

# Ground Engaging Tools (G.E.T.)



## Management Guide

- G.E.T. Management
- Safety
- Preventive Maintenance
  - Wheel Loaders
  - Base Edges
  - Hydraulic Excavators
  - Dozers
  - Motor Graders
- Total Wear Protection
- Remove and Install Instructions



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Protect expensive machine components, reduce operating costs, and get the most out of your machine's performance. The most important part of any machine is its work tool, and ground engaging tools have a direct effect on your machine. Proper selection affects your productivity, fuel consumption, maintenance costs, and possibly the longevity of your equipment. Your Cat® dealer can help you establish an effective management program that minimizes preventable problems.

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This management guide offers information, tips, and ideas but is not intended as a technical manual or a substitute for the advice and recommendations of our parts and service experts. By referencing this manual and following the recommendations in your Operations and Maintenance Manual, you can maximize the productivity, service life, and value of your Cat machines.

# Manage it well. Make it last.

Maximize performance at the lowest cost per ton. Appropriate management of your Ground Engaging Tools (G.E.T.) can give you increased productivity and longer equipment life.

A broad range of G.E.T. options are available, matched to your machine design specifications. And your Cat dealer is always available to help with management, inventory, or technical support.



# G.E.T. Management

The most important part of any machine is its work tool. Buckets or blades, tips or edges, rippers or side cutters – no matter the size, work tools and G.E.T. are the main reason the machine exists. Ground Engaging Tools have a direct effect on the machine's ability to produce. Improper selection may result in:

- More fuel use
- Reduced engine and power train life
- Operator fatigue: fighting the machine, cab vibration

Contact surface can be increased by:

- The G.E.T. selected
- When the G.E.T. is allowed to exceed 100% wear
- The angle the G.E.T. is presented to the material

The larger the contact surface, the more stress introduced to the system. This increased resistance requires the machine needs to work harder, which results in:

- More horsepower and fuel use
- Increased time taken to move the material
- Inefficient contact



Managing your G.E.T. helps you maximize your production while minimizing your operating cost.



# Safety

## WARNING

To guard against death or injury, mine site safety precautions should be observed before attempting to install or remove this assembly.



Safety is the #1 priority of any job. This page provides some important safety tips but is not a complete discussion. It is important that you always reference the safety section in the OMM and begin each session with a safety review.

An important part of ensuring safety is dressing properly:

- Safety glasses
- Safety shoes or steel-toe boots
- Hearing protection when necessary
- Secure long hair when necessary
- Special protective gear such as goggles or gloves when necessary
- Personal music devices or AM/FM radios are strictly prohibited
- Wearing finger rings is strictly prohibited

When preparing to work on a machine, always be aware of the hazards associated with each task. These hazards are listed in the OMM. Good safety practices include, but are not limited to:

- Always park on level surfaces, staying clear of other operations.
- Apply parking brakes and/or wheel chocks.
- Attach a “Do Not Operate” tag to the start switch or controls before servicing equipment.
- Remember to maintain three points of contact with the machine when climbing on and off.
- Avoid contact with hot surfaces or fluids.
- Prevent flammable fluids from coming into contact with hot surfaces.

According to some estimates, failure to lock out equipment before working on it accounts for approximately 10 percent of all serious industrial accidents each year. Technicians can be electrocuted, lose fingers, hands, and arms, or suffer crushing injuries because a machine is turned on while being serviced or maintained. Always use the correct lockout/tagout procedures when servicing a machine. You should complete the course on lockout/tagout offered by Caterpillar before servicing a machine.



# Preventive Maintenance (PM)

Preventive maintenance is a program in which wear and tear and change are anticipated and corrective actions are taken to ensure machine reliability and performance. PM involves a planned and controlled program of systematic inspection, adjustment, lubrication, and replacement of components, as well as performance testing and analysis. A successful PM program will extend the life of equipment and help minimize after-failure repairs that may cause unscheduled downtime.

There are many benefits to performing scheduled preventive maintenance, including:

- Improved system reliability
- Reduction of unscheduled downtime caused by components/system failures
- Lower owning and operating costs
- Better parts inventory management

The following pages discuss techniques and procedures for G.E.T. on various Cat machines. Refer to your OMM and consult your Cat dealer for more information.

## WARNING

**Personal injury or death can result from bucket falling. Lower the bucket to the ground and block the cutting edge off the ground before changing bucket tips or side cutters.**

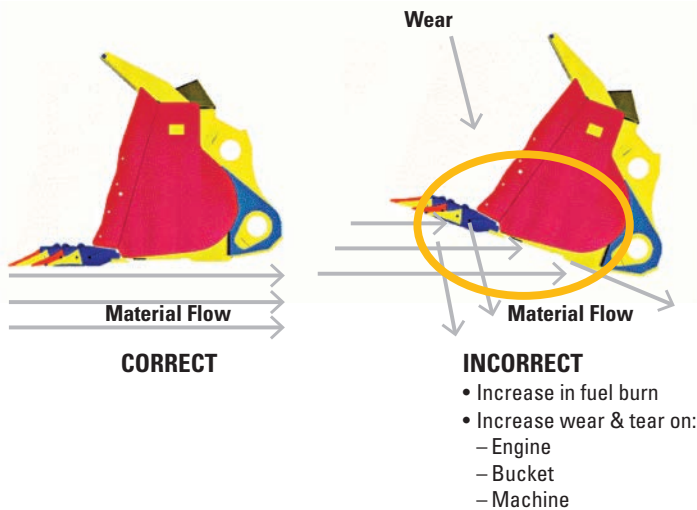
For additional information on inspecting and replacing Ground Engaging Tools (GET), refer to Special Publication, PEXT8033, "GET Inspection and Maintenance Guide".

1. Lower the bucket to the ground and block up the cutting edge. Only block up the cutting edge to a sufficient height for removing the bucket tips.
2. Shut off the engine.
3. Inspect the bucket tips and inspect the edge protectors for wear or damage. Replace broken bucket tips. Replace broken edge protectors. Replace the bucket tips if a hole is worn into the pocket of the tip.



## Wheel Loaders

### Operator Technique



Maintain bucket positioner in proper alignment, with base edge parallel to floor. Cat buckets are designed for the material to slide over a flat floor. Operation outside the design changes the wear pattern of the bucket and G.E.T., and affects loading.



Premature paddle plate wear is caused by:

- Improper bucket level set – “Return to Dig”
- Improper bucket curl. [Raise lift arm(s) before curling]

### Bucket Side Cutters

Check for:

- Excessive wear
- Loose, damaged, or missing bolts

### Bucket Edges, Tips, and Adapters

Check for:

- Cracks on base edges beside adapters and corner welds
- Cracks on base edges on top and bottom of rear weld
- Excessive wear on the bucket tips. Tips worn through on the bottom or cracked in the pocket area should be replaced.
- Damage to the bucket tip adapters. Badly worn bottom straps that are worn into bottom cavity should be replaced.
- Damaged or missing retainer pins. Tap lightly on each pin. If pin moves easily, replace the retainer.



## Wheel Loaders



Check for excessive wear on **bucket wear plate**.



Check for missing **adapter covers**:

- Prevents adapter wear
- Protects adapter welds





## Base Edges— Hydraulic Excavators and Large Wheel Loaders

### Adapters, Tips, Pins, and Retainer

- With weld-on adapters, check for weld cracks. With bolt-on adapters, check for loose hardware. Check for adapters, look at bolt heads—especially rear bolts. If head is beginning to look square, replace the adapter. With weld-on bottom-strap and two-strap adapters, there are cavities in the bottom. When any adapter wears into this cavity, replace all adapters with similar wear.
- Check for tips that are worn through on the bottom or cracked in the pocket area. Replace tips with either problem.
- Do not reuse bent or badly worn pins or retainers.
- Check for missing or broken retainers by tapping lightly on each pin. If pin moves easily, replace the retainer.

### Edge Protection

- Never operate without base edge protection
- Do not allow to wear into base edge
- Install hardware correctly

Base edge replacement involves replacing a base edge assembly, which includes adapters welded in from the factory, or replacing a bolt-on cutting edge base edge, which comes with factory-drilled holes for bolt-on G.E.T..

### Bolt-On Edges and Bolt-On Segments

- Check for remaining protection in front of base edge. With bolt-on edges, pay particular attention to the amount of protection remaining at the front corners of the base edge.
- Look at bolt heads on bottom of bucket. If any are beginning to look square, replace that segment or bolt-on edge piece.

### Base Edge Maintenance Checklist

- 1. Look for severe bottom wear or scalloping between teeth.
- 2. Look for cracks beside adapters and in corner welds.
- 3. Look for cracks on top and bottom of rear weld.
- 4. Small cracks should be watched, if they grow, they should be repaired.
- 5. Does your bucket need BEEPS to help reduce base edge wear? (see p. 16)

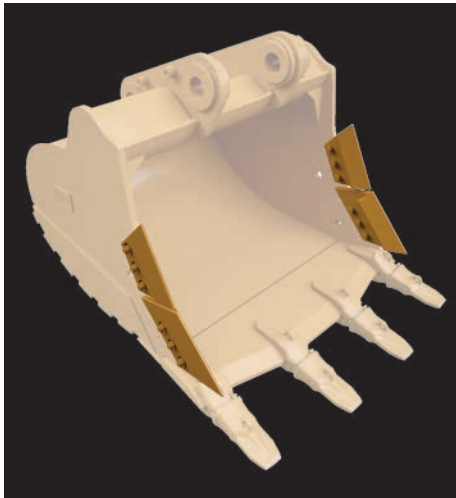
### NOTE:

#### DO NOT APPLY LUBRICANT OF ANY TYPE TO G.E.T. HARDWARE!

1. Clean all surfaces of rust, paint, nicks, and burrs.
2. Tighten nuts to listed torque spec.
3. Carefully strike plow bolt head with a hammer.
4. Retighten nuts to listed torque spec.

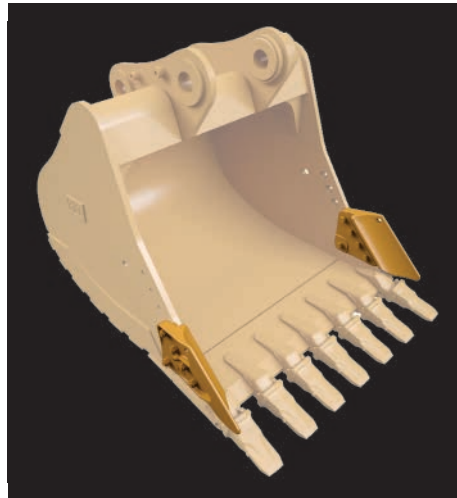
**SAFETY GLASSES MUST BE WORN WHEN STRIKING BOLT HEADS.**

## Hydraulic Excavators



### Strikeoff Sidecutter

- Half arrow shape to provide better penetration than bare bucket.
- Protects the lower bucket sides and corners.
- For use in moderate-to-light conditions.
- Can be stacked for more protection.



### Heavy Duty Sidecutter

- For tough digging conditions.
- More wear material.
- Covers more of the sidebar for enhanced protection of the bucket.
- Scalloped profile improves bucket penetration and machine performance.



### Sidebar Protectors

- Protect your bucket's structural integrity with sidebars and shear blocks.
- Shear block protects the pin from extreme loads and breakage, helping ensure sidebar protector retention.
- Sidebar protector protects the bucket edge.
- Shear block bears the loads instead of the pins.

## Hydraulic Excavator Operator Technique Tips

1. Enter face squarely
  - Don't swing into pile
2. Avoid using excessive prying force
  - Tips and the adapters are designed to break first
3. Minimize ground contact with the bucket
  - Make the tips do the work
4. Enter face with tips at proper angle
  - More contact equals more wear
  - Curl bucket through material maximizing tip contact and minimizing bucket contact

*The correct position is square to the face, tips down at 40 degrees, enter the pile, boom up and curl. The tips do the work, minimal bucket contact, better, quicker loading.*

*More contact equals more wear – minimize non-productive contact!*

### **Rotate Tips**

1. Balance wear
2. Centers to end
3. Ends to center
4. Lower cost per hour

## Dozers

### Blades

Ensuring a long life for your blade and the G.E.T. that protects it involves three simple steps. Clean surfaces, new hardware, and proper installation technique. Always follow the specific instructions for your machine. Your local Cat dealer is only a phone call away if you need assistance.

#### 1. Clean and Pristine

- Surfaces, bolts and nut threads must be clean to ensure maximum clamping force
- When installing, use new hardware as old bolts may have suffered metal fatigue

#### 2. Center Out

- Cutting edge bolts are installed from the center outward—do not install from both ends toward the center
- End bit bolts are installed first from the center outward, then from the center inward

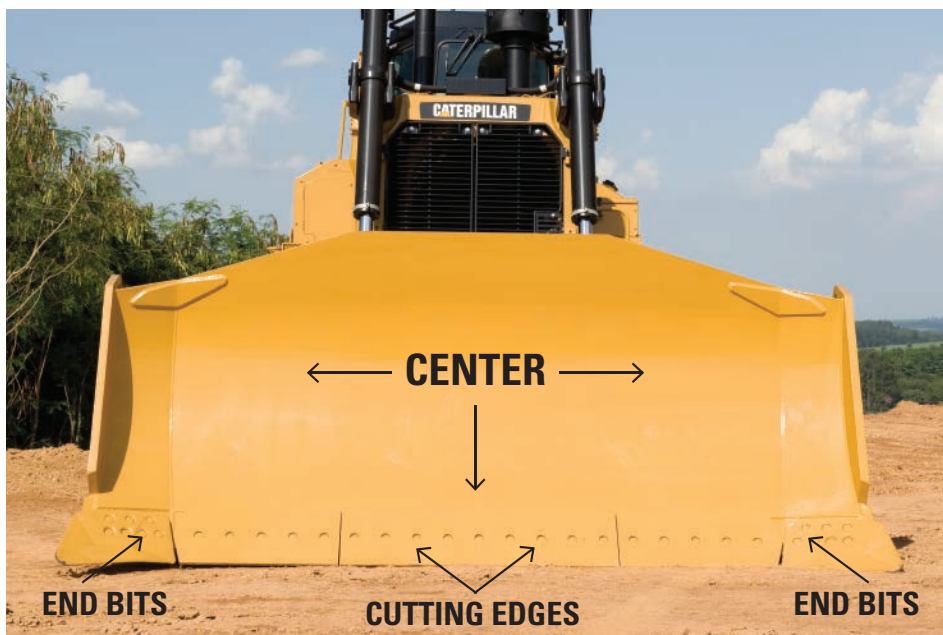
#### 3. Torque, Bang, Torque

- Tighten all bolts to the required torque
- Wearing safety goggles, seat bolt heads in the countersinks with a heavy hammer
- Tighten the bolts again to required torque



### Dozer Blade Maintenance Checklist

- 1. Be sure not to wear into the moldboard.
- 2. Make sure the operator is using proper technique. See below for operator tips.
- 3. Watch the blade angle on corner loading.
- 4. Monitor for balanced system wear.
- 5. Use the thickest edge providing required penetration.

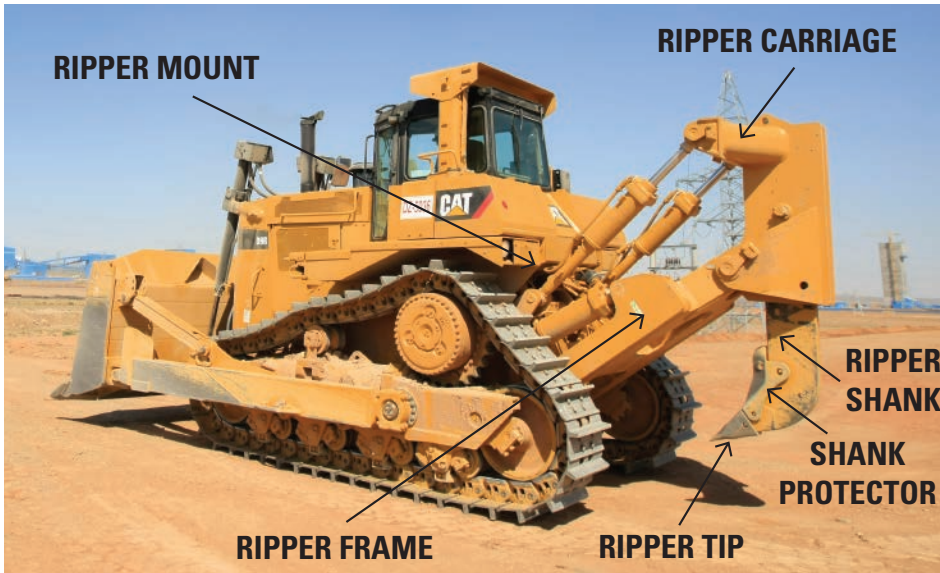


### Dozer Operator Technique Tips

1. Avoid corner loading
2. Blade angle
  - Carry, don't roll
3. Avoid excessive speed
4. Doze in 1st gear
5. Carry the load in 2nd gear

## Dozers

### Rippers



#### Installation & Removal

Hammerless removal and installation is possible with your current side pin shank/ adapter system. CapSure™ retention is built into each tip, so you only need to insert a pin to experience faster, safer, and easier tip change-out.

**1** Insert pin into adapter hole.



**2** Insert washer into adapter hole.



**3** Slide the tip onto adapter.



**4** Turn retainer 180° to lock/unlock.



Removal and installation animation is available at [www.youtube.com/watch?v=UW6\\_jjqa\\_eA](http://www.youtube.com/watch?v=UW6_jjqa_eA) or by scanning the QR code to the right.



#### Ripper Maintenance Checklist

##### Check ripper shank TIP for:

- Excessive wear. If ripper tip is worn too close to shank, replace tip.

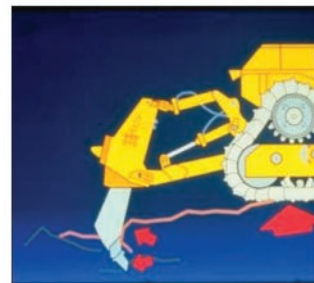
##### Check ripper shank protector for:

- Excessive wear. If ripper shank protector is worn too close to shank, replace protector.

##### Check ripper mount, ripper frame, and ripper carriage for:

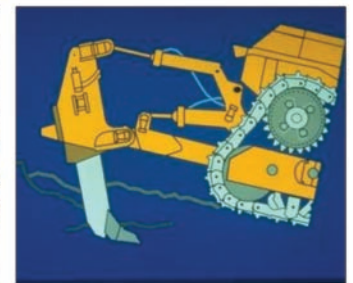
- Structural damage or cracks around welded joints.
- Damage or wear to pin bores.
- Loose, damaged, or missing retainer bolts.

#### Ripper Technique



##### Incorrect

- Position to gain initial penetration
- Not production ripping



##### Correct

- Use correct shank angle

## Motor Graders

Edge selection is critical for enhancing production and keeping cost to a minimum. Application affects the cutting edge shape, metallurgy, and style. Impact, penetration, and abrasion define your application environment. An edge has to penetrate the material and not break during operation. Edge life then becomes a matter of metallurgy and thickness.



### Proper Operating Speed is Key to Smooth Grading and Long G.E.T. Life

#### Too fast

- Too much bounce
- Poor finish
  - Pass ineffective
- Reduced cutting edge life

#### Use less cast angle

- More coverage per pass
- Helps reduce speed

#### Inefficiencies Created by Improper Operating Techniques:

- Dust from excessive speed
- Blade too far forward
- No contact—LHS bias, reforming road, draining material into the pit instead of out
- Creating a drain to put water into the pit

### Choosing a Motor Grader Edge – What is Your Application?



#### Developing a road or performing heavy maintenance

A flat edge is best suited for this application. A better penetrating option is a flat serrated edge. A flat edge has limited ability to carry material forward.



#### Grading hard-packed gravel, frozen earth, and ice

A serrated edge penetrates better than a continuous edge because it exerts more down pressure. A curved serrated edge penetrates better than a flat serrated edge with a forward mold board.



#### Reconditioning or finish grading an existing road surface

Curved edges penetrate the roadway while carrying existing material forward to leave a smooth flat surface. A better penetrating option is a curved serrated edge. A serrated edge will not leave as clean a roadway surface as a continuous edge.

# Preventive Maintenance (PM)

## Motor Graders

### Maintenance Tips

- Use widest edge available
- Use thickest edge to ensure penetration
- Don't wear into the moldboard – 10 mm remaining below moldboard
- Use propeller overlay end bits where corner wear is high
- Use hardened washers on plow bolts to correct torque
- Raise a service report for each problem identified
- Maintenance work is normally done with the centershift lock pin in the center position, and the drawbar and circle centered under the mainframe.
- Maintain straight cutting edges by trimming them with a torch or, if wear is not severe, by dragging the cutting edges on a smooth concrete surface.

### Operating Tips

- 20° board angle
- Moldboard may vibrate and bits may not turn if angle is not correct
- Articulating the rear frame toward the toe of the moldboard approximately 2 to 5 degrees (1 to 1.5 times the width of the tire) will frequently help reduce the machine's tendency to bounce. Start with the moldboard top 2 inches (5.1 centimeters) ahead of the cutting edge. Then adjust to the material and conditions.
- Use of full rear tip could cause material penetration problems and damage the moldboard bottom or pivot area, especially if the cutting edges are worn.
- Cut to the depth of major potholes. Don't fill these holes with loose dry material, because traffic will quickly displace the loose material and the holes will reform.

### Operating Techniques for Reduced Cost

Through better management of the interface between machine and materials, operators can maximize productivity, lower machine operating costs, and reduce cab vibration, improving operator comfort.

#### Moldboard position

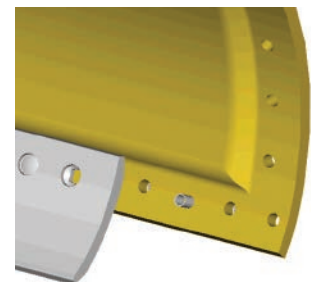
- Start with moldboard 2" (4" for 24H) ahead of the edge
- Grade with cutting edge 90° to the road
- Maintain fixed angle to ensure constant edge thickness
- Laid back reduces penetration and can wear moldboard
- Frequent angle changes will shorten the edge life



#### Speed and excessive down pressure

- Use accumulator to absorb shocks
- < 6 mph/8 kph speed
- Excess speed can cause edge slivering

Need penetration? Choose a thinner edge, a serrated edge or the Cat GraderBits System for the most compacted materials.

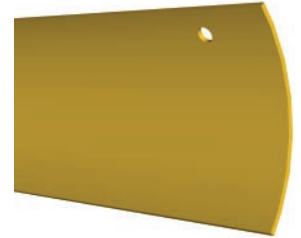


## Crowning

- Occurs when the cutting edge conforms to the material being graded
- A narrow and thin edge reduces the “throw away” material
- Extreme crowning may require a bit system

## Standardize your hardware

- Moldboard bushings reduce  $\frac{3}{4}$ " holes to  $\frac{5}{8}$ "
- Simplify inventory and lower cost



## Motor Graders

### End Bit System

Maximize moldboard life and lower repair costs. Use Cat end bits, overlays, repair plates, and hardware to protect and repair your moldboards and working edges.

### Moldboard End Bits

- Recommended for all applications
- Made of through-hardened DH-2 steel for added strength and



V-Block



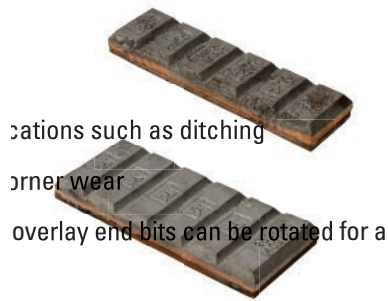
Straight Block

# Total Wear Protection

service life

## Overlays

- Fit
- Re
- Al
- W
- se



Applications such as ditching  
corner wear  
overlay end bits can be rotated for a

## Moldboard Repair Plates

- Extend moldboard life with Cat Moldboard Repair Plates
- Routine monitoring and timely edge replacement can prevent damage

When moldboard repair plates are used, it's a way to extend

## Hardware

- When hardware is used, it's a way to extend
- Cat Grade 500 hardware is used in conjunction with Cat G.E.T. in both situations



PLUG WELD



### Ripper/Scarifier

Check mounts, frame, and carriage for:

- Damage or cracks around welded joints
- Improper lubrication, damage, or wear to pin bores
- Loose, damaged, or missing retainer bolts

Check ripper/scarifier tips for:

- Excessive wear. Replace tips that are worn too close to the shank.

**MAWPS Maintenance Tip**

Wear indicator holes allow for quick and easy inspections, reducing maintenance time.

**1** Weld the adapter perpendicular to material flow for maximum wear material (or parallel to flow with the Cat logo on top for maximum coverage).



**2** Position the wear plate over the base plate and slide the wear plate onto the base plate.



**3** Install one end of the compression retainer with the plug and pry it into place with an 8mm-wide small pry bar.



**4** Clean, use pry bar to remove the compression retainer, and slide the wear plate off the base plate.



Scan the QR code to the right to watch the installation video.



# Remove and Install Instructions

## Hydraulic Excavators

### K Series Drive-Through Tip & Adapter System

Lower-profile tip



No hole in adapter

Twist-on design



Drive-through retainer



#### Installation & Removal

It's safe and easy—just use a standard pry tool and follow this three-step hammerless process:

Scan the QR code to the right to watch the installation video.



**1**

Insert retainer.



**2**

Hammer retainer.



**3**

Secure retainer.



### K Series Hammerless Tip & Adapter System

Lower-profile tip



No hole in adapter

Twist-on design



Standard Hammerless Retainer



Retainer – Bolt Drive



\* Additional offering offered only for the extreme packing and slag applications.

#### Installation & Removal

It's safe and easy—just use a standard pry tool and follow this three-step hammerless process:

Scan the QR code to the right to watch the installation video.



**1**

Insert retainer.



**2**

Press down retainer.



**3**

Remove retainer.



## Hammerless Tip & Adapter System Featuring Capsure Retention



### Installation & Removal

It's fast, easy and safe with the CapSure locking system—just follow these four simple steps:

Scan the QR code to the right to watch the installation video.



- 1** Insert pin and washer into the adapter hole.



- 2** Slide the tip onto the adapter.



- 3** Tighten 180° into the locked position with a 3/4" ratchet.



- 4** Remove by loosening 180° to the unlocked position.



# Expect more from the experts

Following the information and practices in this guide can help keep your Ground Engaging Tools in peak condition. Your Cat dealer is ready to help with questions, service, or just some advice along the way. We're built to put you in control.

Call your Cat dealer for more information.

**LET'S DO THE WORK.™**



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