowel moves backward and to the right
Move both control levers forward	Trowel moves forward in a straight line
Move both control levers backward	Trowel moves backward in a straight line
Move both control levers to the right	Trowel moves to the right
Move both control levers to the left	Trowel moves to the left

NOTICE

All directional references with respect to the steering control levers are from the operator's seat position.

- Push both the left and right control levers forward. See Figure 16.

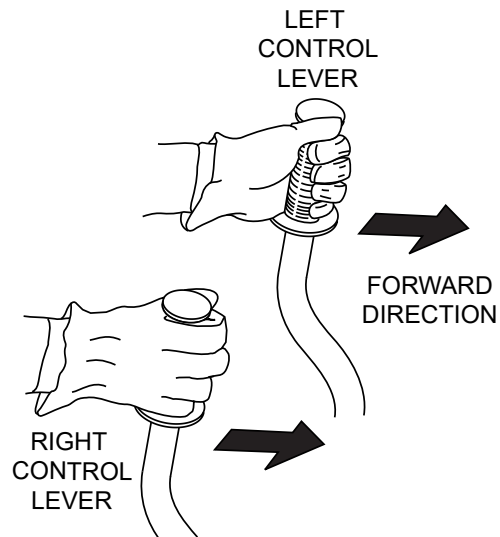


Figure 16. Control Levers (Forward)

- With your right foot, quickly depress the right foot pedal halfway. Notice how the trowel begins to move in a forward direction. Return both joystick controls to their neutral position to stop forward movement, then remove your right foot from the right foot pedal.

3. Practice holding the machine in one place as you increase blade speed. When about 75% of maximum blade speed has been reached, the blade will be moving at proper finishing speed. The machine may be difficult to keep in one place. Trying to keep the trowel stationary is good practice for operation.
4. Practice maneuvering the trowel using the information listed in Table 7. Practice using controlled motions as if you were finishing a slab of concrete. Practice edging and covering a large area.
5. Try adjusting the pitch of the blades. This can be done with the trowel stopped or while the trowel is moving, whichever feels comfortable. Test the operation of optional equipment like retardant spray and lights if equipped.
6. Pull both the left and right joysticks backward and repeat steps 2 through 5 while substituting the word *reverse* for *forward*.


NOTICE


Trowel arms can be damaged by rough handling or by striking exposed plumbing or forms while in operation. **ALWAYS** look out for objects which might cause damage to the trowel arms.


At the front of this manual is a **Daily Pre-Operation Checklist**. Make copies of this checklist and use it on a daily basis.

When performing any maintenance on the trowel or engine, follow all safety messages at the beginning of this manual.

! WARNING

 Accidental starts can cause **severe injury or death**.
ALWAYS place the **ON/OFF** switch in the **OFF** position before performing maintenance.

 Disconnect the negative battery cable from the battery before servicing.

 **ALWAYS** allow the engine to cool before servicing. **NEVER** attempt any maintenance work on a hot trowel (muffler, radiator, etc.).

MAINTENANCE SCHEDULE

Check and retighten all fasteners as necessary.

Daily (8–10 Hours)

1. Check the fluid levels in the engine and gearboxes, and refill as necessary.
2. Check and clean or replace the engine air cleaner as necessary.
3. Lubricate the spiders, thrust collars, and pillow block bearings.

Weekly (30–40 Hours)

1. Replace the blades if necessary.
2. Replace the engine oil and oil filter as necessary.

Monthly (100–125 Hours)

1. Lubricate the pitch adjustment levers.
2. Remove, clean, reinstall and relube the spider arms and thrust collars. Adjust the spider arms.
3. Replace gearbox lubricant after the first 100 hours of operation. Replace every 500–600 hours thereafter.
4. Check the drive belt for excessive wear.

Every 3–6 Months

Lubricate the miter boxes.

Every 6 Months

Lubricate the pitch towers.

Yearly (500–600 Hours)

1. Check the arm bushings, thrust collar bushings, shaft seals, and belts and replace if necessary.
2. Check the pitch control cables for wear.
3. Replace gearbox lubricant after the first 100 hours of operation. Replace every 500–600 hours thereafter.

AIR CLEANER (DAILY)

The Kohler 25-horsepower carbureted and EFI engines are equipped with a replaceable, high-density, paper air cleaner element. Most are also equipped with an oiled foam precleaner which surrounds the paper element.

Check the air cleaner daily or before starting the engine. Check for heavy buildup of dirt and debris, and for loose or damaged components.

NOTICE

Operating the engine with loose or damaged air cleaner components could allow unfiltered air into the engine, causing premature wear and failure.

Precleaner Service

Wash and re-oil the precleaner element (if equipped) every 25 hours of operation. Service the precleaner element more often in extremely dusty or dirty conditions. Refer to Figure 17.

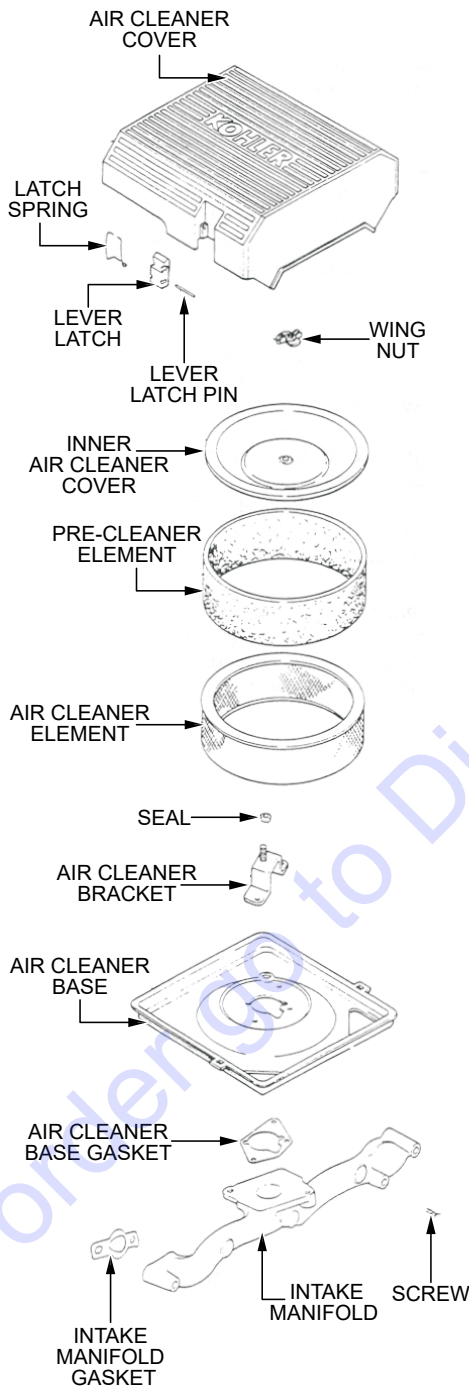


Figure 17. Air Cleaner Components

1. Release the latches located on either side of the air cleaner cover and remove the cover.
2. Remove the foam precleaner from the paper air cleaner element.
3. Wash the precleaner in warm water with detergent. Rinse the precleaner thoroughly until all traces of detergent are eliminated. Squeeze out excess water (but **DO NOT** wring). Allow the precleaner to air dry.
4. Saturate the precleaner with new engine oil. Squeeze out all excess oil.
5. Reinstall the precleaner over the paper air cleaner element.
6. Reinstall the air cleaner cover and secure the latches.

Paper Element Service (Standard Type)

Check the paper element every 100 hours of operation, and more often under extremely dusty or dirty conditions. Replace the element as necessary. Refer to Figure 17.

1. Release the latches located on either side of the air cleaner cover and remove the cover.
2. Remove the wing nut, element cover, seal, and air cleaner element.
3. Remove the precleaner (if equipped) from the paper element.
4. **DO NOT** wash the paper element or use pressurized air to clean it, as this will damage the element. Replace a dirty, bent or damaged element with a new element as prescribed by the engine manufacturer. Handle new elements carefully—**DO NOT** use if the sealing surfaces are bent or damaged.
5. Reinstall the seal, paper element, precleaner, element cover, flat washer, and wing nut.
6. Reinstall the air cleaner cover and secure the latches.

NOTICE

Make sure the correct depth air cleaner element and rubber seal are used for the engine specification involved.

Check Air Cleaner Components

Whenever the air cleaner cover is removed or the paper element or precleaner is serviced, check the following:

- **Air Cleaner Element Cover and Seal** — Make sure the element cover is not bent or damaged. Make sure the wing nut, washer and seal are in place to ensure the element is sealed against leakage.
- **Air Cleaner Base** — Make sure the base is secured tightly to the carburetor and is not cracked or damaged.
- **Breather Tube** — Make sure the tube is installed to both the air cleaner base and the breather cover.

Disassembly and Reassembly (Standard Type)

If the base plate on the standard type must be removed, proceed as follows:

1. Remove the air cleaner components as described previously.
2. Remove the hex flange screws securing the bracket and base.
3. Remove the base and gasket. Carefully pull the rubber breather tube through the base.
4. Remove the tube from the underside of the base if necessary.
5. Reverse the previous steps to reinstall new or service components. Torque screws to 88 in-lb. (9.9 N·m).

Air Intake/Cooling System

To ensure proper cooling, make sure the grass screen, fan cooling fins and other external surfaces of the engine are kept clean at all times.

Every 100 hours of operation (more often under extremely dusty or dirty conditions):

1. Remove the blower housing and other cooling shrouds.
2. Clean the cooling fins and external surfaces as necessary.
3. Make sure the cooling shrouds are reinstalled.

NOTICE

Operating the engine with a blocked grass screen, dirty or plugged cooling fins, and/or cooling shrouds removed, will cause engine damage due to overheating.

CHANGING ENGINE OIL AND FILTERS

1. Change the engine oil after the first 5 hours of use, then every 6 months or 100 hours.
2. Remove the oil filler cap and fill the engine crankcase with the recommended oil type listed in Table 6. Fill to the upper limit of the dipstick.
3. Crankcase oil capacity with oil filter replacement is 2.0 quarts (1.9 liters).

Oil Filter (100 Hours)

1. Replace the engine oil filter (Figure 18) every oil change or 100 hours. Be sure to coat the seal of the new oil filter with clean engine oil.

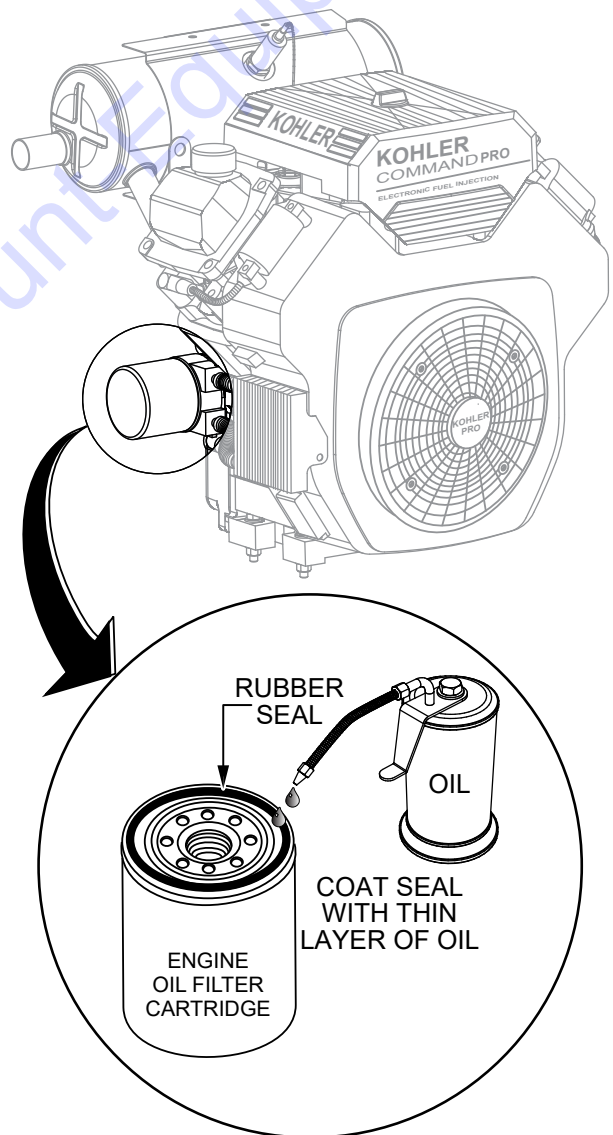


Figure 18. Oil Filter

Fuel Filter (200 Hours)

- Replace the engine fuel filter (Figure 19) every 200 hours.

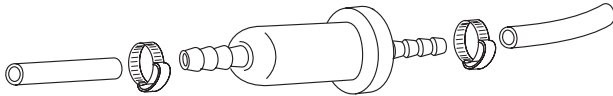


Figure 19. Fuel Filter (Typical)

Oil and Fuel Lines

- Check the oil and fuel lines and connections regularly for leaks or damage. Repair or replace as necessary.
- Replace the oil and fuel lines every two years to maintain performance and flexibility.

LONG-TERM STORAGE

- Remove the battery.
- Drain fuel from the fuel tank, fuel line, and carburetor.
- Remove the spark plug and pour a few drops of motor oil into the cylinder. Crank the engine 3–4 times so that oil reaches all internal parts.
- Clean the exterior with a cloth soaked in clean oil.
- Cover the unit with a plastic sheet and store it in a moisture- and dust-free location out of direct sunlight.

CAUTION

NEVER store the ride-on trowel with fuel in the tank for an extended period of time. **ALWAYS** clean up spilled fuel immediately.

ENGINE TUNE-UP

Refer to the engine owner's manual supplied with the trowel for an engine maintenance schedule, troubleshooting guide, and specific information on tuning up your engine, checking and gapping the spark plugs, etc.

MAINTENANCE (OLD STYLE CLUTCH)

DRIVE MAINTENANCE (OLD STYLE CLUTCH)

This section is intended to aid users in the maintenance of drive assemblies with an old-style Comet clutch.

Checking the Drive Belt

The drive belt needs to be replaced as soon as it starts to show signs of wear. Indications of excessive belt wear are fraying, squealing during use, and emission of smoke or a burning rubber smell during use.

Under normal operating conditions, a drive belt may last approximately 150 hours. If your trowel is not reaching this kind of life span for drive belt wear, check the drive belt for proper pulley alignment and spacing.

To gain access to the drive belt, remove the drive belt guard cover, then visually inspect the drive belt for signs of damage or excessive wear. Replace the drive belt if it is worn or damaged.

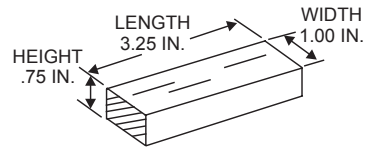


Figure 20. Wood Block for Spacer

1. Remove the drive belt cover (Figure 21).

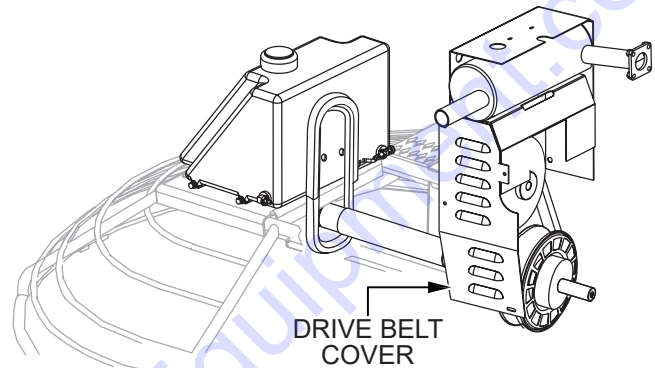


Figure 21. Drive Belt Cover

2. Squeeze the drive belt as shown in Figure 22, and pull the belt upwards. This will spread open the faces of the lower drive pulley.

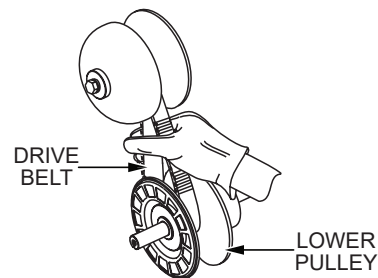


Figure 22. Expanding the Lower Drive Pulley

3. Insert the wood block (Figure 20) between the moveable face and the fixed face of the lower drive pulley. This will help keep the lower drive pulley faces open while installing the new drive belt. See Figure 23.

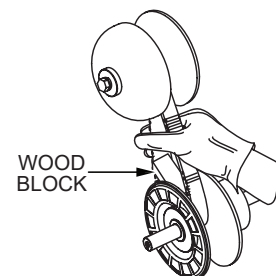


Figure 23. Wood Block

! WARNING



NEVER attempt to insert hands or tools into the belt area while the engine is running and the safety guard has been removed. Keep fingers, hands, hair and clothing away from all moving parts to prevent bodily injury.

! WARNING



DO NOT remove the drive belt guard cover until the muffler has cooled. Allow the entire trowel to cool down before performing this procedure.

Drive Belt Removal

- Leave the existing drive belt intact until instructed to cut it.
- Leave the engine in place for this procedure. It is not necessary to slide the engine to replace the drive belt.
- Have a 3/4" x 1" x 3-1/4" wood block (Figure 20) available.

MAINTENANCE (OLD STYLE CLUTCH)

4. If the belt will not be reused (recommended), cut the drive belt. Make sure all belt remnants are removed from the pulleys.

Spare Drive Belt Installation

The trowel is equipped with a spare (replacement) drive belt carrier, which is mounted on the inboard side of the fuel tank near the clutch. **ALWAYS** make sure there is a spare drive belt in the drive belt carrier before the trowel is placed on a slab to finish concrete.

In the event of a drive belt failure, the spare drive belt can be used for quick replacement at the job site to continue trowel operation. Refer to Figure 24.

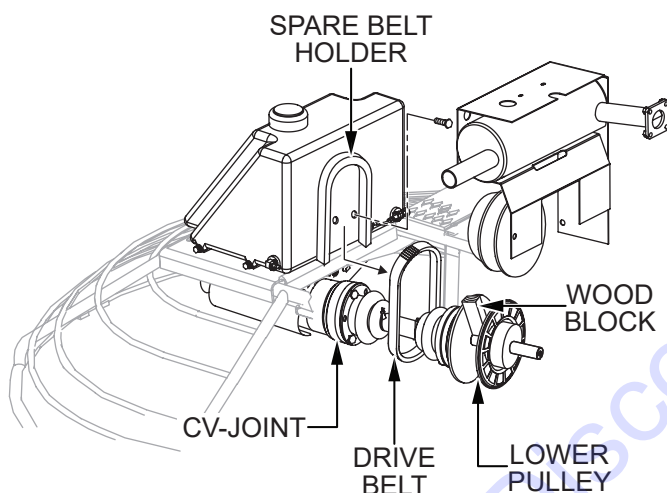


Figure 24. Drive Belt Installation

1. Ensure all remnants of the old belt have been removed from the pulleys.
2. To replace the drive belt with the spare drive belt, remove the two bolts that secure the spare belt holder. This will allow free movement of the belt for installation. Be careful to not contaminate the replacement belt with grease or dirt.
3. With the wood block holding the lower pulley open, place the replacement belt into the lower pulley first. Work the belt over the upper drive pulley into the pulley groove.
4. Squeeze the belt enough to remove the wood block. With the block removed, release the tension on the belt.
5. Reinstall the spare belt holder and drive belt guard.
6. Replace the spare belt before the next trowel use.

Spare Drive Belt Replacement

To replace the spare drive belt, the CV-joint must be disconnected from the left-side gearbox. Refer to Figure 25.

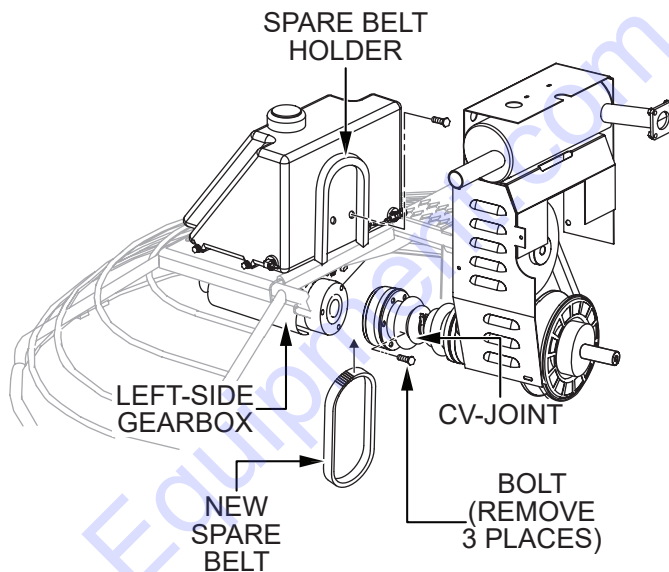


Figure 25. Spare Drive Belt Replacement

1. Place the trowel on suitable supports and observe all safety precautions.
2. Remove the three screws securing the CV-joint to the left-side gearbox coupler.
3. Once the CV-joint has been separated from the left-side gearbox, push the CV-joint inward so that a gap exists between the gearbox and the CV-joint. Slide the spare V-belt between the gearbox coupler and the CV-joint. Avoid contaminating the replacement belt with grease or oil when sliding it between the CV-joint and gearbox coupler.
4. Place the spare drive belt inside the spare belt holder and secure the spare belt holder to the inboard side of the left gearbox.
5. Reinstall the three screws that secure the CV-joint to the left-side gearbox coupler.

MAINTENANCE (OLD STYLE CLUTCH)

Torque Converter

The HTN27-28 trowel is equipped with a torque converter which supplies torque to both the left and right gearboxes.

The function of the torque converter is to automatically deliver the correct amount of torque required by the trowel under all load conditions. This enables the trowel to deliver the necessary torque for float pan applications and the high rotor speeds required for burnishing concrete.

The torque converter is of the variable pitch pulley type, connected by a drive belt (Figure 26).

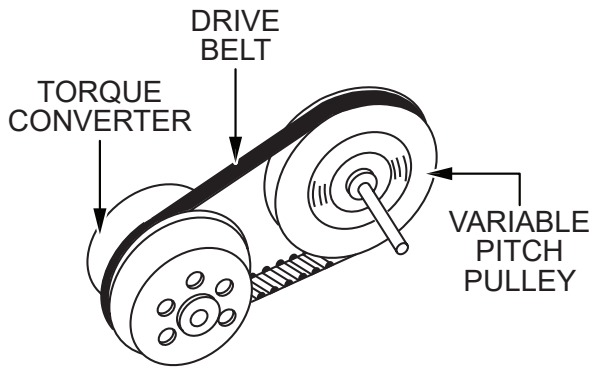


Figure 26. Torque Converter

Drive Pulley

The drive pulley uses centrifugal force to create a belt squeeze force transmitted at the pulley faces (Figure 27). This condition functions as an automatic clutch.

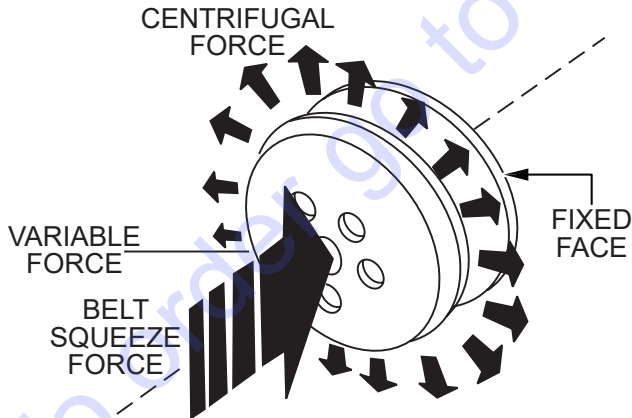


Figure 27. Drive Pulley Centrifugal Force

Centrifugal force pushes the roller arms against the ramp plate, forcing the moveable face toward the fixed face and squeezing the belt (Figure 28).

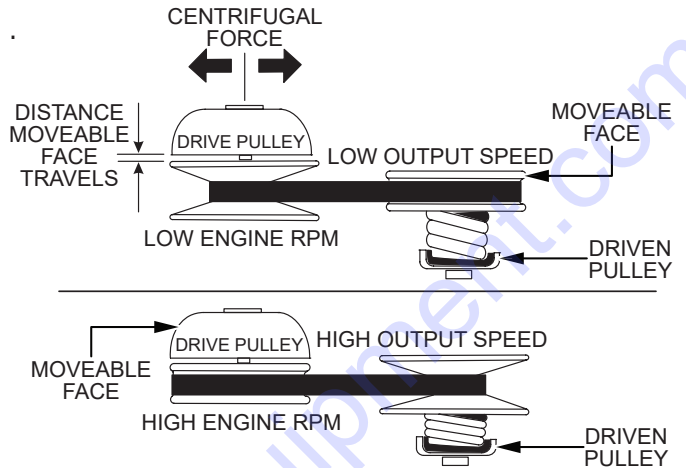


Figure 28. Pulley Interaction

The variable pitch pulleys (Figure 29) have one fixed face, and one moveable face. The drive pulley moveable face is controlled by roller weight arms and springs, which change position according to engine speed. The driven pulley moveable face is controlled by a spring and belt tension.

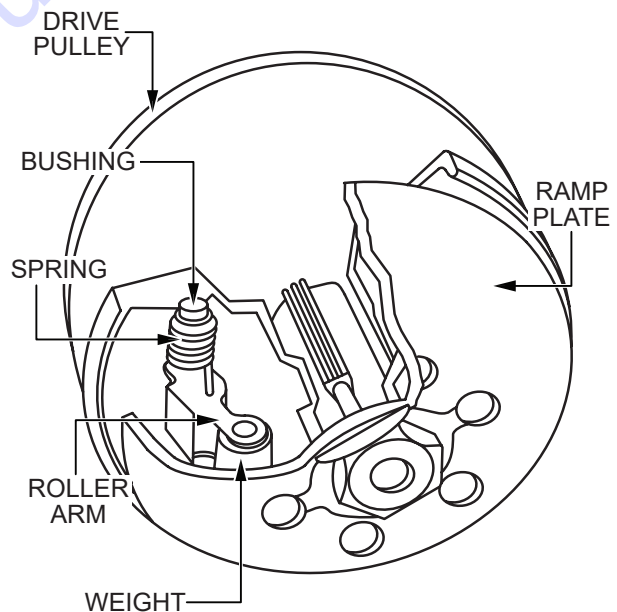


Figure 29. Variable Pitch Pulley

MAINTENANCE (OLD STYLE CLUTCH)

How It Works

Refer to Figure 30.

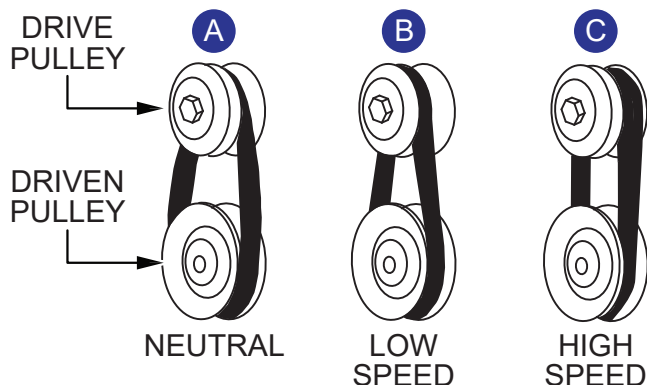


Figure 30. Pulley Conditions

Condition A:

- Engine: Idling
- Drive Pulley: Small
- Belt: Loose and stationary

Condition B:

- Engine: Accelerating
- Drive Pulley: Small but increasing
- Driven Pulley: Large but decreasing
- Belt: Approaching tightness

Condition C:

- Engine: At high speed
- Drive Pulley: Large
- Driven Pulley: Small
- Belt: Tight

Clutch

The clutch system provides a high pulley ratio (analogous to low gear) to start, and a low pulley ratio (analogous to high gear) for high-speed operation, with continuous variation between the two. This makes it unnecessary to use full throttle in order to “break the blades/pans loose.” The trowel can instead be brought up to speed slowly.

The torque-sensitive pulley (Figure 31) utilizes a spring and cam bracket. Peak performance results from proper interaction between the driven pulley spring and the ramp angle of the cam bracket.

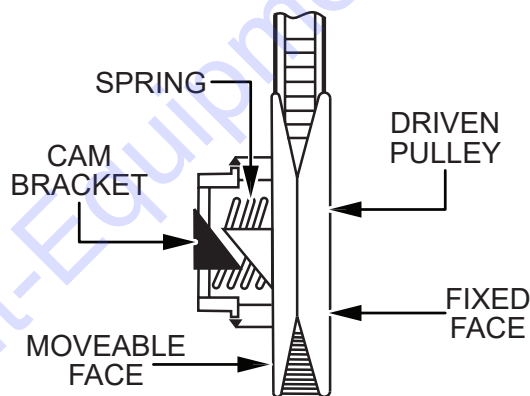


Figure 31. Pulley Spring and Cam Bracket

MAINTENANCE (NEW STYLE CLUTCH)

DRIVE MAINTENANCE (NEW STYLE CLUTCH)

This section is intended to aid users in the maintenance of drive assemblies with a new CVT multi-clutch.

Checking the Drive Belt

The drive belt needs to be replaced as soon as it starts to show signs of wear. **NEVER** use a defective drive belt under any circumstances. Indications of excessive belt wear are fraying, squealing during use, and emission of smoke or a burning rubber smell during use.

Under normal operating conditions, a drive belt may last approximately 150 hours. If your trowel is not reaching this kind of life span for drive belt wear, check the drive belt for proper pulley alignment and spacing.

To gain access to the drive belt, remove the drive belt guard cover (Figure 32), then visually inspect the drive belt for signs of damage or excessive wear. Replace the drive belt if it is worn or damaged.

Drive Belt Guard Removal

1. To gain access to the drive belt, remove the drive belt guard (Figure 32).

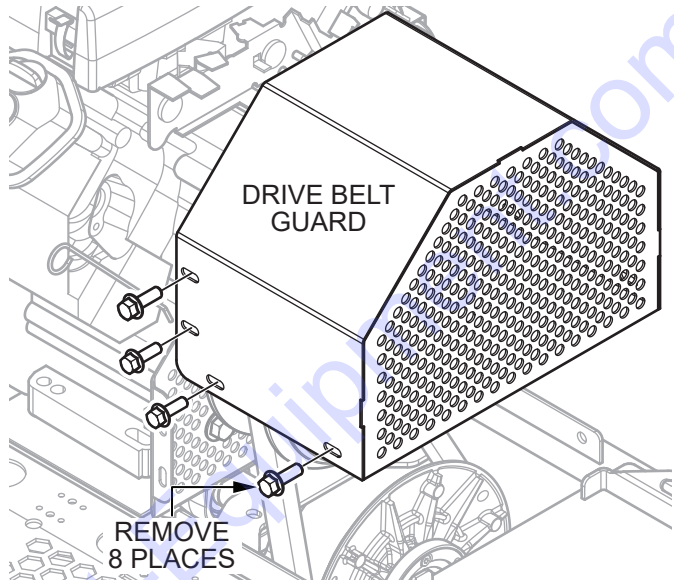


Figure 32. Drive Belt Guard Removal

Spare Drive Belt Installation

The trowel is equipped with a spare (replacement) drive belt holder, which is mounted on the inboard side of the left-side gearbox. **ALWAYS** make sure there is a spare drive belt in the drive belt holder before the trowel is placed on a slab to finish concrete.

In the event of a drive belt failure, the spare drive belt can be used for quick replacement at the job site for continued trowel operation.

WARNING



NEVER attempt to insert hands or tools into the belt area while the engine is running. **NEVER** run the engine with the safety guards removed. Keep fingers, hands, hair and clothing away from all moving parts to prevent bodily injury.

WARNING



DO NOT remove the drive belt guard cover until the muffler has cooled. Allow the entire trowel to cool down before performing this procedure.

MAINTENANCE (NEW STYLE CLUTCH)

1. To replace an existing drive belt with the spare drive belt, remove the two bolts that secure the spare belt holder to the left-side gearbox bracket (Figure 33). Take care to not contaminate the replacement drive belt with grease or dirt.

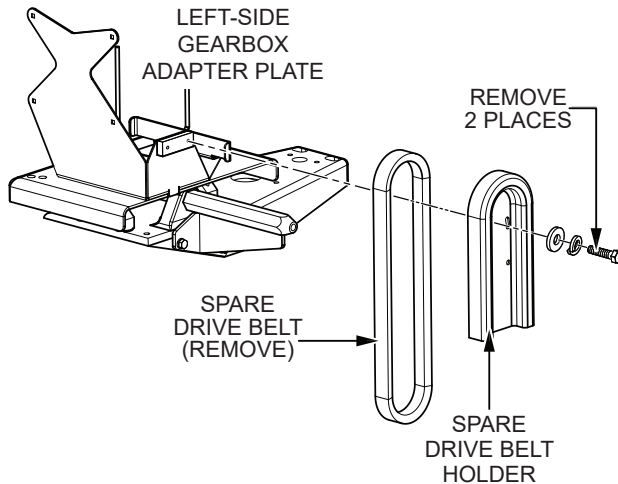


Figure 33. Spare Belt Removal

2. Cut the existing drive belt to remove it from the clutch and lower drive pulley.
3. Ensure all remnants of the old drive belt have been removed from the sheaves/grooves of the clutch and lower pulley.
4. Slide the spare drive belt over the CV-joint (Figure 34) and onto the lower drive pulley.

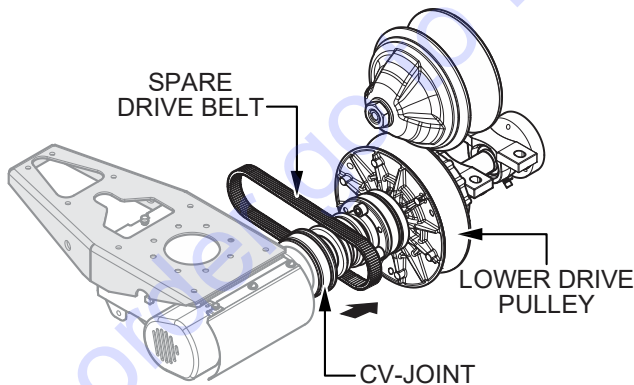


Figure 34. Spare Drive Belt Routing

5. Squeeze the drive belt (Figure 35) and pull upwards and towards the rear of the trowel. This will spread open the faces of the lower drive pulley.

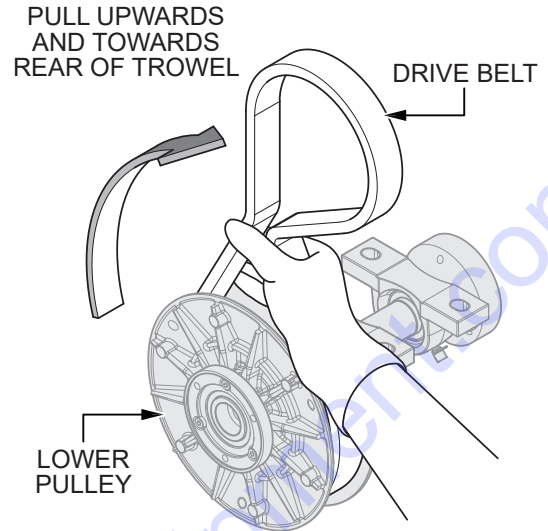


Figure 35. Spare Drive Belt Placement (Lower Pulley)

6. Place the spare drive belt onto the clutch as shown in Figure 36.

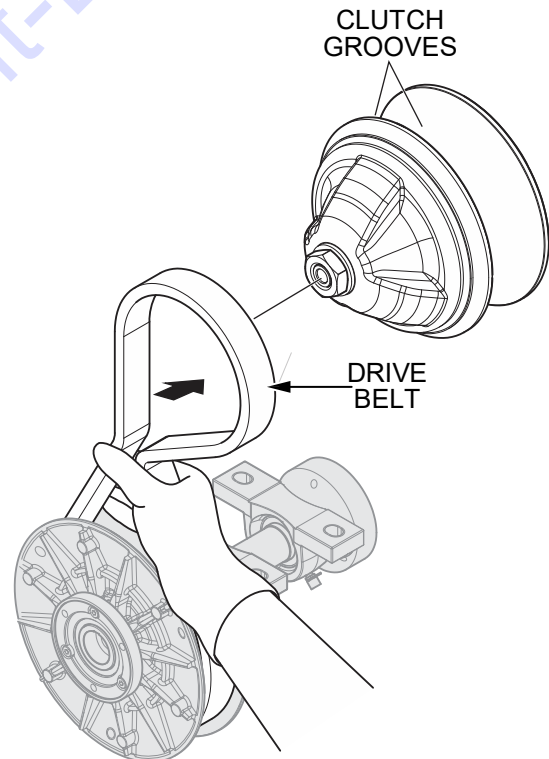


Figure 36. Spare Drive Belt Placement (Clutch)

7. Reinstall the belt guard assembly.

MAINTENANCE (NEW STYLE CLUTCH)

Starting the Trowel/Testing

1. While sitting in the operator's position, start the trowel. Be sure to check the engine oil level prior to starting the engine.

! DANGER

The engine's exhaust contains harmful emissions. **ALWAYS have adequate ventilation when operating.** Direct exhaust away from nearby personnel.

2. Run the machine, bringing the throttle up so that the clutch engages. Cycle the engine from idle to full throttle twice, and shut off the engine. Remove the key.

Spare Drive Belt Replacement

CV-Joint Assembly Removal (Left Side)

1. If necessary, place the trowel on suitable supports (jack stands) and observe all safety precautions.
2. Starting at the left-side gearbox, use a 1/4" Allen wrench and remove the three bolts and lock washers that secure the CV-joint (Figure 37) to the left-side gearbox. Retain the mounting hardware for later use.

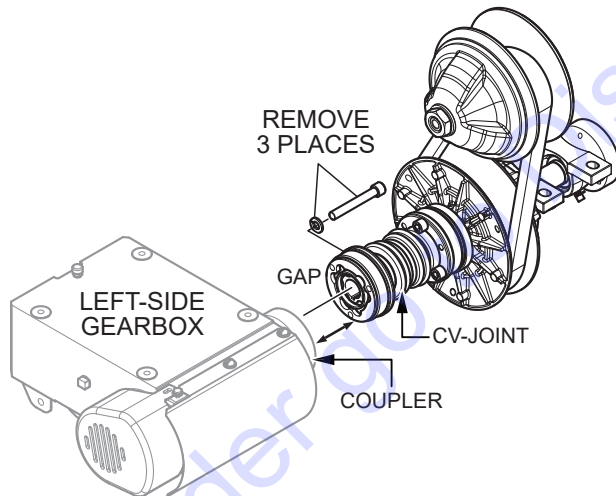


Figure 37. CV-Joint Removal

3. Once the CV-joint has been separated from the left-side gearbox coupler, push the CV-joint inward so that a gap (Figure 37) exists between the gearbox coupler and CV-joint.
4. Slide the new spare drive belt between the gearbox coupler and CV-joint (Figure 38).

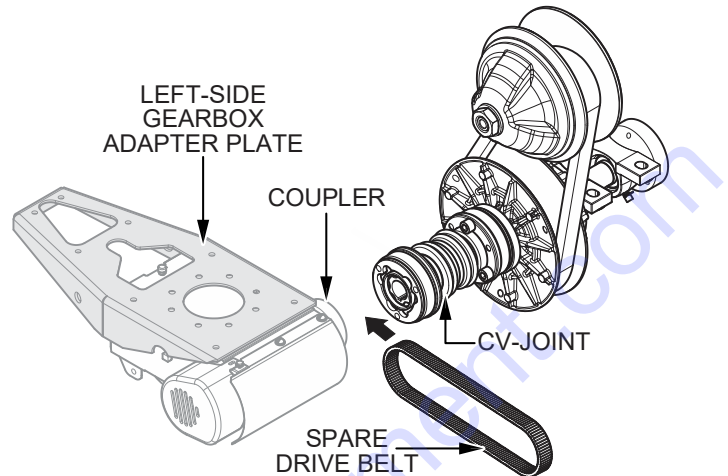


Figure 38. Spare Drive Belt Routing

5. Mount the new spare drive belt and cover (Figure 38) onto the left-side gearbox. Reinstall the two bolts that secure the spare belt holder to the left-side gearbox adapter plate.

CV-Joint Assembly Installation (Left Side)

1. Apply a thin coat of RTV silicone to the mating surfaces of the CV-joint (Figure 39) and left-side gearbox coupler.

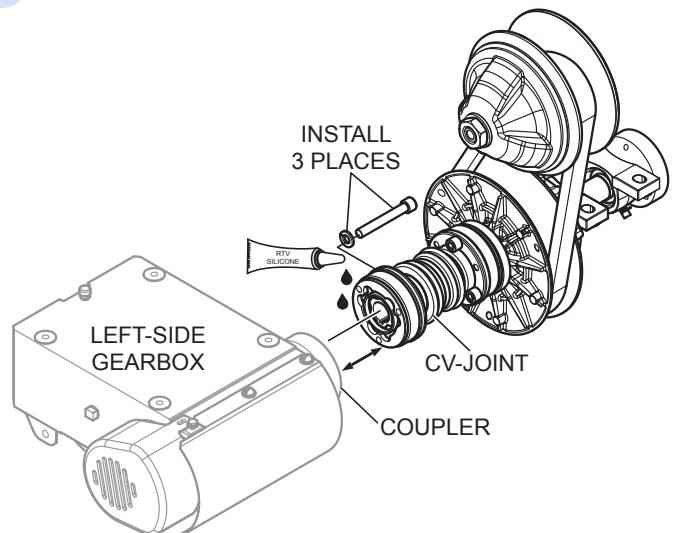


Figure 39. CV-Joint Installation

2. Using a 1/4" Allen wrench, install the three bolts and lock washers that secure the CV-joint (Figure 39) to the left-side gearbox.

MAINTENANCE (NEW STYLE CLUTCH)

How It Works

A *continuously variable transmission* (CVT) system consists of two variable clutches connected together via a V-belt. Each clutch has two tapered sides (sheaves) that keep the belt centered. One sheave is fixed to the shaft and does not move while the other one moves in and out, forcing the belt to a higher or lower position on the clutch sheaves.

As engine speed increases, the primary clutch (drive clutch) closes, forcing the belt to ride outwards on the drive sheaves. The closing of the drive clutch also forces the belt to open the driven or secondary sheaves. The opening and closing of these sheaves creates a ratio variation, hence *continuously variable transmission* or CVT.

Primary Clutch (Drive Clutch)

The primary clutch, more commonly known as the **drive clutch**, is mounted to the output shaft of the engine. This clutch responds to two different forces, centrifugal force from the engine spinning the clutch, as well as resistance that the belt transfers from the secondary clutch.

Secondary Clutch (Driven Clutch)

The secondary clutch, more commonly known as the *driven clutch*, is mounted to the input shaft of the transmission and is connected to the primary clutch via a V-belt.

This clutch responds to two different forces, the force that the belt puts on it from the drive clutch, and the force that the shaft puts on it from the transmission.

The driven clutch is much larger in diameter than the drive clutch and the belt wraps around the outside of the two sheaves—one fixed, and the other moveable.

When the drive clutch begins to shift, it forces the belt higher on the drive clutch. This causes the belt to get tighter and tries to pull the belt into the driven clutch, forcing the two sheaves apart and causing the clutch to shift.

TROWEL LUBRICATION

Regular lubrication is required to maintain your trowel in optimal working condition. Schedule maintenance lubrication according to Table 8 below.

Location	# of Shots	Interval
Spiders	1 to 1½	Every day
Thrust Collars	1	Every day
Pillow Blocks	1	Every day
Pitch Levers	1	Once a month
Miter Boxes	1	Every 3 to 6 months
Pitch Towers	1	Every 6 months

Spiders (Daily)

Perform the following lubrication procedure after **every 8 hours of use**.

1. Locate one of the Zerk grease fittings on either spider assembly (Figure 40). Remove the Zerk fitting cap and set it aside.

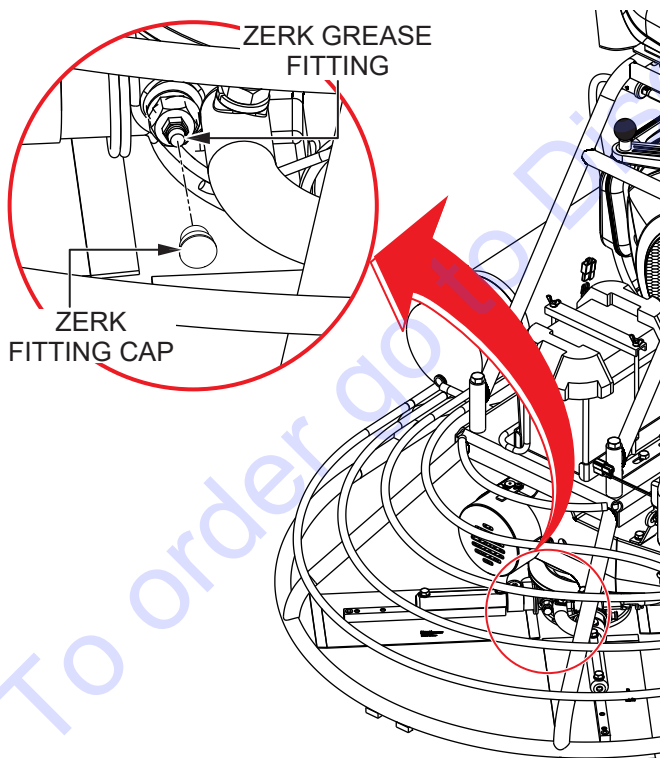


Figure 40. Spider Lubrication

2. Wipe the Zerk grease fitting clean to prevent abrasive material from entering the fitting during lubrication.

3. Lubricate the Zerk grease fitting with 1–1½ shots of multipurpose grade grease. Replace the Zerk grease fitting cap when finished.
4. Repeat steps 1–3 for the remaining grease fittings on both spider assemblies.

Thrust Collars (Daily)

Perform the following lubrication procedure after **every 8 hours of use**.

1. Locate the Zerk grease fitting on either thrust collar (Figure 41). Remove the Zerk grease fitting cap and set it aside.

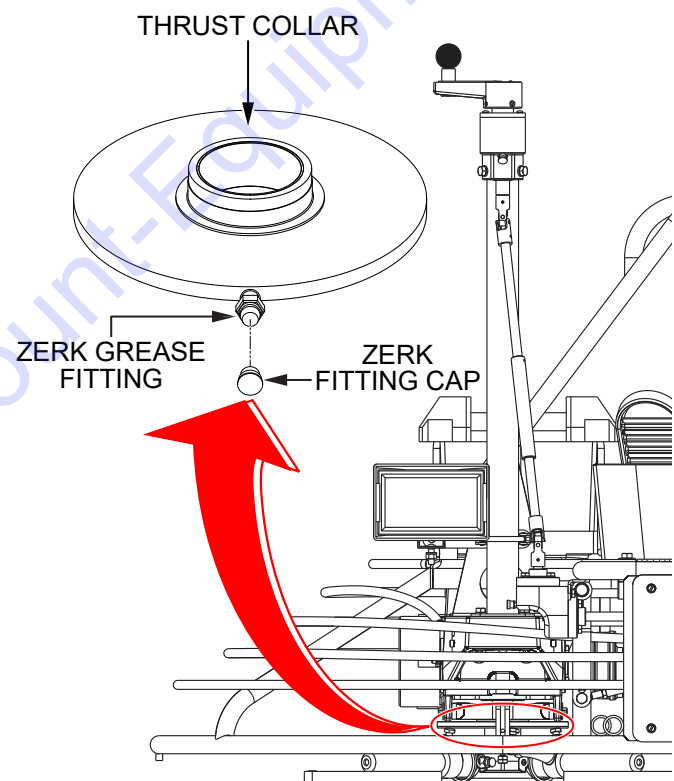


Figure 41. Thrust Collar Lubrication

2. Wipe the Zerk grease fitting clean to prevent abrasive material from entering the fitting during lubrication.
3. Lubricate the Zerk grease fitting with one shot of multipurpose grade grease. Replace the Zerk grease fitting cap when finished.
4. Repeat steps 1–3 for the grease fitting on the remaining thrust collar.

Pillow Block Bearings (Daily)

Perform the following lubrication procedure after **every 8 hours of use**.

1. Locate the grease port plate (Figure 42) at the rear of the trowel, just behind the fuel tank. These two Zerk grease fittings lubricate the pillow block bearings.

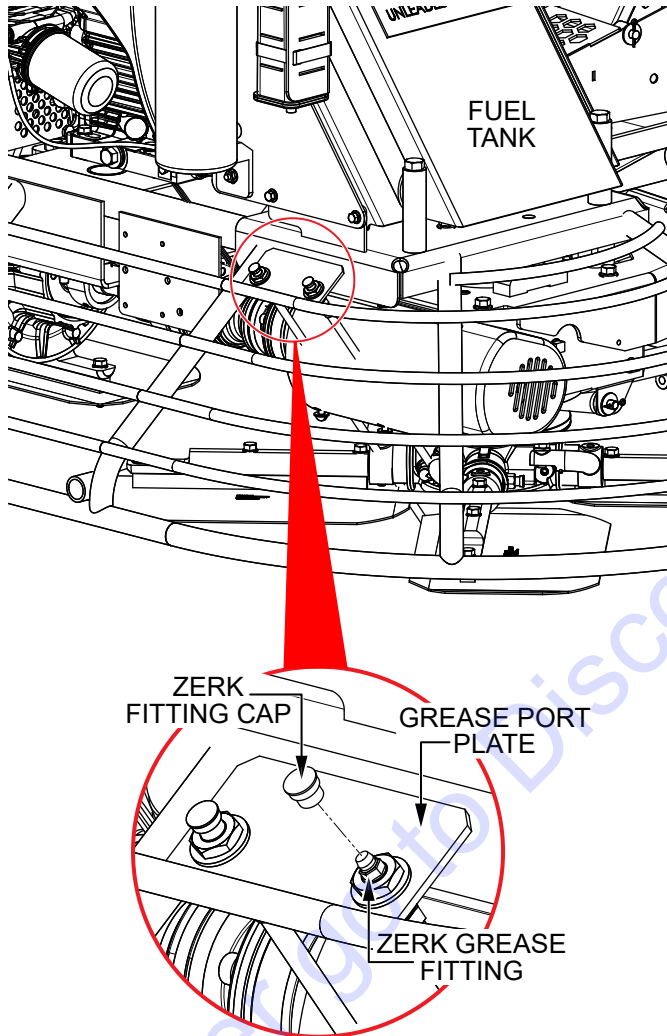


Figure 42. Pillow Block Bearing Lubrication

2. Remove the Zerk grease fitting caps and set them aside.
3. Wipe the Zerk grease fittings clean to prevent abrasive material from entering the fittings during lubrication.
4. Lubricate each Zerk grease fitting with one shot of multipurpose grade grease. Replace the Zerk grease fitting caps when finished.

Pitch Adjustment Levers (Monthly)

Perform the following lubrication procedure **once a month**.

1. Locate the Zerk grease fitting next to the knob on either pitch adjustment lever (Figure 43). Remove the Zerk grease fitting cap and set it aside.

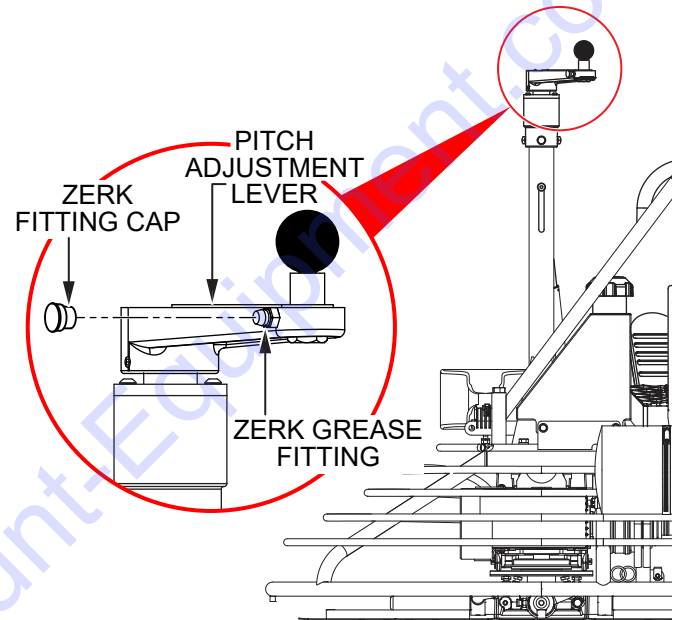


Figure 43. Pitch Adjustment Lever Lubrication

2. Wipe the Zerk grease fitting clean to prevent abrasive material from entering the fitting during lubrication.
3. Lubricate the Zerk grease fitting with one shot of multipurpose grade grease. Replace the Zerk grease fitting cap when finished.
4. Repeat steps 1–3 for the grease fitting on the remaining pitch adjustment lever.

Miter Box (Every 3 to 6 Months)

Perform the following lubrication procedure **once every 3 to 6 months**.

1. Locate the Zerk grease fitting on either miter box (Figure 44). Remove the Zerk grease fitting cap and set it aside.

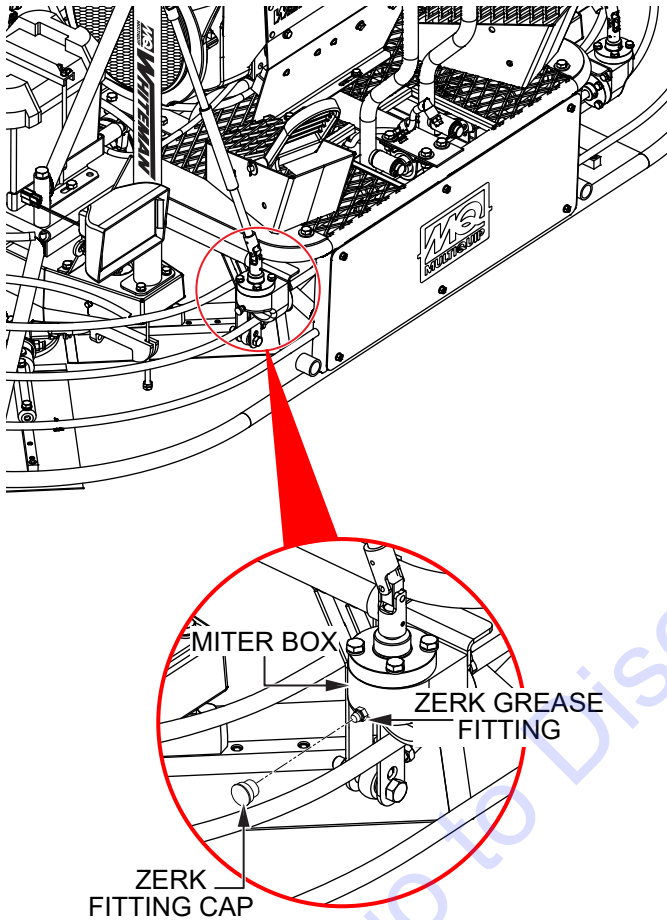


Figure 44. Miter Box Lubrication

2. Wipe the Zerk grease fitting clean to prevent abrasive material from entering the fitting during lubrication.
3. Lubricate the Zerk grease fitting with one shot of multipurpose grade grease. Replace the Zerk grease fitting cap when finished.
4. Repeat steps 1–3 for the grease fitting on the remaining miter box.

Pitch Tower (Every 6 Months)

Perform the following lubrication procedure **once every 6 months**.

1. Locate the Zerk grease fitting just below the pitch adjustment lever on either pitch tower (Figure 45). Remove the Zerk grease fitting cap and set it aside.

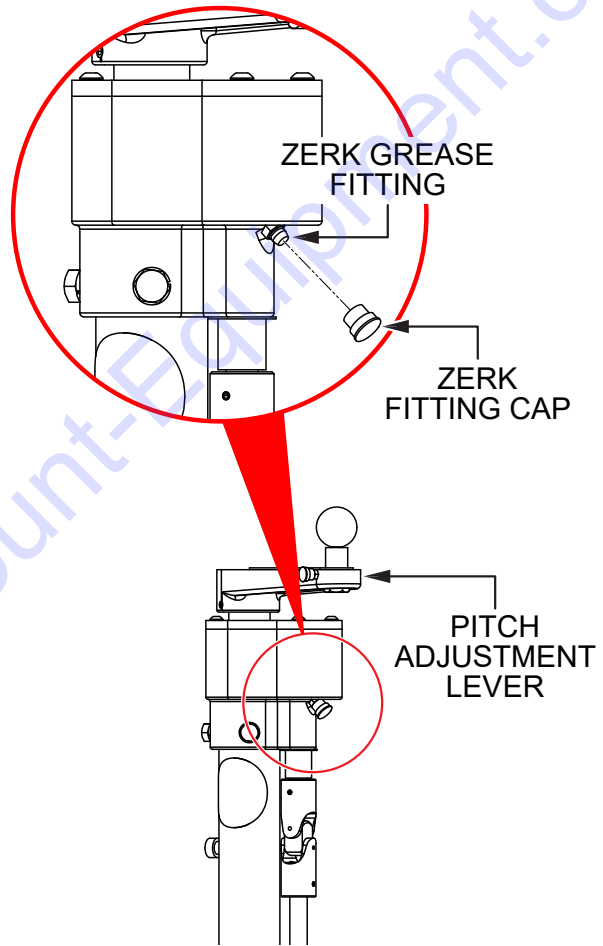


Figure 45. Pitch Tower Lubrication

2. Wipe the Zerk grease fitting clean to prevent abrasive material from entering the fitting during lubrication.
3. Lubricate the Zerk grease fitting with one shot of multipurpose grade grease. Replace the Zerk grease fitting cap when finished.
4. Repeat steps 1–3 for the grease fitting on the remaining pitch tower.

BLADE PITCH

Matching Blade Pitch for Both Sets of Blades

Sometimes it may be necessary to match blade pitch between the two sets of blades. There are some signs that this may be necessary. For example, the differences in pitch could cause a noticeable difference in finish quality between the two sets of blades. Or, the difference in blade pitch could make the machine difficult to control. This is due to the surface area in contact with the concrete—the blade set with the greater contact area tends to stick to the concrete more.

Single Pitch

On a single-pitch trowel, each spider assembly can be pitched individually, forcing the operator to constantly make adjustments on each pitch tower.

Twin Pitch™

Trowels equipped with Twin Pitch™ controls may have blade pitch synchronized between the two sets of blades. If the blades need to be synchronized, perform the following procedure. Refer to Figure 46.

1. Lift the pitch adjustment handle on either side. Once lifted, that side is now disconnected from the Twin Pitch™ system.
2. Adjust to match the opposite side.
3. When adjusted, lower the handle to the Twin Pitch™ operating position.

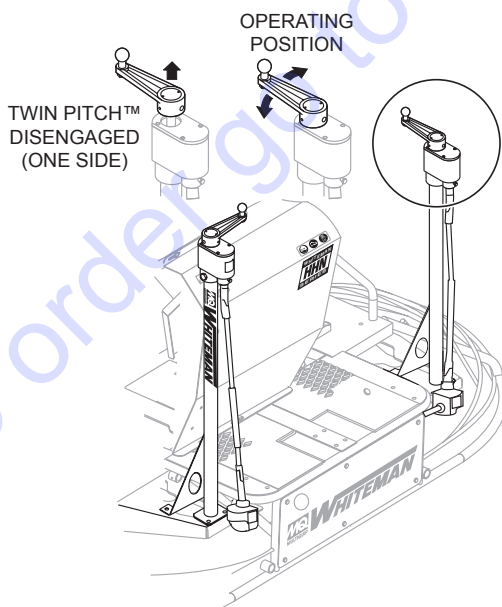


Figure 46. Pitch Towers

TROWEL ARM ADJUSTMENT

Use the following procedure to check and adjust trowel arms when it becomes apparent that the trowel is finishing poorly or in need of routine maintenance.

Look for the following indications. Trowel arm alignment, worn spider bushings, or bent trowel arms may be the cause.

- Are the blades wearing unevenly? Is one blade completely worn out while the others look new?
- Does the machine have a perceptible rolling or bouncing motion when in use?
- Look at the machine while it is running. Do the guard rings rock up and down?

1. Place the trowel in a flat, level area.

NOTICE

A clean, level area to test the trowel is essential. Any unlevel spots in the floor or debris under the trowel blades will give an incorrect perception of adjustment. Ideally, a 5 × 5 ft. (1.5 × 1.5 meter), 3/4-inch (19 mm) thick, flat steel plate should be used for testing.

2. Pitch the blades as flat as possible. The adjustment bolts should all barely make contact with the lower wear plate on the spider. If one is not making contact, adjustment will be necessary (Figure 47).

Figure 47 illustrates incorrect alignment, worn spider bushings, or bent trowel arms. Check that the adjustment bolt is barely touching (0.10" max. clearance) the lower wear plate. All alignment bolts should be spaced the same distance from the lower wear plate.

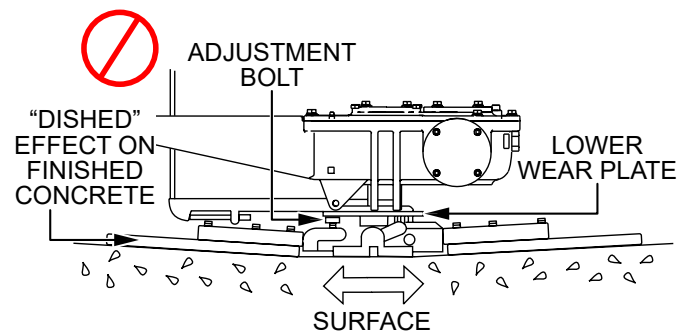


Figure 47. Incorrect Spider Plate Alignment

Figure 48 illustrates the correct alignment for a spider plate as shipped from the factory.

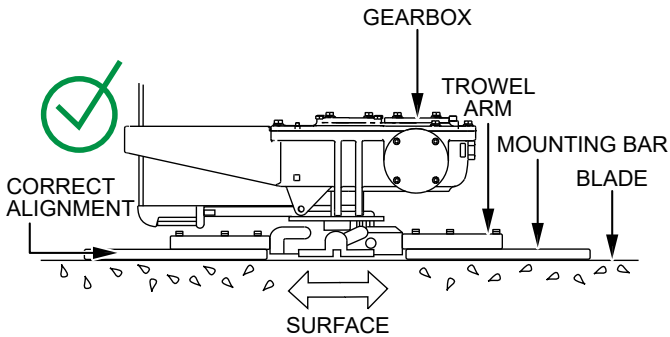


Figure 48. Correct Spider Plate Alignment

Stabilizer Ring Removal

1. If the trowel is equipped with an outer stabilizer ring (Figure 49), remove the four bolts at the end of each trowel arm.

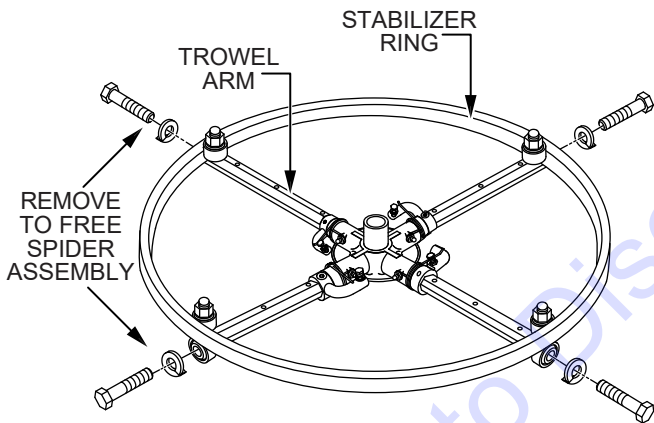


Figure 49. Stabilizer Ring

2. Examine the stabilizer ring for bends or out-of-round condition. Replace the ring if it is damaged. If there is no damage to the ring, set it aside for later use.

Trowel Blade Removal

1. Remove the trowel blades from the trowel arm by removing the three hex head bolts (Figure 50) from the trowel arm. Set the blades aside.

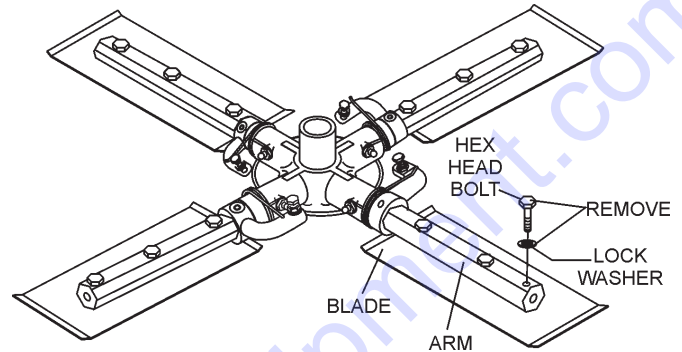


Figure 50. Trowel Blade Removal

2. Wire brush any build-up of concrete from all six sides of the trowel arm. Repeat this for the three remaining arms.

Trowel Arm Removal

1. Each trowel arm is held in place at the spider plate by a Zerk grease fitting (hex head bolt). Remove the Zerk grease fitting from the spider plate (Figure 51).

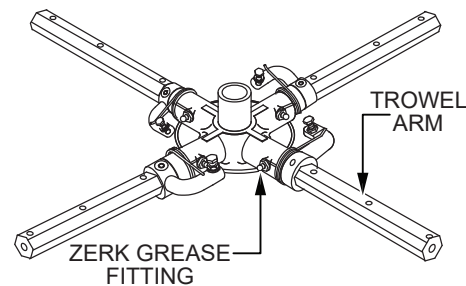


Figure 51. Trowel Arm Removal

2. Remove the trowel arm from the spider plate (Figure 51).

- Should the trowel arm insert (bronze bushing) come out with the trowel arm, remove the bushing from the trowel arm and set it aside in a safe place. If the bushing is retained inside the spider plate (Figure 52), carefully remove the bushing.

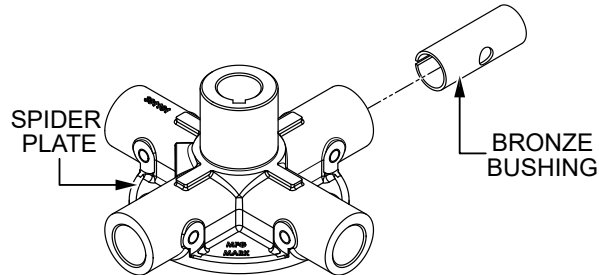


Figure 52. Bronze Bushing

- Examine the bronze trowel arm bushing (Figure 52) and clean it if necessary. Replace the bushing if it is out-of-round or worn.

Checking Trowel Arm Straightness

Trowel arms can be damaged by rough handling (such as dropping the trowel on the pad) or by striking exposed plumbing, forms or rebar while in operation. A bent trowel arm will prevent smooth, fluid rotation of the blades. If bent trowel arms are suspected, check for straightness as follows:

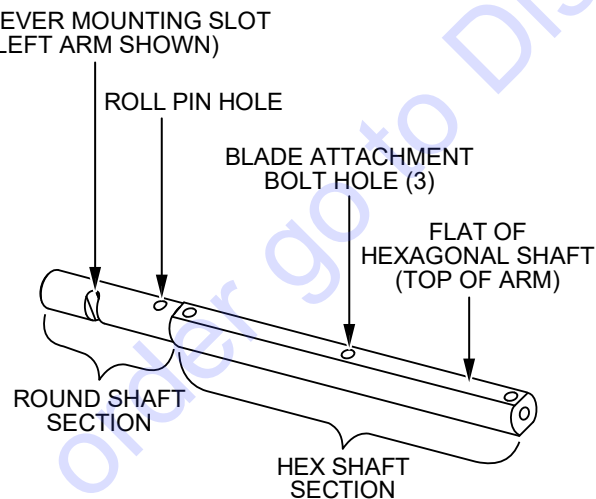


Figure 53. Trowel Arm

- Use a thick steel plate, granite slab, or any surface which is true and flat (Figure 54) to check all six sides of each trowel arm for straightness.

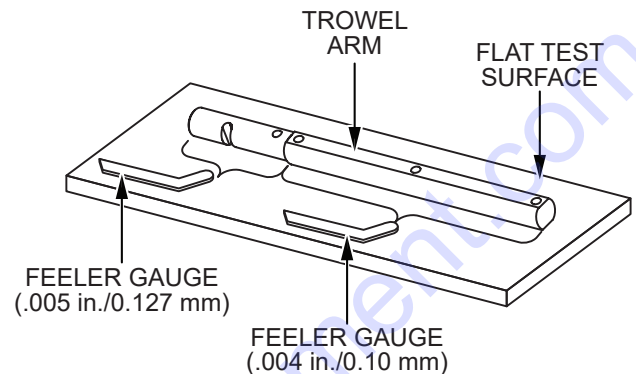


Figure 54. Checking Trowel Arm Straightness

- Check each of the six sides of the trowel arm hex section. A feeler gauge of .004 inch (0.10 mm) should not pass between the flat of the trowel arm and the test surface along its length on the test surface. See Figure 54.
- Check the clearance between the round shaft and the test surface, as one of the flat hex sections of the arm rests on the test surface (Figure 54). Rotate the arm to each of the flat hex sections and check the clearance of the round shaft. Use a feeler gauge of .005 inch (.127 mm). Each section should have the same clearance between the round of the trowel arm shaft and the test surface.
- Replace the trowel arm if it is bent or uneven.

Trowel Arm Adjustment

Figure 55 illustrates the trowel arm adjustment tool (P/N 9177) with a trowel arm inserted. As each trowel arm is locked into the tool, the arm bolt is adjusted until it contacts a stop on the fixture. This will consistently adjust all of the trowel arms, keeping the finisher as flat and evenly pitched as possible.

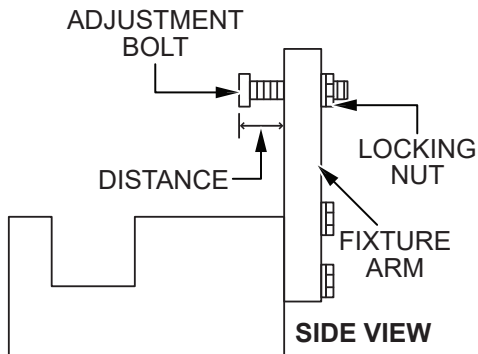


Figure 55. Trowel Arm Adjustment Tool Side View

1. Place the fixture arm in the **UP** position (Figure 56A) for a trowel arm with **clockwise** blade rotation. Place the fixture arm in the **DOWN** position (Figure 56B) for a trowel arm with **counterclockwise** blade rotation.

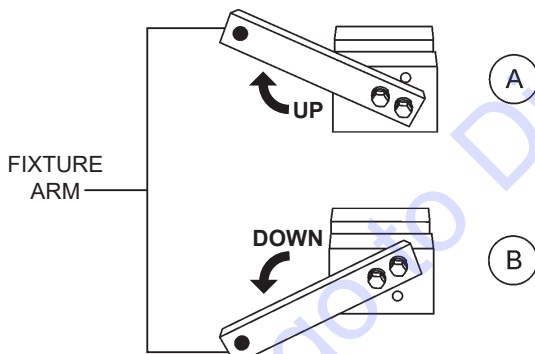


Figure 56. Fixture Arm Positioning

2. Unscrew the locking bolts on the adjustment tool and place the trowel arm into the fixture channel as shown in Figure 57. A thin shim may be required to cover the blade holes on the trowel arm. Make sure to align the trowel adjustment bolt with the fixture adjustment bolt.

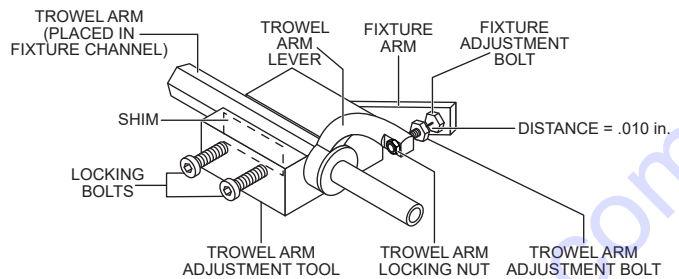


Figure 57. Trowel Arm Adjustment

3. Use an Allen wrench to tighten the locking bolts securing the trowel arm in place.
4. Adjust the bolt distance shown in Figure 57 to match one of the arms. The other arms will be adjusted to match this distance.
5. Loosen the locking nut on the trowel arm lever, then turn the trowel arm adjusting bolt until it barely touches (.010") the fixture adjusting bolt.
6. Once the correct adjustment is made, tighten the lock nut on the trowel arm to lock it in place.
7. Loosen the locking nuts on the adjustment fixture, and remove the trowel arm.
8. Repeat for the remaining trowel arms.

REASSEMBLY

1. Clean and examine the upper and lower wear plates and thrust collar. Examine the entire spider assembly. Wire brush any concrete or rust buildup. If any of the spider components are damaged or out-of-round, replace them.
2. Make sure the bronze trowel arm bushing is not damaged or out-of-round. Clean the bushing if necessary. If the bronze bushing is damaged or worn, replace it.
3. Reinstall the bronze bushing onto the trowel arm.
4. Repeat steps 2 and 3 for each trowel arm.
5. Make sure that the spring tensioner is in the correct position to exert tension on the trowel arm.
6. Insert all trowel arms with levers into the spider plate (with bronze bushings already installed), using care to align the grease holes on the bronze bushings with the grease hole fittings on the spider plate.


7. Lock the trowel arms in place by tightening the Zerk grease fitting hex head bolts and jam nuts.
 8. Reinstall the blades onto the trowel arms.
 9. Reinstall the stabilizer ring onto the spider assembly.
 10. Lubricate all grease points (Zerk fittings) with premium Lithium 12-based grease, conforming to NLG1 Grade #2 consistency.
3. Attach the blade tie-downs to the far side of the Z-clip brackets using the tie-down knobs.
 4. Make sure the blade edges are secured under the Z-clips and the tie-downs are secured completely over the edges of the blade bar before operating the trowel.

FLOAT PAN INSTALLATION

Float pans attach to the trowel blades and allow early floating on wet concrete and easy movement from wet to dry areas. They are also very effective at embedding large aggregates and surface hardeners.

Refer to Figure 58 when installing pans onto finisher blades.

WARNING

 **NEVER** lift the trowel with pans attached.

ALWAYS install pans either in the work area or in an area that is next to and level with the work area.

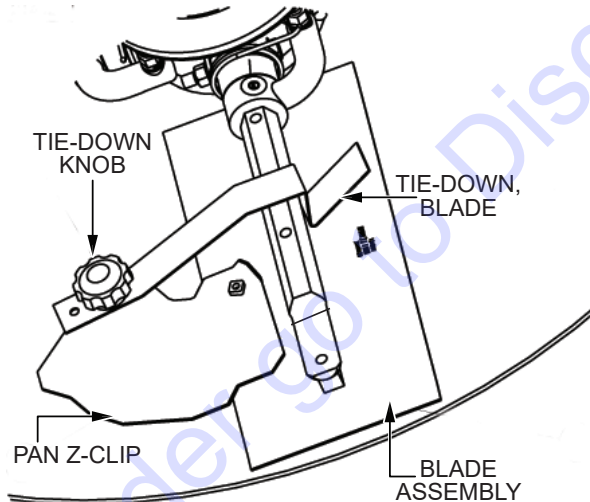


Figure 58. Float Pan Installation

1. Lift the trowel just enough to slide the pan under the blades. Lower the finisher onto the pan with the blades adjacent to the Z-clips.
2. Rotate the blades into position under the Z-clips. Make sure the blades are rotated in the same direction of travel as when the machine is in operation, or use the engine to rotate the blades into position.

DECOMMISSIONING

Decommissioning is a controlled process used to safely retire a piece of equipment that is no longer serviceable. If the equipment poses an unacceptable and unrepairable safety risk due to wear or damage, or is no longer cost effective to maintain (beyond life-cycle reliability) and is to be decommissioned (demolition and dismantlement), the following procedure must be performed.

1. Drain all fluids completely, including oil, gasoline, hydraulic oil, and antifreeze. Dispose of fluids properly in accordance with local and governmental regulations. **NEVER** pour fluids onto the ground or down drains or sewers.
2. Remove the battery and bring it to an appropriate facility for lead reclamation. Use safety precautions when handling batteries that contain sulfuric acid.
3. The remainder of the trowel should be brought to a salvage yard or metal reclamation facility for further dismantling.

TROUBLESHOOTING (TROWEL)

Troubleshooting (Ride-On Mechanical Trowel)		
Symptom	Possible Problem	Solution
Engine running rough or not at all.	Stop switch malfunction?	Make sure that the stop switch is functioning when the operator is seated. Replace switch if necessary.
	Fuel?	Look at the fuel system. Make sure there is fuel being supplied to the engine. Check to ensure that the fuel filter is not clogged.
	Ignition?	Check to ensure that the ignition switch has power and is functioning correctly.
Safety stop switch not functioning.	Bad contacts?	Replace switch.
	Loose wire connections?	Check wiring. Replace as necessary.
	Other problems?	Consult Discount-equipment.
Trowel bounces, rolls concrete, or makes uneven swirls in concrete.	Blades?	Make sure blades are in good condition, not excessively worn. Finish blades should measure no less than 2 inches (50mm) from the blade bar to the trailing edge, combo blades should measure no less than 3.5 inches (89mm). Trailing edge of blade should be straight and parallel to the blade bar.
	Pitch Adjustment?	Check that all blades are set at the same pitch angle as measured at the spider. A field adjustment tool is available for height adjustment of the trowel arms (contact Discount-equipment).
	Bent trowel arms?	Check the spider assembly for bent trowel arms. If one of the arms is even slightly bent, replace it immediately.
	Trowel arm bushings?	Check the trowel arm bushings for tightness. This can be done by moving the trowel arms up and down. If there is more than 1/8 inch (3.2 mm) of travel at the tip of the arm, the bushings should be replaced. All bushings should be replaced at the same time.
	Thrust collar?	Check the flatness of the thrust collar by rotating it on the spider. If it varies by more than 0.02 inch (0.5 mm) replace the thrust collar.
	Thrust collar bushing?	Check the thrust collar by rocking it on the spider. If it can tilt more than 1/16 inch (1.6 mm) - as measured at the thrust collar O.D., replace the bushing in the thrust collar.
	Thrust bearing worn?	Check the thrust bearing to see that it is spinning freely. Replace if necessary.
Machine has a perceptible rolling motion while running.	Main shaft?	The main output shaft of the gearbox assembly should be checked for straightness. The main shaft must run straight and cannot be more than 0.003 inch (0.08 mm) out of round at the spider attachment point.
	Yoke?	Check to make sure that both fingers of the yoke press evenly on the wear cap. Replace yoke as necessary.
	Blade Pitch?	Check to ensure that each blade is adjusted to have the same pitch as all other blades. Adjust per maintenance section in manual.

TROUBLESHOOTING (TROWEL)

Troubleshooting (Ride-On Mechanical Trowel) - continued		
Symptom	Possible Problem	Solution
Lights (optional) not working.	Wiring?	Check all electrical connections in the lighting circuit. Verify wiring is in good condition with no shorts. Replace defective wiring or components immediately.
	Lights?	If +12VDC is present at light fixture connector when light switch is activated and light does not turn on, replace light bulb.
	Bad switch?	Check the continuity of light switch. Replace light switch if defective.
	Bad fuse?	Check fuse. Replace fuse if defective.
Retardant spray (optional) not working.	Retardant?	Check retardant level in tank. Fill tank as required.
	Wiring?	Check all electrical connections in the spray pump circuit. Verify wiring is in good condition with no shorts. Replace defective wiring or components immediately.
	Bad switch?	Check the continuity of both left and right spray switches (palm handles). Replace spray switch if defective..
	Bad spray pump?	If +12VDC is present at pump connector when spray switch is activated and pump does not operate, replace spray pump.
Steering is unresponsive.	Bad fuse?	Check fuse. Replace fuse if defective.
	Blade speed out of adjustment?	See section on blade speed adjustment.
	Steering linkage out of adjustment?	Adjust the connecting linkage found at the base of the handle. Contact Discount-equipment for instructions.
Operating position is uncomfortable.	Worn components?	Check for wear of steering bearings and linkage components. Replace if necessary.
	Seat adjusted for operator?	Adjust seat with lever located on the front of the seat.
Power head on Electric Pitch (optional) not working.	Broken or loose parts?	If the motor runs and the pitch is not affected, parts inside the power head may be loose or broken. Return power head to dealer for service.
	Wiring?	Check all electrical connections and wiring. Check the continuity at the power head unit. Verify that there is voltage present at the power head switch with the key switch in the "on" position.
	Switch?	Check the continuity of the switch. If switch is malfunctioning, replace immediately.
Linkage on Twin Pitch not working.	Crank handles?	Make sure that both crank handles are pushed down as far as possible to ensure that the linkage is engaged.
	Broken part?	Replace all broken parts immediately.
Clutch slipping or sluggish response to engine speed change.	Worn belts?	Replace belt.
	Clutch out of adjustment?	Adjust per instructions in maintenance section of this manual.
	Worn or defective clutch parts?	Replace parts as necessary.
	Worn bearings in gearbox?	Rotate input shaft by hand. If shaft rotates with difficulty, check the input and output shaft bearings. Replace as necessary.
	Worn or broken gears in gearbox?	Verify that the gearbox shaft rotates when the input shaft is rotated. Replace both the worm and worm gear as a set.

TROUBLESHOOTING (ENGINE)

Engine Troubleshooting		
Symptom	Possible Problem	Solution
Engine cranks but will not start.	Fuel tank is empty.	Fill fuel tank.
	Shut-off valve is closed.	Open fuel shut-off valve.
	Fuel line has suction leak or is restricted. Fuel filter, or fuel tank cap vent is obstructed.	Check fuel line condition and fuel line clamps. Ensure that fuel line is not kinked. Check fuel filter for restriction and replace if necessary. Check fuel cap vent and clean or replace as necessary.
	Fuel supply is contaminated.	Drain and clean fuel tank, clean tank and refill with fuel.
	If carbureted, carburetor is underchoked or overchoked.	Apply recommended amount of choke for cold and warm weather.
	Spark plug is fouled, improperly gapped, or damaged. Spark plug leads disconnected.	Check spark plug for fouling, check gap, and inspect for damage. Clean or replace spark plug as necessary. Reattach spark plug leads if disconnected.
	Safety stop switch malfunction.	Ensure that the Safety Stop Switch is functioning when the operator is seated. Replace switch if necessary.
Engine starts but will not continue running.	Fuel tank is empty.	Fill fuel tank.
	Shut-off valve is closed.	Open fuel shut-off valve.
	Fuel line has suction leak or is restricted. Fuel filter is obstructed, or fuel tank cap vent is blocked.	Check fuel line condition and fuel line clamps. Ensure that fuel line is not kinked. Check fuel filter for restriction and replace if necessary. Check fuel cap vent and clean or replace as necessary.
	If engine is carbureted, carburetor is underchoked or overchoked.	Apply recommended amount of choke for cold and warm weather.
	Faulty ignition switch or starter.	Replace defective switch or starter.
	Engine is seized.	Repair or replace engine.

TROUBLESHOOTING (ENGINE)

Engine Troubleshooting (Continued)		
Symptom	Possible Problem	Solution
Engine lacks power.	Air cleaner is obstructed.	Replace air cleaner.
	Altitude causes 3% loss of horsepower per 1000 feet of altitude.	If available, install high altitude jets in carburetor.
	Choke is partially closed.	Open choke.
	Faulty spark plugs or spark plug leads. Spark plug lead disconnected.	Replace spark plugs or spark plug leads if faulty. Reattach spark plug leads if disconnected.
	Fuel is contaminated.	Drain and clean fuel tank. Refill with clean fuel.
	There is a lack of lubrication.	Check engine oil.
	Engine is overheated	Allow engine to cool. Find and repair cause of overheating.
	Exhaust is restricted.	Remove or repair restriction.
	Ignition timing incorrect.	Set engine ignition timing to manufacturer's specification.
Engine overheats.	Ignition timing incorrect.	Set engine ignition timing to manufacturer's specification.
	Fuel mixture is too lean.	Look for intake system leak. Repair any leaks found.
	Exhaust is restricted.	Remove or repair restriction.
	Fan or fan shroud is broken or missing.	Replace fan shroud.
	Coolant level is low.	Fill radiator when cool. Add coolant to fill line on reservoir.
	Crankcase oil level is too high or too low.	Check engine oil. Fill if low, drain if overfilled.
Engine will not crank.	Battery is discharged or defective.	Charge and test battery. Replace if defective.
	Loose or faulty wires or connections.	Inspect wiring, repair any bad connections or wires.
	Faulty ignition switch or starter.	Replace defective switch or starter.
	Engine is seized.	Repair or replace engine.

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