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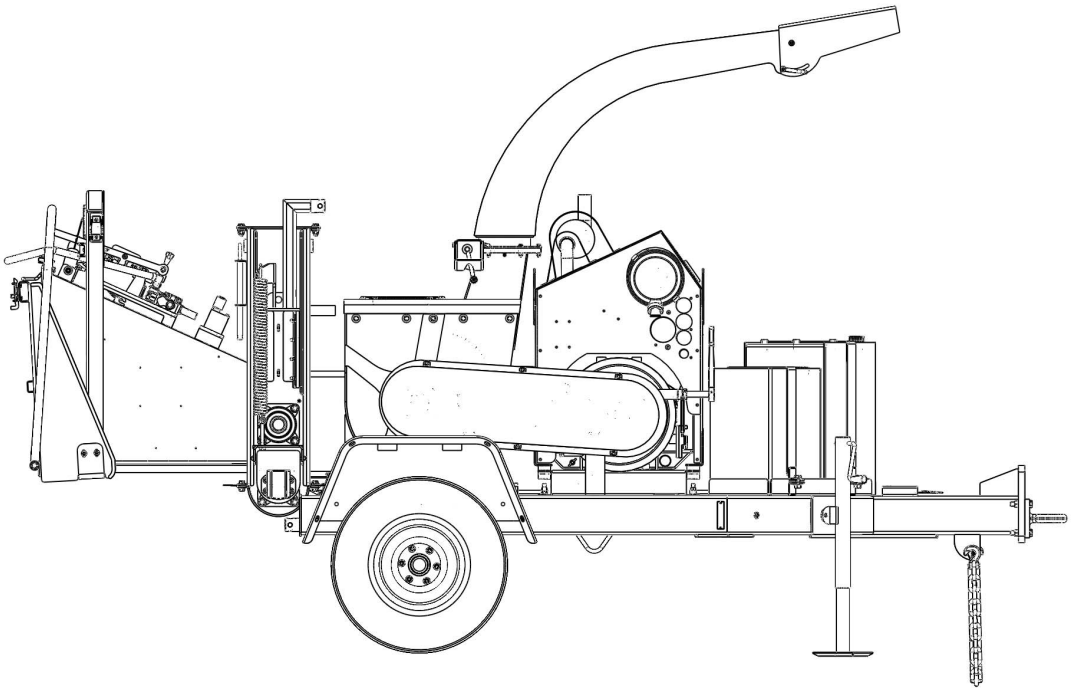

Operator's Manual

www.altec.com

Altec Environmental Products, LLC. reserves the right to improve models and change specifications without notice.

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2013

Preface

This unit is the result of Altec Environmental Products, LLC's advanced technology and quality awareness in design, engineering, and manufacturing. At the time of delivery from the factory, this unit met or exceeded all applicable requirements of the American National Standards Institute. All information, illustrations, and specifications contained within this manual are based on the latest product information available at the time of publication. It is essential that all personnel involved in the use and/or care of this unit read and understand the Operator's Manual. Keep this manual with the unit.

Given reasonable care and operation, according to the guidelines set forth in the manuals provided, this unit will provide many years of excellent service before requiring major maintenance.

Impacts to and excessive forces on the equipment, through vehicular accidents, rollovers, excessive loading, and the like, may result in structural damage not obvious during a visual inspection. If the equipment is subjected to such impacts or forces, a qualified person may need to perform additional testing such as magnaflux or ultrasonic testing as applicable. If structural damage is suspected or found, contact Altec Environmental Products, LLC for additional instructions.

Warning

Death or serious injury can result from component failure. Continued use of equipment with hidden damage could lead to component failure.

Never alter or modify this unit in any way that might affect the structural integrity or operational characteristics without the specific written approval of Altec Environmental Products, LLC. Unauthorized alterations or modifications will void the warranty. Of greater concern, is the possibility that unauthorized modification could adversely affect the safe operation of this unit, resulting in personal injury and/or property damage.

Danger

Death or serious injury will result from operation of a chipper, while coupled to an energized aerial device. Non-insulated aerial devices have no dielectric rating. When coupled, chipper to aerial lift and in the proximity of energized conductors, there shall be no operation or contact with the chipper.

Set-up requirements, work procedures, and safety precautions for each particular situation are the responsibility of the personnel involved in the use and/or care of this unit.

Table of Contents

Section 1 — Introduction

About This Manual…

This manual provides instruction for the operation of the unit. The operator must be familiar with the unit and its capabilities before using the unit on the job. This manual is written to provide an understanding of the unit, safety, proper set-up, and operation.

Charts and figures are provided to support the text. Because options vary from one model to another, some figures may only be a representation of what is actually on the unit.

Contact the following organizations for additional information.

- American National Standards Institute (ANSI) Z133.1 Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush-Safety Requirements
- American Public Power Association (Safety Manual for an Electric Utility)
- American Society for Testing and Materials (ASTM)
- American Welding Society (AWS)
- European Committee for Standardization (CEN)
- Fluid Power Society (FPS)
- Hydraulic Tool Manufacturer's Association (HTMA)
- International Electrotechnical Commission (IEC)
- International Organization for Standardization (ISO)
- Occupational Safety and Health Administration (OSHA)
- Federal Motor Carrier Safety Administration (FMCSA)
- U.S. Department of Transportation (DOT)
- Federal Highway Administration (FHWA)

Dealers, installers, owners, users, operators, renters, lessors, and lessees must comply with the appropriate sections of the applicable ANSI standard.

The Appendix contains reference items to assist in unit operation. A glossary of industry terms is provided for your convenience. This glossary provides an understanding of the industry terms and phrases used in Altec manuals. Throughout the manual, the term unit is used to describe the Altec device, subbase, and the associated interface with the vehicle.

Additional copies of this manual may be ordered through your Altec representative. Supply the model and serial number found on the serial number placard and the manual part number from the front cover to assure that the correct manual will be supplied.

This symbol is used throughout this manual to indicate danger, warning, and caution instructions. These instructions must be followed to reduce the likelihood of personal injury and/or property damage.

The terms danger, warning, caution, and notice represent varying degrees of personal injury and/or property damage that could result if the preventive instructions are not followed. The following paragraphs from ANSI publications explain each term.

Danger
Indicates a hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.

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, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Notice
The preferred signal word to address practices not related to personal injury.

Section 2 — Unit Specifications

Purpose of the Unit

This unit has been designed and built to reduce brush and above ground tree components into uniformed wood chips.

General Specifications

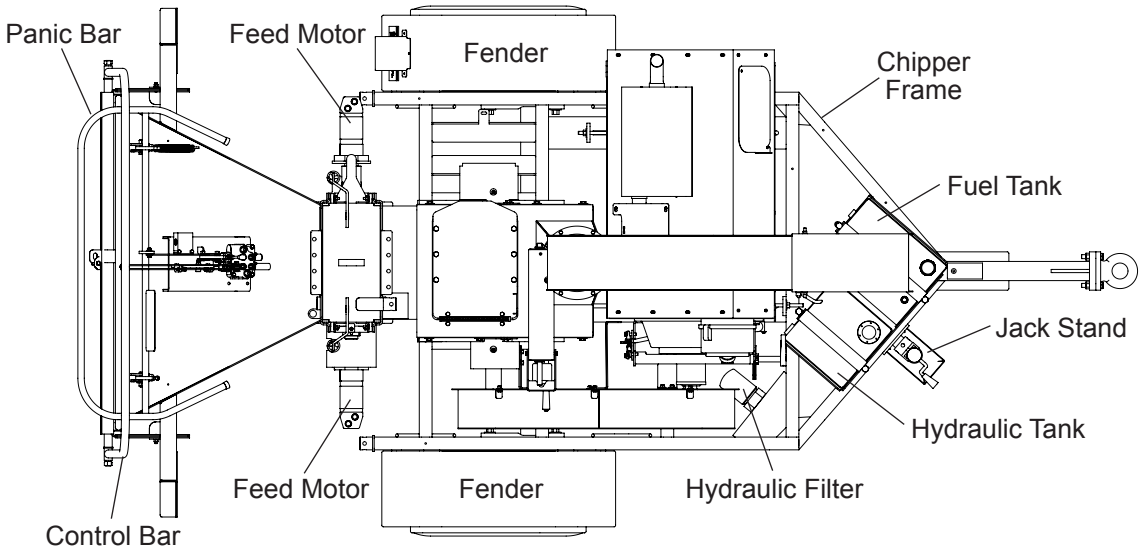
This unit is a 12″ (30.28 cm) capacity, controlled feed drum chipper. The chipper mechanism is permanently mounted on the towable frame assembly. The chipper mechanism is belt driven through a self contained industrial engine. Material is fed utilizing two horizontally mounted, hydraulically controlled feed rolls. Cutter head consists of a 21″ (53.34 cm) diameter drum housing two 9″ (22.9 cm) cutter knives. Chip discharge is designed for both chip box and road side discharge applications.

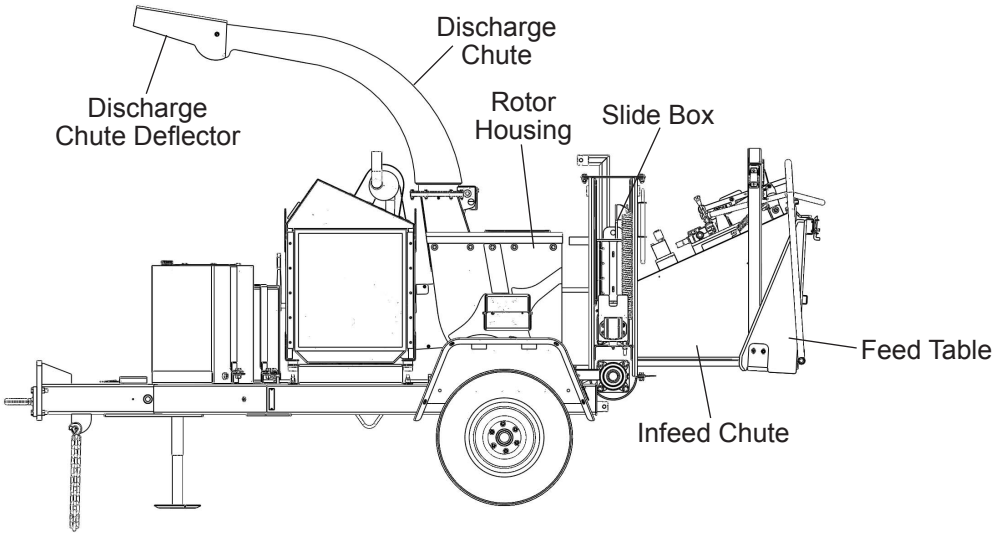
Item	Specification
Chipping capacity	12″ (30.28 cm)
Engine horsepower	85 horsepower
Noise level[1]	80 db
Weight	4,950 lbs (2,245 kg)
Tongue weight (may vary)	300 lbs (136 kg)
Travel height	98″ (2.48 m)
Width	79″ (2.01 m)
Travel length	166″ (4.22 m)
Operational length	190″ (4.83 m)
Feed roller opening	17″ (43.18 cm) wide x 12″ (30.28 cm) high
Feed table dimensions	53″ (134.62 cm) wide x 29″ (73.66 cm) deep
Infeed chute opening	50″ (127 cm) wide x 30″ (76.2 cm) high
Length to feed roll nip point[2]	90″ (2.29 m)
Rotor dimensions	20″ (50.8 cm) wide x 21″ (53.3 cm) diameter
Rotor weight	500 lbs (227 kg)
Rotor rpm	2,200 rpm
Feed rolls	16 1/2″ (41.9 cm) wide x 9″ (22.9 cm) diameter
Feed rate	107 feet per minute
Feed wheel motor rating	29 cu. in. displacement
Hydraulic pressure	2,500 psi (172.4 bar)
Hydraulic tank capacity	11 gallon (41.64 l)
Fuel tank capacity	20 gallon (75.7 l)
Trailer lighting	LED
Discharge chute rotation	360°

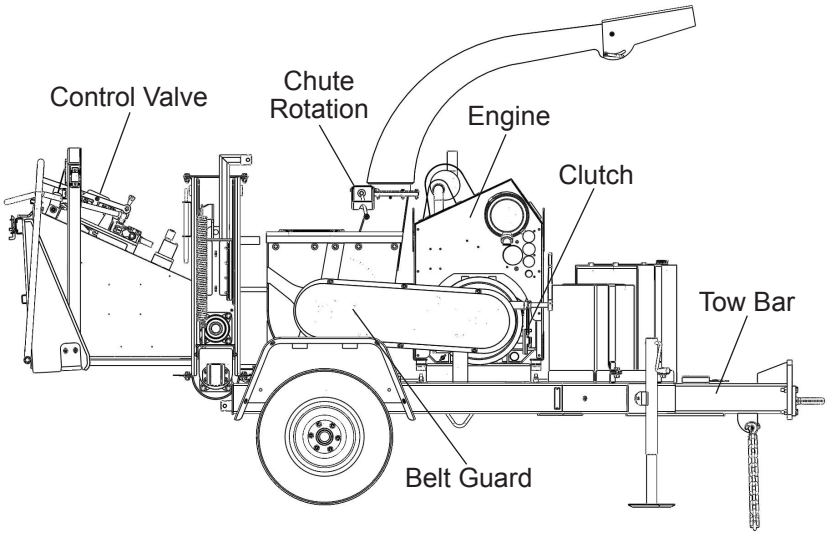
[1] Noise levels vary according to engine specifications, material size and composition.
[2] Measured from ground level at infeed chute, through the center of the feed table.

Figure 2.1 — Unit Specifications

Component Identification







Safety Instructions

This unit is designed and manufactured with many features intended to reduce the likelihood of an accident. Safety alerts throughout this manual highlight situations in which accidents can occur. Pay special attention to all safety alerts.

Danger

Death or serious injury will result from careless or improper use of the unit. Do not operate the unit without proper training.

Warning

Death or serious injury can result from careless or improper use of the unit. The operator bears ultimate responsibility for following all regulations and safety rules of their employer and/or any state or federal law.

It is very important that all personnel are properly trained to act quickly and responsibly in an emergency, knowing the location of the controls and how they operate. Keep any tools or equipment needed to perform manual operations in a well-marked, designated area. Keep the work area well organized and eliminate trip hazards.

Danger

Death or serious injury can result from entanglement with material being fed into the chipper. Make sure adherence to all required personal protective equipment and clothing. Make sure all safety operational and maintenance parameters are strictly enforced.

Death or serious injury can result from accessing moving components such as cutter drum/disc or drive components. Never attempt access to or attempt to cover moving components.

Death or serious injury will result from unprotected contact with energized conductors. Do not operate or come in contact with a chipper while coupled to an operational aerial device.

Knowledge of the information in this manual and proper training provide a basis for safely operating the unit. Follow your employer's safe work practices and the procedures in this manual when operating the unit.

Lock-Out Tag Out Procedure (LOTO)

Warning

Failure to properly lock-out tag out the chipper can result in death or serious injury.

LOTO procedures must be completed prior to performing maintenance or clearing debris from internal components of the chipper or engine.

Never leave the chipper unattended with the keys in the ignition.

1. Turn Ignition key off and remove key. Secure the key in a safe location with controlled access.
2. Make sure chipper rotor or disc comes to a complete stop.
3. Remove negative battery cable.
4. Lock and tag battery box.
5. Follow all appropriate LOTO procedures according to OSHA Standards 29 CFR Standard 1910.147 (The Control of Hazardous Energy).
6. Follow any additional federal, state, local, or controlling agency standards or procedures that may apply.

General Operating Information

- Do not operate the unit without proper training.
- Be sure that the unit is operating properly, and has been inspected, maintained, and tested in accordance with the manufacturer's and government's requirements.
- Use required personal protective equipment.
- Be aware of the surroundings.
- Perform the Daily Preoperational Inspection before operating the unit each day.
- Apply the tow vehicle parking brake and chock chipper and tow vehicle wheels.
- Properly set up chipper operational area, including vehicle and pedestrian control.
- Never exceed the rated capacity values.
- Follow all of your employer's work rules and applicable government regulations.

Capacity

This unit capacity is the maximum size material which will pass through the feed wheel opening. Always take into consideration general material shape, protrusions, and attached limbs.

Chipper Personnel Safety Devices

Danger

Improper or careless use of this chipper will result in death or serious injury. All personnel using this chipper must be trained and qualified in all aspects

of the operations, maintenance, repair, and safety procedures defined in this manual prior to conducting any operations or procedures. All maintenance personnel and operators shall ensure the proper operation of each safety device prior to starting the engine or operating the chipper. Contact Altec Environmental Products for replacement parts.

Warning

Death or serious injury can occur when operating this unit. Safety devices are not a substitution for proper operation. Read the manual and all safety decals and placards.

Panic Bar Assembly

In the event of an unforeseen situation the panic bar can be activated by pulling down on bar A or by pulling or pushing bar B towards the rear of the chipper. This action will stop all movement of the feed roller.

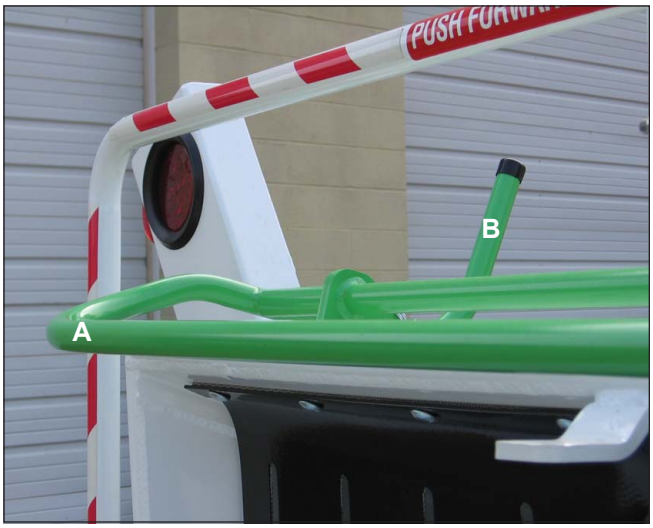


Figure 3.1 — Panic Bar Assembly

The panic bar assembly consists of two bars (A and B), the hydraulic valve and the bar linkage. When you pull down on bar A or push towards the rear of the chipper on bar B, the bar connecting linkage activates the handle on the valve. This action stops all movement of the feed rollers. To continue operation you must manually reset the handle on the valve to the Run position.

Warning

Death or serious injury can occur if entrapped in roller movement. Feed rollers begin movement as soon as the valve handle is activated. Make sure all operators are advised prior to your actions and that the infeed chute is clear of all personnel and tools before reactivation of the feed system.

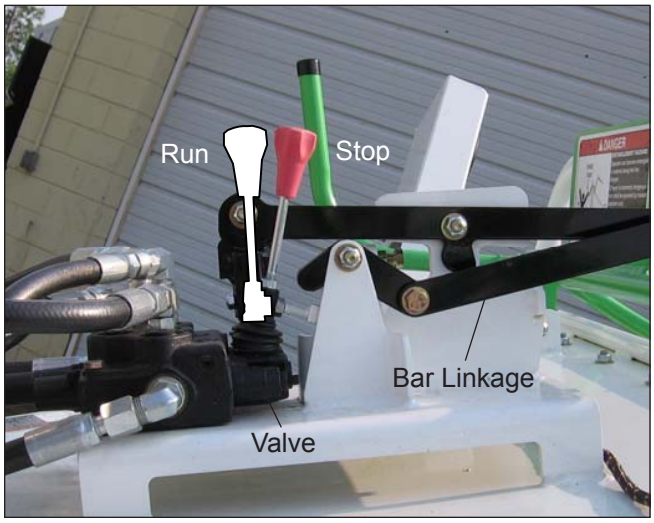


Figure 3.2 — Valve and Bar Linkage

1. Test the panic bar assembly daily and whenever new personnel are assigned to the chipper.
2. After completing all appropriate safety and operational checks and with no material in the feed chute, pull or push the feed bar to activate the feed roller in the forward or reverse direction. Visually verify the rotation of the feed roller.
3. Push down on bar A or move bar B.
4. Feed roller movement must stop.
5. If feed rollers do not stop, repair as necessary prior to operating the chipper.

Personal Protective Clothing and Equipment

Warning

Death or serious injury can occur if proper personal protective equipment is not utilized. To decrease the possibility of death or serious injury, all chipper operators must wear appropriate protective equipment and clothing.

Notice

The chipper operational area is the area around the chipper that has the potential for flying debris from the discharge chute or infeed chute and has the potential for material to be engaged by the chipper or to be fed by an operator into the chipper (material being dragged to the chipper).

Protective Equipment Specifications

Head Protection

Warning

Death or serious injury can result from falling or rapidly shifting objects. Hard hats are required.

Head protection must conform to ANSI Z89.1 and under chin strapping shall not be worn while operating or within the operational area of the chipper.

Eye Protection

Warning

Death or serious injury can result from flying objects. Always wear eye protection.

Wrap around eye protection that meets ANSI Z87.1 shall be worn at all times when operating or working within the operational area of the chipper.

Hearing Protection

Warning

Prolonged exposure to loud noise can cause impairment or loss of hearing. Wear suitable hearing protective devices such as earplugs to protect against objectionable or uncomfortable loud noise.

Plug type ear protection or full ear coverage devices (muff type) shall be worn at all times when operating or within the operational area of the chipper. Full ear coverage devices (muff type) are vulnerable to being entangled by branches when feeding the chipper.

Breathing Protection

Caution

Exposure to dust can result in respiratory difficulties. Always wear appropriate respiratory protection.

Some locations or jobs may require the use of breathing protection. Use paper filter type dust masks that will tear away if entangled in brush being fed into the chipper. Dust type, tear away respirators shall be worn if circumstances require breathing protection. Respiratory protection shall comply with applicable federal regulations as well as with ANSI Z88.2.

Hand Protection (Gloves)

Warning

Death or serious injury can result if operator becomes entangled. Gloves must easily release from the hand when pulled from the palm, cuff, or fingers. Never wear gauntlet, cuffed, or strapped gloves.

- *Chipper Operation*
  When operating or handling brush within the operational area of the chipper, loose fitting gloves are the only gloves that shall be worn.

- *Blade Maintenance*
  When handling or working around the blades, make sure that the gloves are of sufficient material to prevent serious injury from cutting (heavy leather palmed work gloves or Kevlar material).

Clothing

Warning

Death or serious injury can result if operator becomes entangled in material being feed into chipper. Always wear appropriate clothing.

- Work clothes shall be close fitting, but not restrictive of movement, without any decorations or loose parts that may become entangled in the material being fed to the chipper. Items such as jewelry, chains, and backpacks, shall not be worn while operating this unit.

- Jackets or shirts with straps at the cuff or shoulders, scarves, neckties, or gauntlet, cuffed, or strapped type gloves must not be worn.

- Hooded sweat shirts may be worn only if the hood is tightly drawn around the face with the drawstring and the drawstrings tucked into the outer garment. Tuck the hood under the outer garment when not in use. Jackets, shirts, or other outer garments must be closed and free from pockets, straps, buckles, etc., which could become entangled in the equipment or on brush being fed into the chipper.

- Remove all chaps, climbing equipment, full body harness, or any other protective equipment that is not required and may be an entanglement source when operating or within the operational area.

Warning

Death or serious injury may occur when proper traffic control is not maintained. Always control both pedestrian and vehicular traffic.

Some work areas may require the wearing of reflective or highly visible garments such as a vest or chaps to alert passing traffic. When using high reflective or high visibility garments make sure that the garments are constructed and worn in a manner as to" tear away" from the operator in the event of entanglement with brush. High-visibility safety apparel and headgear, when required, shall con-

form to ANSI-ISEA 107-2004 and U.S. Department of Transportation (DOT) Manual on Uniform Traffic Control Devices (MUTCD).

Effective means for controlling pedestrian and vehicular traffic shall be instituted on every job site where necessary, in accordance with the U.S. Department of Transportation Manual on Uniform Traffic Control Devices or applicable state and local laws and regulations.

Caution

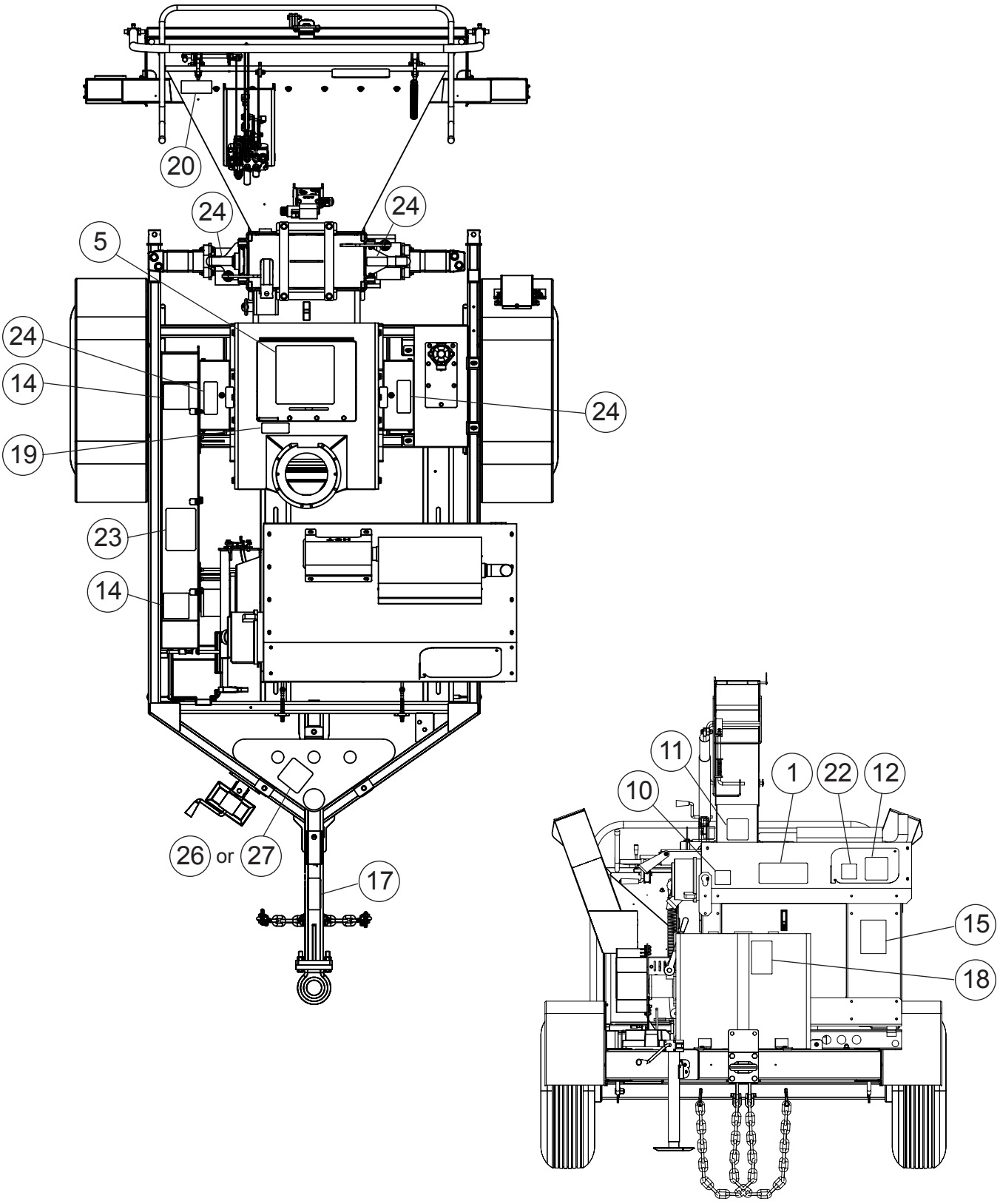
Serious injury may occur without the use of proper protective footwear. Always wear footwear as approved by your employer appropriate to the work location and conditions.

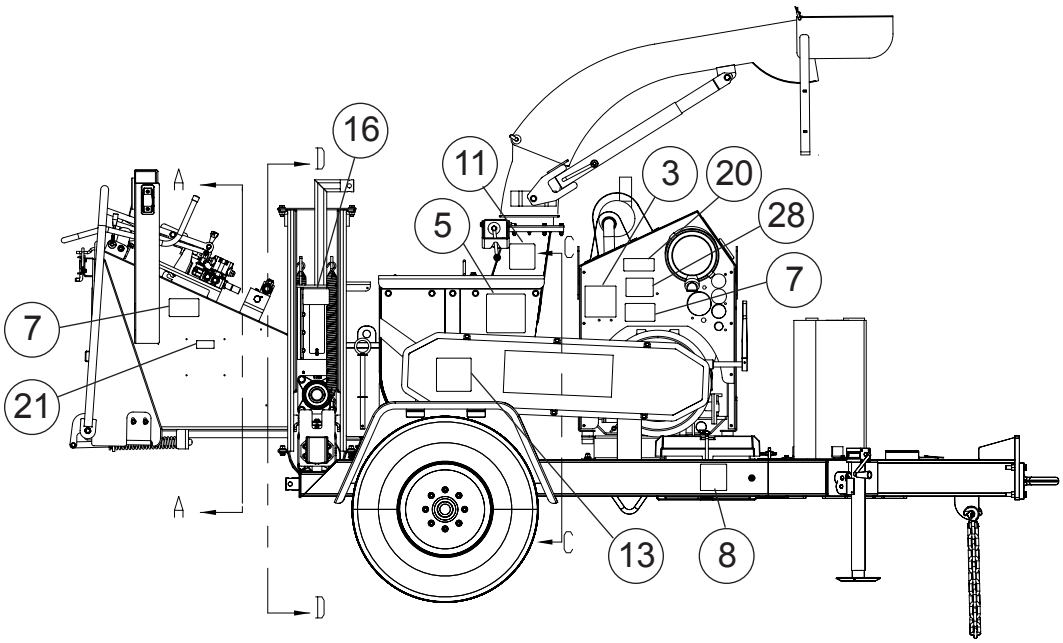
Accident Prevention Signs

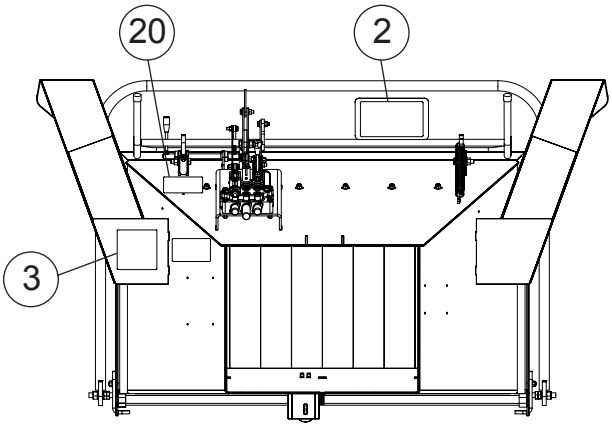
This unit was equipped with accident prevention signs at the time of manufacture. If any of these are lost or become illegible, obtain replacements from your Altec representative.

The location, part numbers, and descriptions of all placards are listed in the Parts Manual. Refer to the Accident Prevention Signs and Diagram for examples of the placards and their locations.

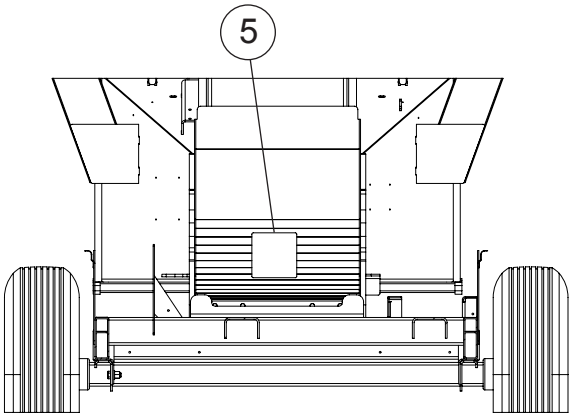
Accident Prevention Signs Diagram



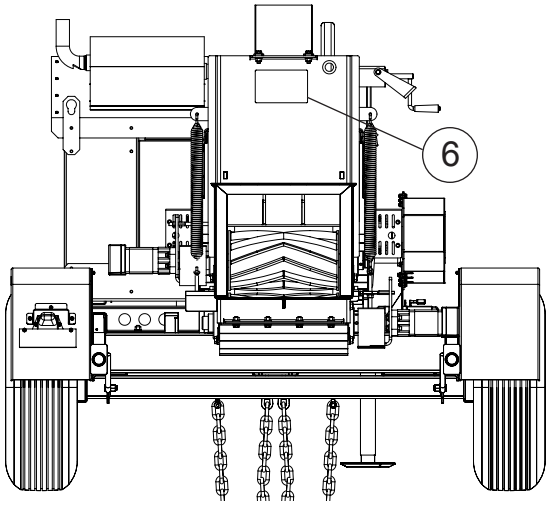




Section A - A



Section C - C



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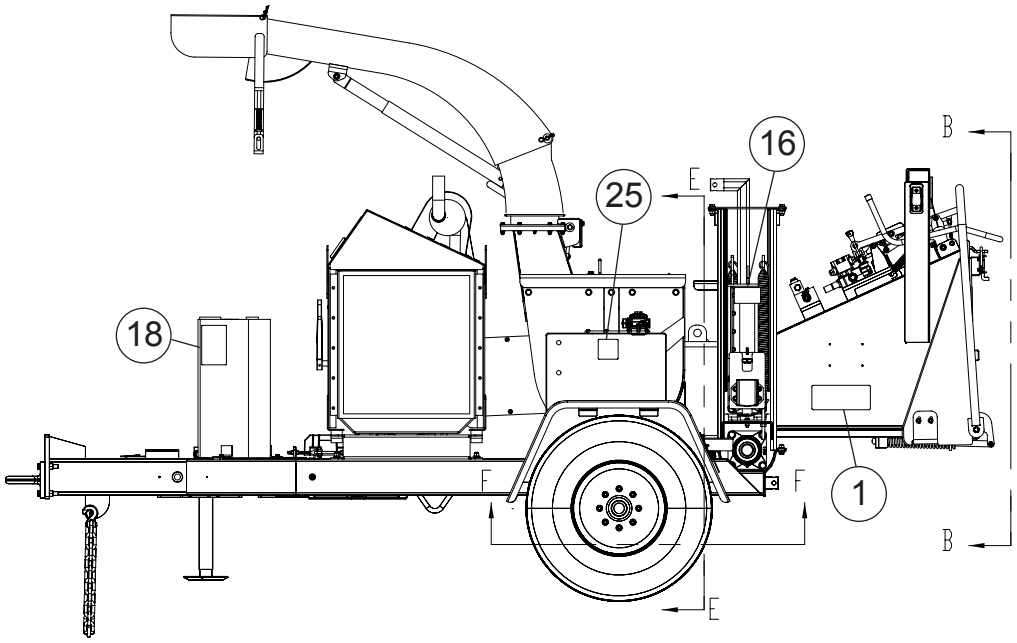
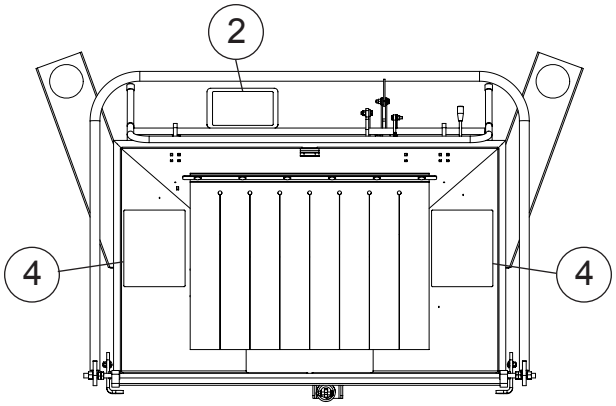
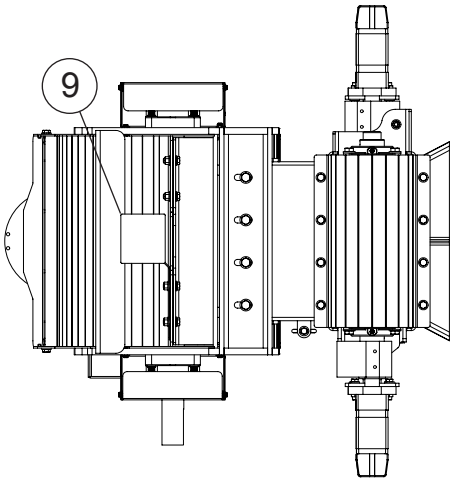
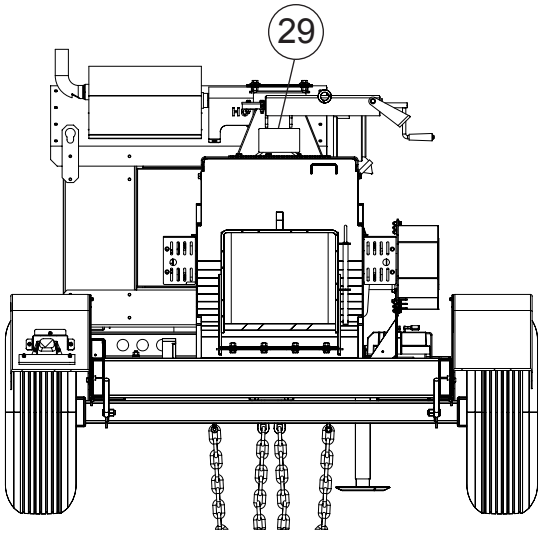




Section B - B

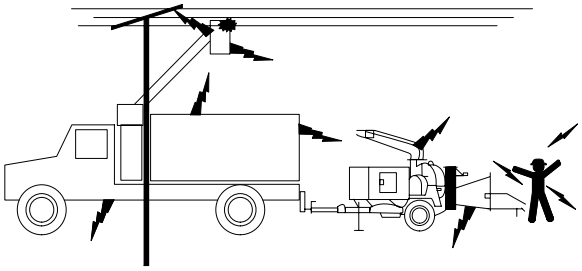


Section F - F



Section E - E

DANGER



ELECTROCUTION HAZARD!

Death or serious injury will result from contact with chipper, load, unit, vehicle, or vehicle attachments if any part of unit becomes energized.

All workers must understand and follow safe arboriculture work practices.

If any part of the tow vehicle is elevated within minimum approach distance of an energized conductor, all personnel must KEEP CLEAR!

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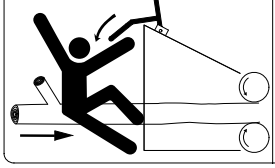
1

DANGER

PULL BAR DOWN TO STOP!

PANIC BAR



ENTANGLEMENT HAZARD!

Operator can become entangled in material being fed into chipper.
Chipper is extremely dangerous and shall be operated by trained operator only.
Understand and ensure proper operation of safety device prior to operation.
Failure to comply will result in death or serious injury.

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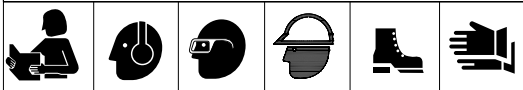
2

DANGER



OPERATION BY QUALIFIED PERSONNEL ONLY

Operating chipper without proper training will cause death or serious injury to yourself and others.

Do not operate equipment unless:

- You have been qualified/certified by your employer or other.
- You have read and understand operation and maintenance manual before operating or servicing chipper.
- You follow your employer's work rules, government regulations, and operating instructions found in manufacturers manuals, unit decals, and other material provided with this unit.
- You are sure equipment is operating properly and has been inspected, maintained, and tested in accordance with manufacturer's and government requirements.
- You are sure that all decals, covers, and guards are properly installed.
- You are wearing necessary protective equipment for hand, foot, head, ear and eye.

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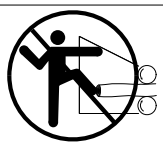
3

DANGER

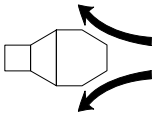
SEVER & CRUSH HAZARD!

This chipper will cause death or serious injury. ALWAYS follow all instructions and warnings listed below.

- NEVER reach near feed rollers or cutter blades.



- NEVER put any body part inside of in-feed chute.
- NEVER climb onto feed table or inside in-feed chute.
- NEVER push wood into in-feed chute with leg or foot.



- ALWAYS feed brush into chipper from the left or right of center. Release material before cutting mechanism fully grabs material.

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4

DANGER

SEVER & ENTANGLEMENT HAZARD!

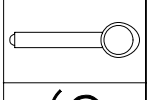
Contact with rotating disc, drum or shaft could cause death or serious injury.

Disc, drum, and drive components continue to rotate after engine is off.

- Read and understand operation and maintenance manual before operating or servicing chipper.

- Never open hoods, remove guards or covers, access knives, or perform any maintenance until all movement has stopped.

- Remove key and properly lock out/tag out engine operation.
- Ensure disc or drum has stopped.



- Use manufacturer's lock pin to lock disc or drum before performing maintenance.
- Never start engine when hoods, guards or covers are open or removed.

- Ensure all hoods, guards or covers are properly installed and secure with manufacturer's pins and fasteners before starting or operating chipper.

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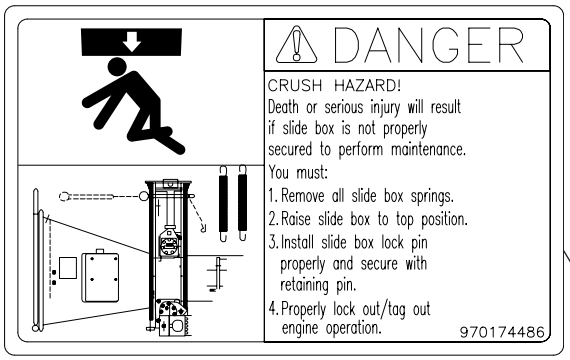
5


DANGER
CRUSH HAZARD!
Death or serious injury will result if slide box is not properly secured to perform maintenance.
You must:
1. Remove all slide box springs.
2. Raise slide box to top position.
3. Install slide box lock pin properly and secure with retaining pin.
4. Properly lock out/tag out engine operation.
970174486

6


PELIGRO
No opere este equipo a menos que usted haya leido y entendido todas las instrucciones de seguridad y de operacion y todas las calcommanias.
DANGER
Ne pas faire fonctionner cet equipement, sauf si vous avez lu et compris toutes les mesures de securite et des instructions operationnellas, et tous les autocollants.
970176388

7


WARNING
EXPLOSION HAZARD!
STAY AWAY! Battery can explode.
ACID BURN HAZARD!
Battery acid can blind and burn skin. Always wear protective equipment when servicing and/or working near battery.
Failure to comply could result in death or serious injury.
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8


WARNING
DROPPING PARTICLE HAZZARD!
Always wear goggle type eye protection.
Particles will drop when access door is opened.
Failure to comply could result in serious injury
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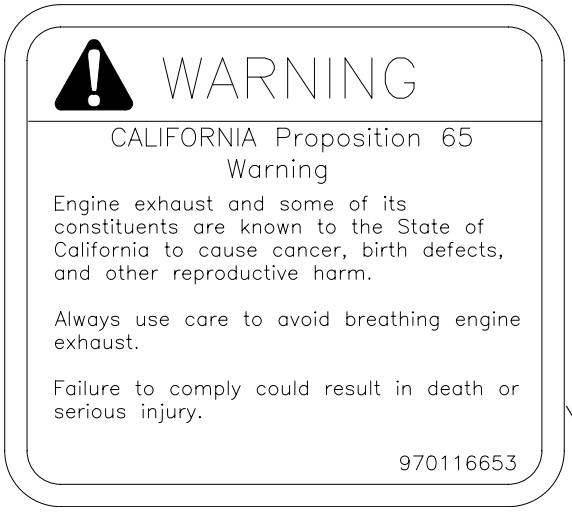
WARNING
CALIFORNIA Proposition 65 Warning
Engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.
Always use care to avoid breathing engine exhaust.
Failure to comply could result in death or serious injury.
970116653

10


WARNING
FLYING OBJECT HAZARD!
Death, serious injury, or blindness could result from objects thrown from discharge chute.
◦ Always wear eye protection
◦ KEEP DISCHARGE AREA CLEAR
970174499

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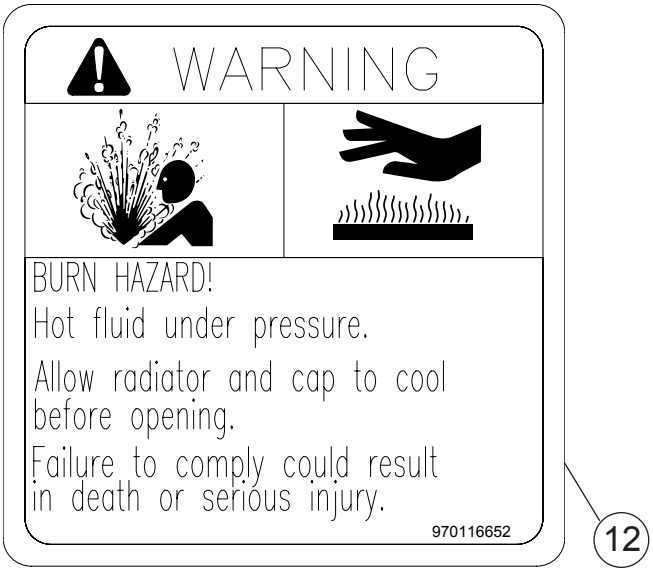

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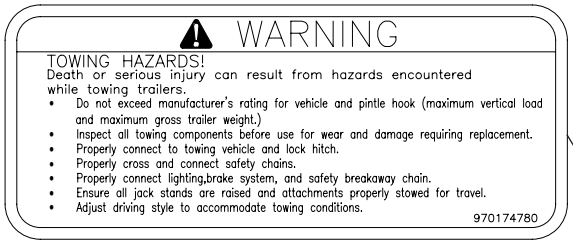

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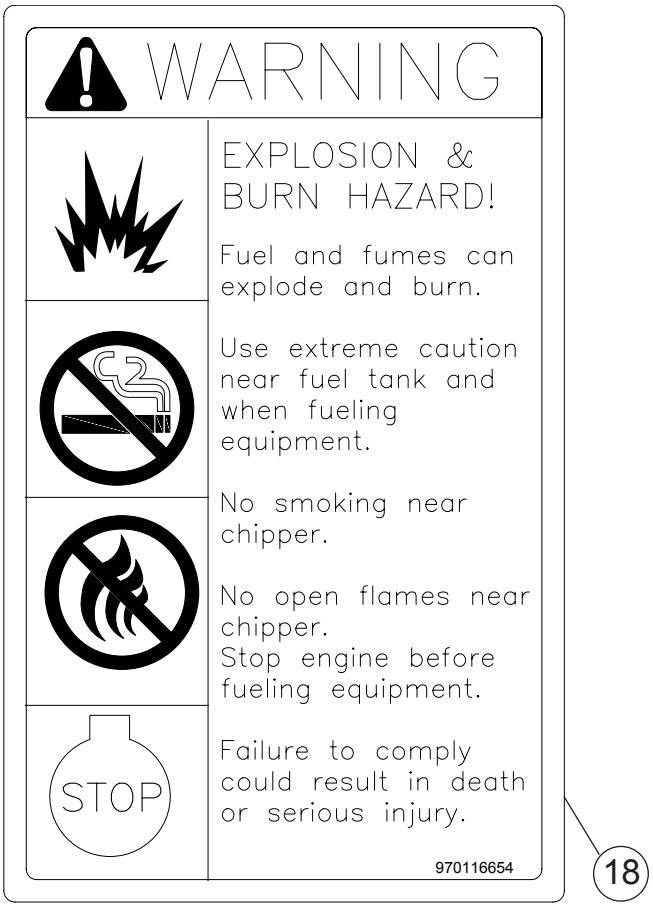

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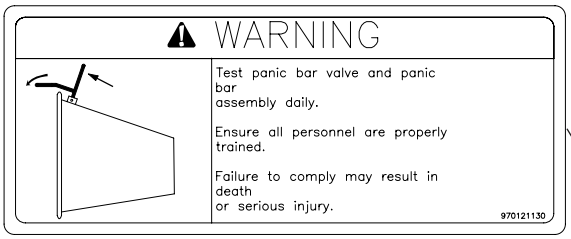

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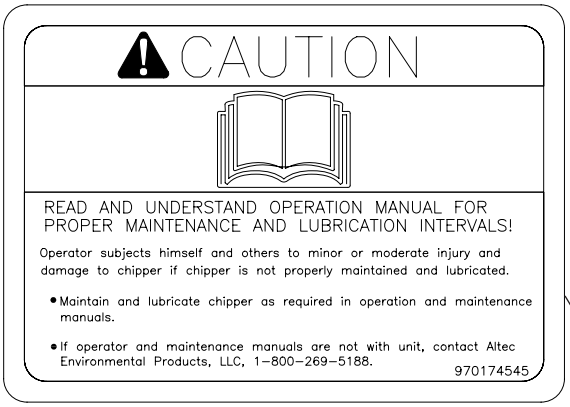

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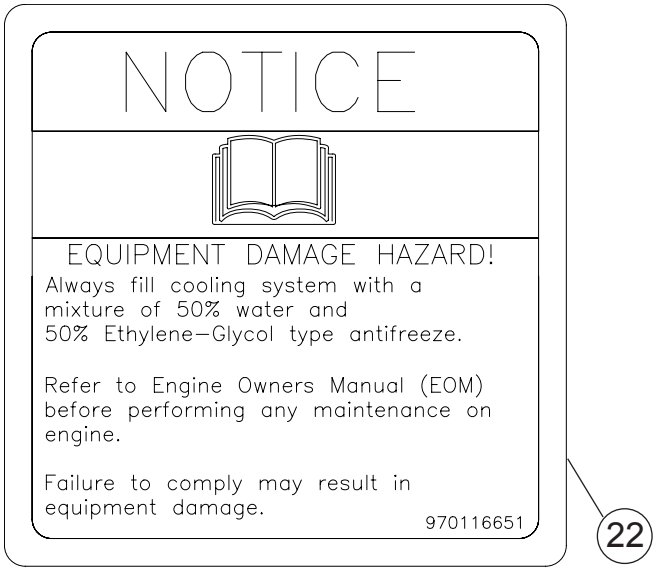

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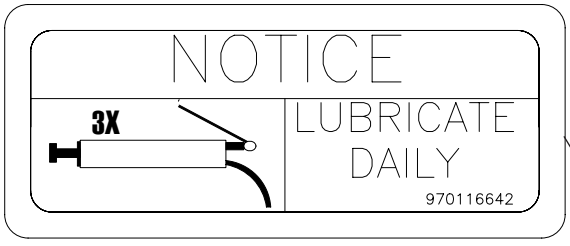

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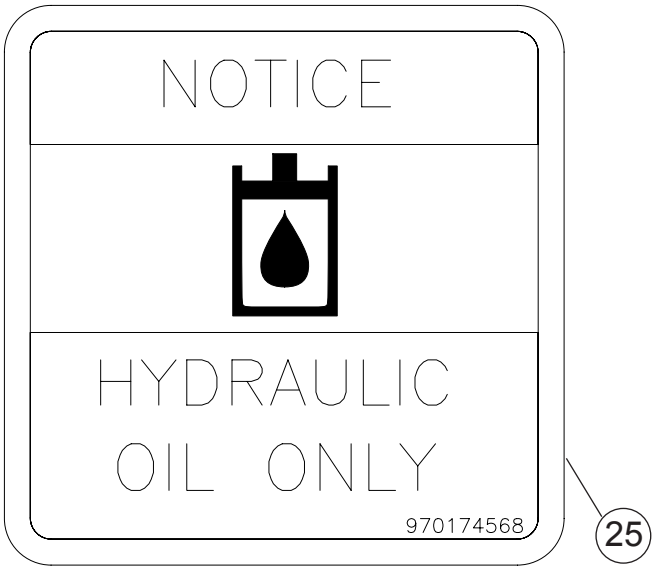
NOTICE
HYDRAULIC
OIL ONLY
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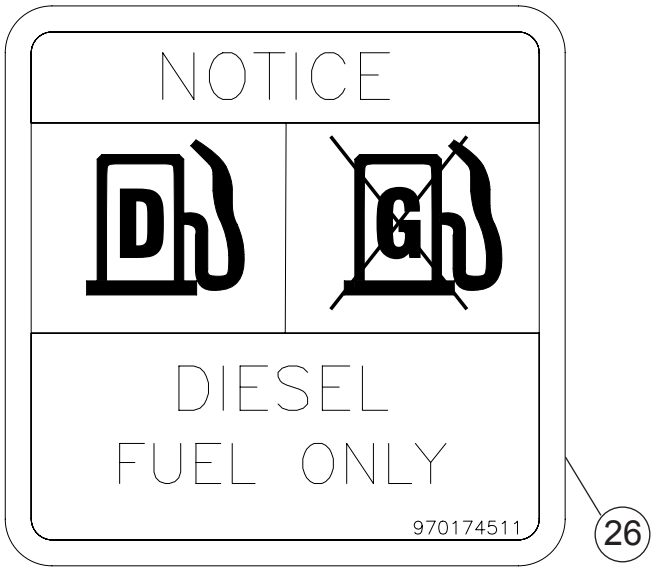
NOTICE
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FUEL ONLY
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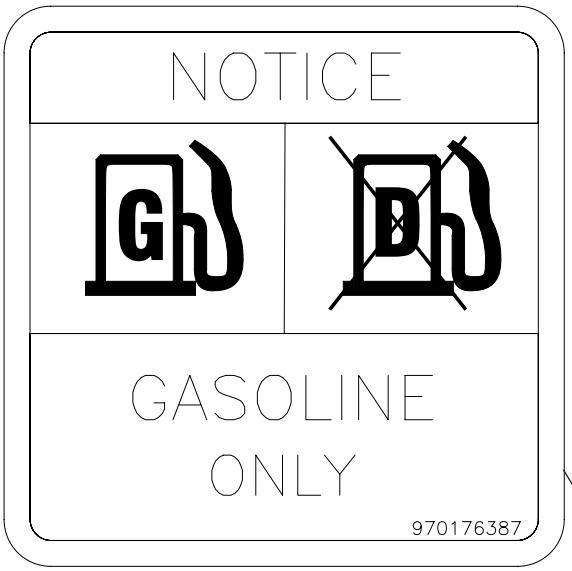
NOTICE
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GASOLINE
ONLY
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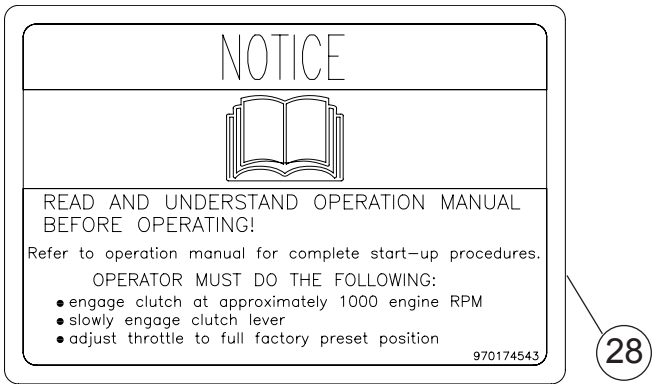
NOTICE
READ AND UNDERSTAND OPERATION MANUAL
BEFORE OPERATING!
Refer to operation manual for complete start–up procedures.
OPERATOR MUST DO THE FOLLOWING:
• engage clutch at approximately 1000 engine RPM
• slowly engage clutch lever
• adjust throttle to full factory preset position
970174543

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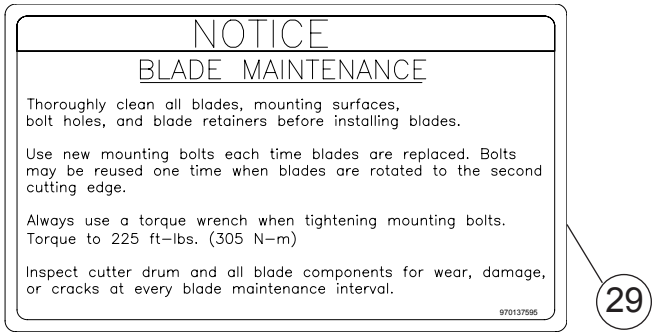
NOTICE
BLADE MAINTENANCE
Thoroughly clean all blades, mounting surfaces,
bolt holes, and blade retainers before installing blades.
Use new mounting bolts each time blades are replaced. Bolts
may be reused one time when blades are rotated to the second
cutting edge.
Always use a torque wrench when tightening mounting bolts.
Torque to 225 ft–lbs. (305 N–m)
Inspect cutter drum and all blade components for wear, damage,
or cracks at every blade maintenance interval.
970137595

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Daily Preoperational Inspection

Notice

Before the chipper is put into operation it is very important to read and follow procedures outlined in the engine manufacturer's Engine Owner's Manual (EOM).

To assist the reader in determining when to refer to the Engine Owner's Manual, look for this symbol (EOM). You will find this symbol used throughout the rest of this manual.

Danger

Death or serious injury will occur when accessing moving components. Do not access the rotor, disc or drive components until you have read and understand the Operator's Manual and all safety decals and placards. Drum and drive systems continue to move after the clutch has been disengaged and the engine has been turned off. Make sure that the drum and drive systems have come to a complete stop before attempting any maintenance in this area. Blades are extremely sharp. Care must be taken to avoid contact with the blades and blade pinch points.

Warning

Serious injury can occur when accessing blades or sharp components. Always secure the cutter to prevent rotation before tightening fasteners or performing maintenance in the drum housing areas. Never place any part of the body under or behind guards or any other visually obscured area.

Important Checks
The following checks should be performed prior to leaving the storage area.

- Check engine fuel, coolant, and oil levels (EOM).
- Check the engine air filter (EOM).
- Check all cap screws and nuts to make sure they are tight.
- Check cutting knives to make sure all attachment cap screws are tight and knives are in good condition.
- Inspect the anvil to make sure all attachment and adjustment cap screws are secure.
- Check all controls for free and proper operation.
- Inspect discharge chute to determine if it is clear, properly positioned and secure.
- Inspect the chipper frame and structure for any bent, broken, cracked, missing or loose parts. This includes the tongue tube, hitch, and all hardware associated with these items. Damage may be hidden on removable tongues by the receiver section of the frame. Make sure this area is undamaged and replace if unit has been jackknifed or there is indications of fatigue in this area.
- Check all guards to make sure they are undamaged, in place and properly secured, including the chip deflector curtain.
- All decals and placards must be in place and legible prior to operating the chipper.
- Check hydraulic fluid level. Fluid must be between 2" to 3" (5.08 to 7.62 cm) from the top of the tank when the fluid is cold.
- Check feed roller for debris.
- Check the transition area for debris that could lock the drum or disc during start up.
- Make sure the safety devices are properly installed and functioning properly.
- Make sure the folding feed table extension is in place and secure for both operation and travel.
- Verify that there are no loose tools or materials on the chipper or on the feed chute.
- Make sure the tires are properly inflated and wheel lug nuts torqued to the proper value in the Fastener Specific Torque Application Chart in the Appendix.
- Verify proper operation of the panic bar.
- Inspect the hydraulic system and look for signs of leaks or wear. Leaks shall be corrected, worn components replaced and the hydraulic level checked.

Danger

Moving components are extremely dangerous and will cause death or serious injury. Never open the rotor cover while the rotor is in motion.

Hitching to Tow Vehicle

Warning

Improper towing or hitching of the chipper to the tow vehicle can cause death or serious injury. Properly hitch chipper to tow vehicle, verify the road-worthiness of the chipper and tow vehicle, and verify all equipment is properly stowed. Check the tow vehicle's operating manual for rated towing capacity.

Do not tow the chipper unless all the important checks listed below are satisfactorily completed.

The chipper and tow vehicle, as well as the hitch and receiver create pinch points that can cause death, serious injury, or damage. Stay clear of these points during all operations and be aware as they change during movement of vehicles.

The chipper tongue weight is too great for one person to lift safely. Serious muscle strains can occur if attempted alone. Get help when hitching and unhitching the chipper.

Never stand between the tow vehicle and the chipper while the tow vehicle is backing. Make sure the tow vehicle is securely parked and the driver notified before approaching the area between the chipper unit and the tow vehicle.

- Chipper secured to tow vehicle and safety pin/latch or hitch locking devices secured.
- Secure jack stands in the travel position.
- Chipper frame must be level or the tongue slightly lower than the rear of the chipper while towing to make sure proper weight distribution. The hitch height may have to be adjusted when towing with vehicles of varying hitch height.

Warning

Death or serious injury can occur when towing a chipper with improper weight distribution. Loss of vehicle control can occur. Always check and adjust if necessary for proper weight distribution.

- Safety chains installed properly.
  a. Route chains under trailer tongue in an X pattern between tow vehicle and trailer.
  b. Adjust slack in chain to permit turning but not dragging on the ground.
  c. Make sure that the chains and connection points are secure and undamaged.
- Connect trailer wiring to the tow vehicle and make sure all trailer lighting is operating properly.
- Make sure that the safety breakaway switch is functioning properly and attached securely to the tow vehicle. Allow enough slack to make sure vehicle turns will not activate the safety breakaway switch.
- Make sure the tow vehicle has a properly adjusted brake controller. Refer to the brake controller's operating manual for proper operating, adjusting, and maintenance information.
- Check the general condition of the tires, tire pressure and make sure all lug nuts are securely fastened.
- For proper towing weight distribution make sure the discharge chute is properly secured in the forward pointing position.
- Verify there are no loose tools or materials on the chipper or in the feed chute.
- Check all cones, wheel chocks, signs, or other support tools and materials to ensure proper stowage.
- Make sure the folding feed table is secured in its closed position.

Fueling Chipper

Fill the fuel tank at the end of each work shift leaving a gap at the top of the tank for expansion of fuel. A full tank will not only maximize the work shift but will also reduce the possibility of condensation forming in the tank and moisture entering the fuel lines.

Warning

Gasoline and diesel fuel are dangerous. First and foremost they are highly flammable, they are easy to ignite, and they burn explosively. Secondly, exposure to gasoline or diesel fuel liquid or vapor can adversely affect health. Always ensure proper handling and storage of fuels. Improper handling and storage of fuels can result in death, serious injury, or illness.

To Avoid Fire

- Turn off all ignition sources (chipper and tow vehicle).
- Keep fuel away from any flame or spark.

- Discharge potential static electric charge buildup by touching chipper metal away from fuel tank with your hand prior to touching the fueling nozzle to the fuel tank.

- Do not smoke.

Controls

Warning

Death or serious injury can occur if the following procedures are not verified.

All operators must be properly trained.

Always make sure the PTO is disengaged before starting the engine.

Always make sure the hydraulic feed roller feed control bar is in its neutral position before starting the engine.

Always make sure all guards are in place and properly secured.

Caution

Improper engine operation can result in property damage. For engine operation always refer to the Engine Operations Manual (EOM) prior to starting the engine.

Feed Roller Operation

The feed roller(s) is controlled by pushing or pulling the feed control bar which is located on the top and both sides of the feed chute. The three control positions are as follows.

Reverse – activates the rollers to push material out of the chipper rotor cutting zone.

Neutral – stops movement of the feed rollers.

Feed – pulls material into the chipper cutting zone.

Warning

Death or serious injury can occur if controls are not operating properly. Make sure the feed roller control bar operates properly and freely before using the chipper. Do not operate the chipper if the components are damaged or do not operate smoothly, completely, and without binding.

PTO/Clutch Engagement

Warning

Death or serious injury can occur when working in the proximity of moving components.

The rotor/disc and drive system will continue to rotate after the engine has stopped and the clutch has been disengaged.

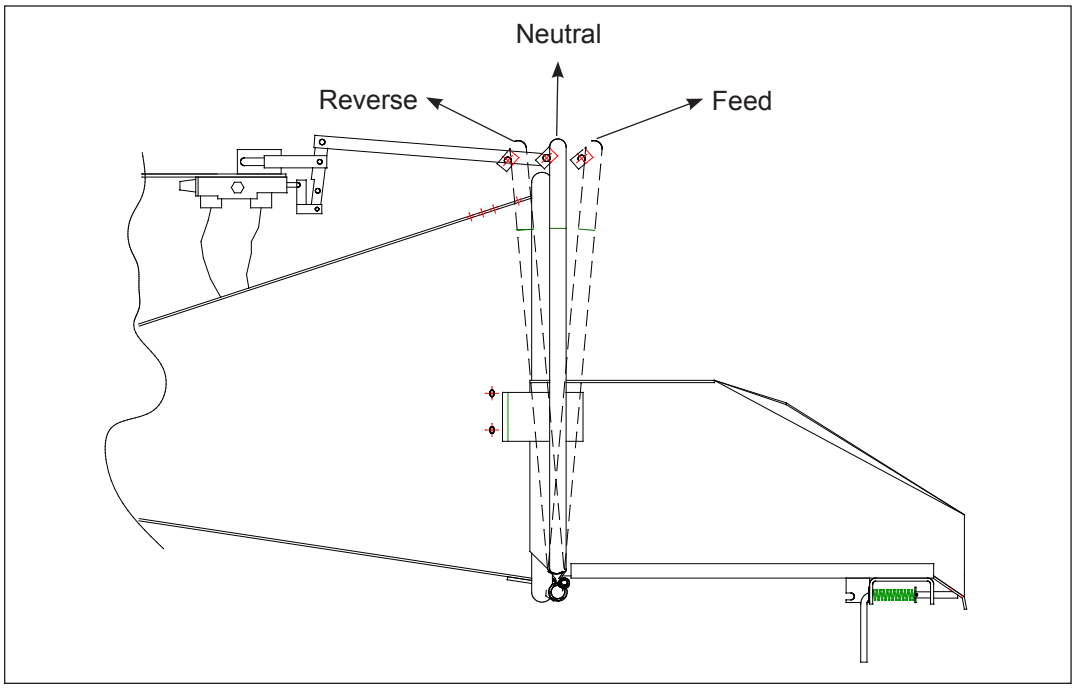

Figure 4.1 — Feed Roller Control Arm Movement

Do not attempt to perform service on the PTO, engine or chipper head until all movement has come to a complete stop.

Remove ignition keys, remove negative battery cable and lock battery box. Follow OSHA statute 1910.147 for proper lock-out procedures.

Do not leave the chipper unattended until all movement of the engine, disc, or drum has stopped.

Notice

Shown is a Stein PTO. The PTO supplied with the chipper may operate in a different manner. Please familiarize yourself with the proper operation of the PTO prior to chipper operation.

1. Verify infeed chute and feed roller areas are free from materials.

2. Verify discharge chute is properly directed and secured. Materials left in cutter housing or discharge chute may discharge during clutch engagement and rpm run-up.

Warning

Flying materials can cause death or serious injury. Always make sure the discharge chute is not pointed towards personnel.

3. Engine rpm should be at approximately 1,000 rpm or the engagement setting on fixed position throttles.

4. Slowly engage the clutch. Stop if any unusual sounds are heard. Investigate prior to proceeding.

5. After engine has stabilized at the engagement rpm, slowly increase engine rpm to the preset operating speed.

Notice

Property damage will occur when attempting a clutch engagement with a plugged cutter housing or discharge chute. Never attempt to unplug a chipper using rapid or repeated clutch engagements.

Work Site Preparation

Warning

Improper chipper setup or work site preparation can result in death or serious injury.

If you are unhitching the chipper from the tow vehicle, confirm the chipper wheels are blocked. Make sure the jack stand is undamaged and properly configured to support the weight of the chipper. Damaged jack stands should be replaced before supporting the chipper. Do not operate the chipper without being properly hitched to the tow vehicle. Failure to do so can cause serious injury and/or property damage.

The chipper tongue weight is too great for one person to lift safely. Serious muscle strains can occur if attempted alone. Get help when hitching and unhitching the chipper.

Never stand between the tow vehicle and the chipper while the tow vehicle is backing. Make sure the tow vehicle is securely parked and the driver notified before approaching the area between the chipper unit and the tow vehicle. Coordinate signals with all personnel to ensure accurate communication.

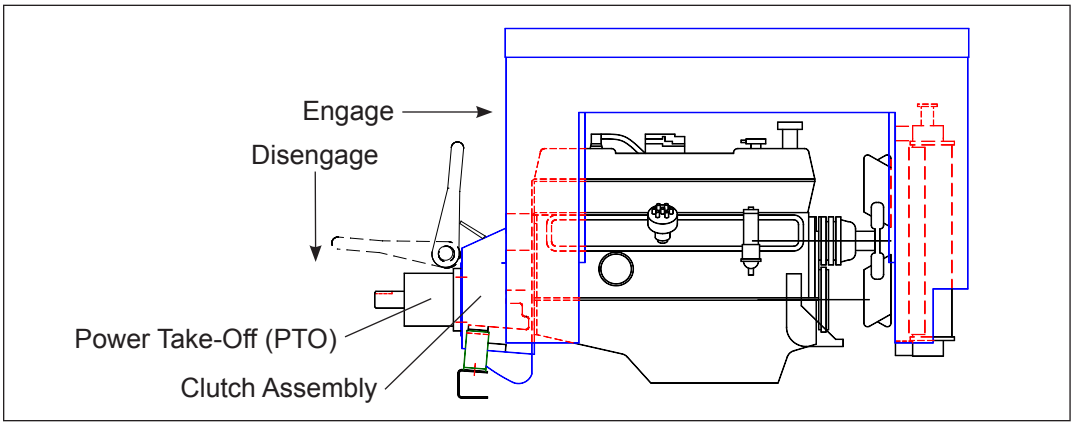

Figure 4.2 — PTO/Clutch Engagement

Make sure the discharge chute is properly directed and locked in place.

Prior to starting the engine, check the feed chute to make sure it is clear of foreign material such as wrenches, axes, etc.

Organization and preparation of the work site and brush is a major factor in safe chipper operations.

Operating personnel must observe the following points to ensure safety.

- Work sites should be clear of vehicle and pedestrian traffic.
- Signs, cones, ropes, barriers, and/or flagmen may be required to provide adequate warning and diversion of automotive and/or pedestrian traffic.
- Do not operate the chipper beneath a potential drop zone and verify that no one is performing work overhead of the chipper or chipper work zone.
- Provide a clear area on the curb side of the chipper to allow the operator to maneuver while feeding the chipper.
- Position the chipper in an area free of flammable materials to reduce the risk of starting a fire from sparks emitted from the engine exhaust or heat.

Danger

An electrically energized tow vehicle (such as an aerial device or crane) can also energize the chipper and will cause death or serious injury. Never approach a chipper that is connected to a vehicle operating in the proximity of power lines.

- Confirm that all operators are wearing the proper clothes and personal protective equipment.
- Restrict all personnel, except the operators feeding the chipper, from the feed and discharge areas of the chipper.

Warning

Death or serious injury can occur from projectiles associated with the normal operation of the chipper. Make sure pedestrian traffic, spectators, or any other personnel not operating the chipper are prevented from entering the work area around the chipper, or the chipper operational area. Secure and maintain an adequate work zone to make sure that material being fed, flying debris, and chips can not come in contact with those not operating the chipper.

The action of chipping produces projectiles such as chips and unchipped debris (sticks, limbs, brush, etc.) that can cause serious injury from both the discharge chute as well as the infeed chute.

- Set the chipper up on level ground with no stumps or trip hazards in the loading area. During chipper operation keep the loading area free of limbs, tools, or other objects which may become a trip hazard.
- Confirm all operators are properly trained, have read and understand all placards and decals, and are authorized by the employer.
- Make sure that all tools, ropes, and other work related objects are clear of the chipper and the chipper operational area and cannot come into contact or be drug into the chipper with the brush. Ropes, especially climbing ropes attached to someone, can result in death or serious injury.

Notice

The chipper operational area is the area around the chipper that has the potential for flying debris from the discharge chute or infeed chute and has the potential for material to be engaged by the chipper or to be fed by an operator into the chipper (material being dragged to the chipper).

Brush Preparation

Warning

Improper brush preparation can result in death or serious injury. Inspect brush for non-wood material such as anything made of metal, glass, or stone. Feeding such materials into the chipper will not only damage the cutting blades, they can even shatter, scattering blade fragments. These fragments can cause death, serious injury, and/or property damage.

Remove vines from the material being chipped and dispose of properly. Do not leave vines in the area around the chipper and do not attempt to place vines into the chipper. Material clothing or personnel entangled in vines can result in death or serious injury. Vines may hide foreign materials that can cause property damage.

Inspecting and organizing the brush prior to chipping will allow the job to be performed more efficiently and provide added safety in performing the job by minimizing the danger of foreign material, vines, etc., from entering the chipper. Pretrimming and proper delimbing will allow the brush to be drawn easily through the chipper.

- Arrange trees, tree limbs, or brush with the cut ends facing the chipper infeed chute.

- Do not cut the trees, tree limbs, or brush into short pieces, i.e., short logs or sticks.

- Do cut the trees, tree limbs, or brush into the longest lengths that can be safely and easily handled. This will reduce the number of pieces of material that have to be handled and fed into the chipper and will reduce the time required to perform the job. Cut wood at an angle to help ease the feed roller open and facilitate feeding. Chipper performance is best when the feed wheels are securely gripping the material as it is feeding into the rotor.

Warning

Serious injury can occur from improper handling of materials. Be sure to cut all trees, tree limbs, and brush into lengths that can be safely handled by the operating personnel available. Do not attempt to lift material that is too heavy to be lifted safely. Serious back injury can result from attempting to lift material that is too heavy or from improper lifting technique. Always keep your back straight when lifting and lift with your legs.

Notice

Know the limitations of the chipper. Never attempt to feed material too large for the chipper. Always precut large crotches to ensure adequate clearance through the transition area.

When preparing large material for feeding the chipper, properly trimming the crotches will greatly reduce the amount of downtime clearing transition/feed roller jammed materials. Either clear cut the limbs off the largest material to be chipped, or courtesy cut partially though the limbs which will allow the smaller limbs to fold back during the chipping operation.

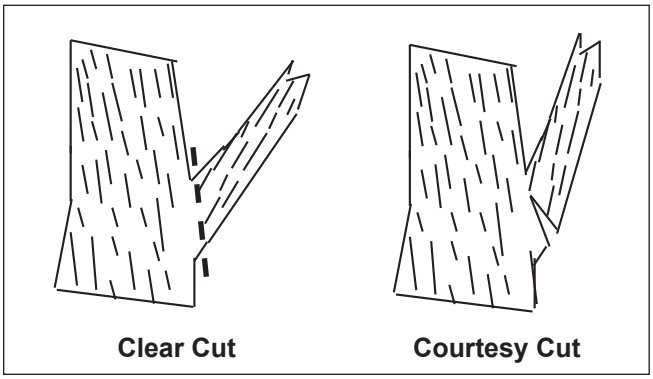

Figure 4.3 — Type of Cut

Consider the total width when utilizing a courtesy cut. The total width will include the diameter and radius of the bend of limbs as they fold back during the feeding process. Exceeding the opening size can result in lodging of material in the transition area.

Starting the Engine

Danger

Death or serious injury can occur if operators are not properly trained. You must read and understand the entire Operator's Manual and all safety decals/ placards prior to operation of the chipper.

Death or serious injury can occur when the chipper is operated without guards in place. Never start the engine with the rotor hood open.

Before starting the engine, check the feed chute to make sure it is clear of any foreign objects and that the discharge chute is directed away from personnel.

Notice

Disengage the clutch and place the feed control bar in the center neutral position. Never force the clutch lever. You can damage the linkage. Make sure the clutch handle has adequate free play before operating.

Never engage the starter for more than 30 seconds continuously. Allow two minutes between attempts to start. This will allow the starter to cool down.

Notice

Engine life will be significantly increased by allowing the engine to operate at a fast idle for 7 to 10 minutes before engaging the clutch.

The greatest amount of wear to an engine occurs when it is first started and is cold. The lubricating oil has drained back into the oil pan and does not flow freely to the entire engine when first started. To achieve the greatest life from your engine, do not operate at high speed or heavy loads until the engine has warmed up.

Refer to EOM supplied with the chipper for specific start-up, operational, and maintenance instructions.

Engaging/Disengaging Cutter Head

Engaging

Warning

Death or serious injury can occur with unexpected chip discharge or equipment movement. Make sure

that all personnel and individuals, not actively involved in the chipper feeding process, are removed from the chipper operational area and all personnel within the chipper operational area are notified before starting the engine on the chipper.

Notice

Failure to properly engage the PTO can damage the drive system and the PTO, which will not be a warrantable repair.

1. When the engine has reached operating temperature and is running smoothly at 1/4 to 1/3 throttle, slowly engage the clutch. Engaging the clutch too quickly or slowly can cause excessive clutch wear. During clutch engagement the operator must ensure clutch shaft movement. If no movement is heard or seen stop and investigate immediately. The ideal rate of engagement will cause the cutter rotor to rotate up to speed without causing the engine to lose speed or stall. If any unusual sounds or noises are heard stop engagement and investigate immediately.

2. With the clutch fully engaged and the engine running smoothly, set the throttle control to its maximum setting to bring the rotor up to the factory set cutting speed.

Notice

Always operate the chipper at full factory throttle position. The maximum throttle setting is factory preset. This provides maximum efficiency of the chipper. Tampering with the engine speed governor can cause property damage and will void the warranty.

Disengaging

Danger

Death or serious injury can occur if contact is made with rotating or moving components. Disengaged clutch rotor and drive systems continue to move after the clutch has been disengaged and the engine has been turned off. Make sure that the rotor and drive systems have come to a complete stop before attempting any maintenance in this area.

Turn the engine off. Remove the keys from the chipper ignition. Place these keys in your pocket.

Do not leave the chipper unattended until all movement has come to a complete stop.

1. Disengage the hydraulic feed system by moving the feed control bar to the neutral or center position.

2. Reduce engine speed to idle.

3. When the engine and rotor reach idle speed, disengage the clutch.

4. Turn off the ignition switch, and remove the key.

Warning

Death or serious injury can occur if attempts are made to access the cutter or drive system.

The rotor and drive system will continue to rotate after the engine has stopped and the clutch has been disengaged. The hydraulic feed system may continue to be operational until the rotor and drive system stop rotating.

Do not attempt to remove guards or attempt repairs until the rotor and drive system have come to a complete stop.

Feeding Brush to the Chipper

Warning

Feeding brush, limbs, and trees into the chipper is a potentially dangerous task. It requires constant attention, proper training, authorization by the employer, and an awareness of the dangers associated with this machine. Only those personnel meeting these requirements shall be allowed to operate or maintain this chipper. Failure to observe these rules can result in death, serious injury, or property damage.

Following the procedures outlined in this manual prior to operation, reading the entire manual, proper training, safe operations, preparation for operation, proper equipment and clothing, work site preparation, and brush preparation will reduce the risk of injury. However, every situation and action cannot be anticipated by Altec Environmental Products. All operators must use common sense and be constantly aware of the surroundings and situation. Traffic, coworkers, spectators, debris, brush, and other equipment constantly change the hazards so constant awareness and adaptation to those changes must be practiced. Placing yourself, or others into a dangerous situation, being careless or simply not paying attention can result in death or serious injury.

Never place hands, arms, legs, or feet into the infeed chute.

Never attempt to push material into the infeed chute using your hands or feet. Loss of life or limb will occur.

Do not use any item with metal components as a tool to push brush into the cutter mechanism. Blade failure

can occur and cause violent discharge from the cutter mechanism causing death or serious injury. Only materials which are being chipped should be used as push or drag tools.

- Feeding brush to the chipper involves a technique that requires a smooth continuous motion. Place the prepared brush on the feed apron, push it into the throat of the cutter housing, and then move quickly to the curb side of the chipper.

- Please follow the procedures and safety designations listed below.

Warning

Make sure the brush is not too large for the machine. Placing material that is too large for the opening can result in clogging or jamming of the material.

The operator shall stand to the side when operating the chipper. Material in the transition area could be kicked back while positioning the material into the feed chute. In the event there is debris in the transition, use another piece of wood to clear the transition area before standing behind the feed chute with the feed roller in a raised position.

While feeding the chipper it is common for material to be suddenly and violently kicked up or to the side. Never stand or position yourself directly above or beside material while being fed. Once material is engaged, quickly move away from the material. Unexpected advancement or movement of material could result in death or serious injury.

On equipment with FeedSense®, special care must be taken since the material starts and stops at intervals without warning. Never approach the material once it has become engaged by the feed roller. In the event that material has not advanced in a reasonable amount of time, reverse the material completely with the control bar and start the material again. Make sure the throttle is completely advanced to the factory preset setting to ensure proper operation of the FeedSense®.

Make sure the chip deflector curtain is in proper condition, in place, and secure. This device is provided to stop or reduce the velocity of any kickbacks during chipping operations. Operations without this device can cause serious injury.

During chipping operations, never position yourself directly behind the infeed chute. Brush or debris can be kicked back or up without warning, possibly causing serious injury.

Do not feed material while another operator is between you and the infeed chute. Only one operator should feed the unit at any given time.

Never attempt to lift material that is beyond your lifting capabilities and incorporate proper lifting techniques to avoid injury.

Improper use of cranes, winches, and tractors to load material can result in death or serious injury and can severely damage the equipment. The use of these types of lifting tools should be operated by experienced personnel that are trained in their proper use, understand the limitations of the chipper, can comprehend the ramifications and dangers of improper use and have been authorized by the employer to perform these procedures. Damage to the equipment through the use of non-attached or improperly used lifting devices may not be covered under the warranty.

Do not feed crotches or multiple pieces of wood that can become a pinch point during feeding.

Do not lean, stand, sit, or permit others to lean, stand, or sit on the feed apron during chipping operations. Loss of balance can result in death or serious injury.

Never reach into or lean over the feed table or into the feed chute. Death or serious injury will occur.

Keep the working area clear of limbs and debris. Tripping or entanglement can allow the operator to be dragged into the chipper causing death or serious injury.

Do not throw clean up sweepings into the cutter mechanism. Foreign material such as stones, wire or metal scrap can cause blade failure, resulting in serious injury.

1. Position the cut end of the brush toward the feed apron. Approach the feed apron from the curb side at an angle that will not position you directly in front but to the side of the feed apron to avoid brush kickback and traffic hazards.

2. Place the brush on the feed table. Feed the cut end toward the throat of the cutter housing. Release the brush before the hydraulic feeding mechanism fully grabs it and hydraulic auto-feed begins. Smaller pieces of brush may be thrown in on larger pieces being pulled.

3. As the brush begins to self-feed, quickly turn your face away from the chipper.

4. Keep moving quickly forward and to the curb side of the feed apron and do not wait for the brush to finish

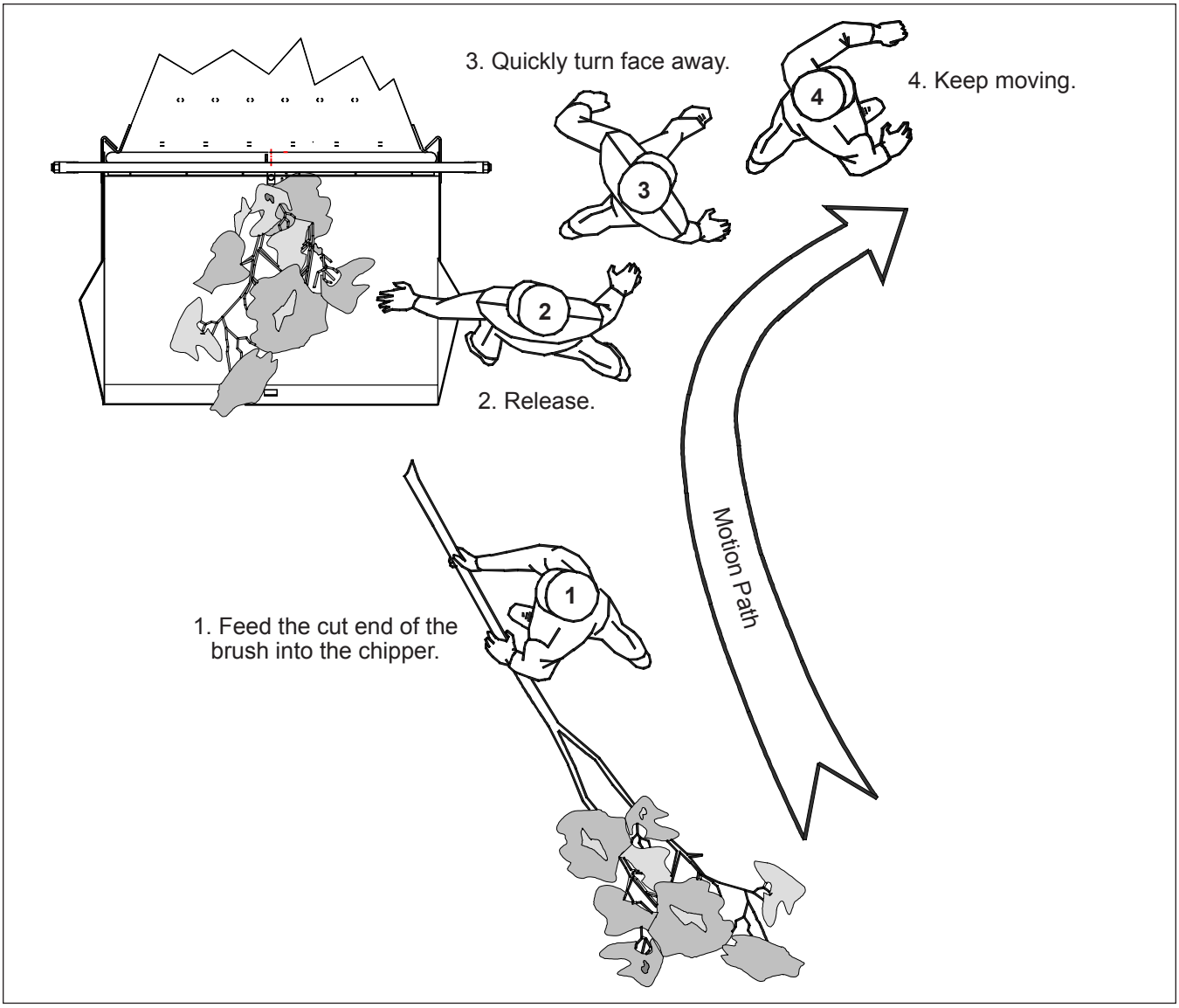

Figure 4.4 — Proper Brush Feeding Technique

feeding. The distinctive sound of the chipper cutting will confirm proper operation.

5. If the hydraulic feed wheels fail to grab and self-feed the brush, use a separate piece of brush to push the stalled brush toward the cutter until it begins to self-feed. Never position yourself directly behind the feed apron during this operation. Stand to the curb side of the apron.

6. Do not attempt to feed or re-feed small pieces of brush which remain on the feed apron. Reserve a large piece of brush as the last piece to be fed to the chipper. This will clean up any small pieces left on the feed apron.

7. When feeding large material into the chipper, place the leading edge of the material onto the infeed chute and feed it from the rear by lifting the material and pushing forward. Never stand or position yourself directly above or beside material being fed. Once material is engaged, quickly move away from the material.

Notice

Some chippers may be equipped with push paddles. Employers/owners with this option must make sure that all operators are instructed as to the following special requirements involved with its use.

8. Instruct operators to grip the handle with a relaxed grip and to release if entrapped in brush or feed roller.

9. Replace damaged or missing pusher. Do not use the paddle to push rakings that may contain rocks, metal or other non-wood materials.

Danger

Death or serious injury can occur if proper feeding techniques are not followed. Never place any part of the body including hands, arms, face, or torso above a piece of material that is being engaged into the feed rollers. Material can be violently kicked up or shifted causing death or serious injury through direct impact or entrapment between the material being fed and the chipper infeed chute.

Always release material as it engages with the feeding mechanism.

Figure 4.5 — Releasing the Material

Slide large material along bottom of feed chute from the rear pushing it into the chipper feeding rolls. Release material as soon as it engages with the rolls.

Figure 4.6 — Sliding Large Material

Winch Safety and Operation (Optional Equipment)

Read and understand the entire manual prior to operation of the chipper or the winch.

Warning

Improper use of the winch can result in death or serious injury. Only those properly trained and authorized by the employer shall operate the winch.

Engagement of the cable in the feed roller or cutter could result in death, serious injury, or property damage. Always remove the cable assembly prior to feeding material into the chipper.

Death or serious injury can occur due to personnel entanglement or crushing. Always make sure personnel are aware of cable/material location and changing pinch point hazards.

Safety

Wear all personal protective clothing and equipment as designated by your company policy, OSHA, or other governing organizations.

Make sure you place yourself and coworkers in proper, safe positions while hoisting. Always increase chipper operational area during winch operations. While hoisting always be aware of the pinch points between hand, foot, and body with the cable, wood and between towed object and any fixed objects. These pinch points are constantly changing during the hoisting operation. Cable may create cable loops on the ground, caution must be taken to avoid entrapment in these loops. Never pull with tow vehicle using the cable as a dragline. Always attempt to pull from directly behind the chipper. When not in use always properly stow hook and cable out of the feed zone area. Chipper must always be properly hitched to the tow vehicle and the vehicle must be properly chocked in place.

Daily Inspection

Inspect cable, hook assembly, and winch structure for damage or excessive wear prior to use. Ensure proper operation of winch controls. Cable must be inspected for broken/worn strands, or other physical damage which would degrade the operational load capacity. The hook must be inspected for wear and deformation such as hook opening spread. Hoist must be in good condition and all fasteners in place and properly tightened. Winch structure must be inspected for structural deformation, cracked or broken welds and proper fasteners in place and tight.

Operation
Place panic bar in the non-operational position. This will stop feed roller movement, and allow the winch and lift cylinder to continue operation. The winch control valve is located on the curb side of the infeed chute. Always keep tension on the cable while dereeling. Have an assistant walk the cable out to the desired location. Secure the cable to the material to be chipped 2' to 3' (61 to 91.4 cm) from the end. This will allow you to place the end of the material on the infeed chute or by lifting the feed roller into the feed roll bite. After hoisting the material to the desired position. Remove the cable and secure the hook in the storage position putting slight tension on the cable to remove any slack in the cable/hook assembly. To begin chipping, reposition the panic bar into the operational position.

Notice

Use of a separate choker strap or rope will extend the life of your winch cable.

FeedSense®

Maintaining proper operating rpm is a critical part of efficient chipper operation. If rpm is allowed to fall below design parameters the velocity of discharging chipped material will fall, resulting in discharge chute clogging.

The FeedSense® system automatically controls rpm through control of the hydraulically driven feed roller(s). When the system is on, the controller senses cutter speed. When the cutter drops to a preset minimum rpm, the feed roller(s) is temporarily stopped until the engine recovers to its preset operating rpm. After engine recovery, the FeedSense automatically begins the forward feeding process and continues as long as rpm is maintained above the low set point.

⚠ Danger

Death or serious injury can occur when entangled with material being feed into the chipper. Sudden and automatic advancement of the material will occur when the FeedSense® is activated. After material has been engaged by the chipper always stay clear of possible entanglement hazards.

To View Battery Voltage

LCD Display: **12.0** — Press and Hold Both Buttons: ▼ + ▲

To View Total Hours

LCD Display: **82.8** — Press and Hold: ▲

To Disable Output

LCD Display: **off** — Press and Hold for Four Seconds: ▼

In this mode, the LCD will alternate displaying engine rpms for 9 to 10 seconds and off for 1 second. To revert to Enable Outputs simply press set button ● once.

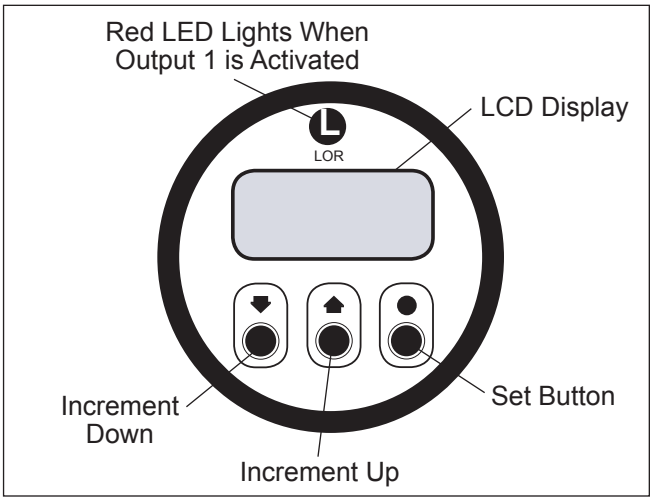

Figure 4.7 — FeedSense Display

Restoring Factory Settings

Press and hold ▼ + ● while turning ignition key to the On position. Continue to hold until the display reads dEF

Release buttons.

Scroll Feature
The scroll briefly displays each of the OEM program settings once. This allows the user to view every parameter without risking an inadvertent programming change.

Press and hold while turning ignition key to On position. 

Release button.

After each of the OEM program settings have been displayed once, the gauge reverts back to normal operation.

Section 5 — Clearing Plugs

Clearing Feed Rollers

Danger

Death or serious injury can occur if proper plug clearing procedures are not followed. Only personnel that have been properly trained, understand the dangers, and are authorized by the employer may perform this operation.

Extreme care must be taken when removing material or performing service in the feed roller area.

Never place any part of the body into the feed roller area. Use a stick or other nonmetallic object to clear this area of debris.

In the event of material jammed between the feed rollers and the drum, attempt the following actions before attempting the mechanical actions contained in this section.

Extreme care must be taken when removing material or performing service in the transition chute area. Before beginning any procedure make sure all movement of the engine, rotor, and feed roller have come to a complete stop. Remove keys from the ignition and place in pocket. Follow LOTO procedures.

Always make sure the feed roller assembly is secure before attempting maintenance in the feed roller/transition area.

Never reach into or place any part of the body into the transition chute.

Always use appropriate tools to remove jammed materials. Never reach into the feed chute.

1. By pushing forward on the control bar attempt to reverse the material backward.

2. With the drum at operational speed, attempt to load another log into the feed rollers. This action may advance the jammed material.

3. With the drum at operational speed, attempt to load brush on the top of the jammed material. This action may advance the jammed material.

4. If equipped with a lift cylinder, raising or lowering the cylinder may advance the material.

Chippers With Optional Lift Cylinder Kit

1. Move feed roller control arm to the neutral position. Make sure the feed rollers have come to a complete stop.

2. Using the lift cylinder valve, raise the upper feed roll assembly to its maximum position.

3. Install the upper feed roll lock pin into position.

4. Turn engine off and remove keys.

5. Remove negative battery cable.

6. Lock battery box.

7. Make sure all movement of drive components and cutter assembly have come to a complete stop.

8. Using appropriate tools remove any material interfering with the rotation of the cutter mechanism.

9. Reconnect battery cable.

Danger

Death or serious injury can occur if proper chipper configuration is not used. Do not feed material into the chipper with the upper feed roll in the locked open position.

10. Restart engine.

11. Return upper feed roll to the normal operating position.

Chippers Without Optional Lift Cylinder Kit

1. Move feed roller control arm to the neutral position. Make sure the feed rollers have come to a complete stop.

2. Make sure the chipper is properly coupled to the tow vehicle.

3. Remove the front jack stand and remount on the front side of the slide box assembly.

4. Using the jack stand, raise the upper feed roll assembly to its maximum position.

5. Install the upper feed roll lock pin into position.

6. Turn off the engine and remove the keys.

7. Remove negative battery cable.

8. Lock battery box.

9. Make sure all movement of drive components and cutter assembly have come to a complete stop.

10. Using appropriate tools remove any material interfering with the rotation of the cutter mechanism.

11. Restart engine.

12. Return upper feed roll to the normal operating position.

Danger

Death or serious injury can occur when personnel come in contact with pinch points. Never attempt to pry open the feed rollers. Rollers must only be opened using either the lift cylinder or the Altec Environmental Products supplied jack.

Always be aware of pinch points during the lifting operation. These dangerous pinch points are changing during the lifting operation. Never place any part of your body between the feed rollers.

Clearing Discharge Chute

Danger

Death or serious injury can occur if proper clearing procedures are not followed. Only personnel properly trained and authorized may perform this operation.

Never operate the chipper with the discharge chute removed or material jammed in the chute.

Never attempt to clear the discharge chute while the chipper is in operation.

Always make sure the engine is shut off and all drive and cutter components have come to a complete stop.

Follow LOTO procedures.

Always use proper hoisting equipment.

The plugged discharge chute can weigh more than 200 pounds (90.7 kg). Use appropriate hoisting equipment when removing the chute.

1. Attach hoisting equipment to chute.

2. Unbolt the eight $^{5}/_{16}$" bolts, remove the split ring.

3. Using the hoisting equipment remove the chute.

4. Use appropriate tools to unplug the chute.

5. Check drum housing/chute transition and clean out if necessary.

6. Reinstall discharge chute.

Notice

PTO or drive train may be damaged from chute plugging or attempting to start the chipper with obstructions in the rotor housing or discharge chute. This damage is not covered under the chippers warranty policy.

There are many factors contributing to discharge chute clogging. Most of these factors are controllable through proper maintenance and operator training.

Listed below are the most common problems associated with chute clogging and the suggested corrective action.

Stringy Chip Discharge
- Dull or damaged knives. Change knives.
- Dull or damaged anvil. Change anvil.
- Incorrect anvil/knife clearance. Adjust to proper gap
- Improperly sharpened knives

Poor Chip Discharge Velocity
Engine must operate at the maximum factory preset governor speeds. During operation the engine speed must not be permitted to drop more than 200 to 300 rpm. Engine speed is controlled by using the control bar and through proper brush preparation and feeding techniques.

Chipping Leafy or Wet Materials
Feed chipper slower than dry material and mix large heavier limbs with leafy wet material to purge the drum housing and discharge chute of smaller wet materials.

Units Equipped With FeedSense®
Make sure FeedSense® is in the on position.

Disc Speed Slows But Engine rpm Remains High
- Make sure belts are properly adjusted and belt or pulleys are not worn.

- Make sure the clutch is properly adjusted.

Section 6 — Care of the Unit

Warning

Only qualified and authorized personnel shall perform repairs or maintenance on this equipment. Improper maintenance or repair can result in death, serious injury, or property damage.

Notice

Use checklists in the Appendix as daily, weekly, monthly, and yearly guides for preventive maintenance.

Only properly trained personnel should perform maintenance or repair of the equipment. Consult Altec Environmental Products, LLC before performing any maintenance procedure that is not specifically covered in this or the maintenance manuals. Improper maintenance or repair may void any and all warranties on this equipment.

The following engine information is general in nature and applies to some of the popular engines available for the chipper. For specific information please refer to your EOM.

Warning

Disengage clutch and the hydraulic feed system.

Remove keys from the ignition switch and place in pocket.

Never reach into the engine cowling or within the engine panels with the engine running. Making contact with moving parts can result in death or serious injury.

Use caution when accessing the engine cowling or in the vicinity of the engine exhaust. Components may be extremely hot and could result in serious injury should contact be made between components and flesh.

Engine Oil

The engine oil level should be checked each day or when the engine has been operated for 10 hours, whichever comes first. It is preferable to check the oil level after the engine has been stopped for a period of time. This allows the oil in the upper section of the engine to drain down into the oil pan. This will allow you to obtain an accurate measurement of the level of oil in your engine. If the level is low, refer to your EOM for the recommended viscosity and type of oil for your engine.

Change the engine oil and filter according to schedules and instructions provided in your EOM.

Engine Coolant

Warning

Severe burns will occur if you attempt to remove the radiator cap off a hot engine. Never check the coolant when the engine is hot. Allow the engine to cool down first. Refer to the EOM for proper procedures. Always make sure proper eye and hand protection is worn when servicing the coolant system.

Check the coolant level before starting the engine at the beginning of each work period. The coolant level should not be less than 1” (2.54 cm) below the top of the radiator upper tank. Refer to the EOM for proper coolant and mixture ratio.

Warning

Severe burns will occur if you attempt to remove the radiator cap off a hot engine. You must never attempt to clean or inspect the radiator with the engine running or while the engine is hot. Engine coolant is extremely hot. Do not attempt to remove the radiator cap until the engine has cooled to a safe temperature range. Always remove the radiator cap slowly and with extreme caution due to temperature and pressures in the coolant system.

The engine radiator can quickly become plugged with wood particles. This will cause improper engine cooling, and may cause extensive damage to your engine. Many factors contribute to the buildup of wood particles in the radiator. The main contributor to radiator plugging is clouding of particles from the chipper discharge to the engine radiator area. Directing your discharge downwind of the engine radiator area or if discharging into a chip bed the use of chip box screens or canvases will greatly reduce this clouding effect. Proper belt condition and coolant mix-ratio/level are also critical to proper engine cooling. The radiator should be inspected and cleaned on a daily basis using compressed air only. Do not use water to flush the coolant fins of the radiator. Any wood particles left from a water flush will harden and become extremely difficult to remove.

Notice

Improper radiator maintenance can result in engine damage that will not be covered under the engine warranty.

Engine Air Filter

Due to the varying degrees of dust produced during the normal chipper operation, it is critical to the life of your

engine to maintain a clean air filter. Do not hit the filter against an object to clean the filter. Check your filter weekly and clean or replace as specified in your EOM. Failure to properly maintain the engine intake system and filters can quickly decrease the engine's effective horsepower and cause engine failure. Failures due to improper air intake system maintenance are not covered under engine warranty.

Clutch and Power Take-Off (PTO)

The PTO clutch mechanism is supplied by the engine manufacturer. It is very important to lubricate the PTO bearings, clutch levers, and linkage. For specific information and lubrication interval requirements refer to your clutch/PTO owner's manual. Proper inspection, operation, and maintenance of the clutch will greatly increase the useful life of the chipper clutch. Improper operation or maintenance of the clutch will void clutch warranty.

Inspection

- Verify all cap screws, pins, and linkage components are in good condition and properly tightened.
- Verify adequate free play on the clutch handle/linkage assembly. With the clutch in the engaged position (handle vertical) there should be approximately 1" to 1½" of free play at the end of the handle without pressure being applied to engage the clutch.
- Without proper free play, premature failure of the clutch will occur.

Notice

Damage occurring from improper clutch adjustment will not be covered under warranty. Refer to PTO owner's manual for detailed adjustment procedures.

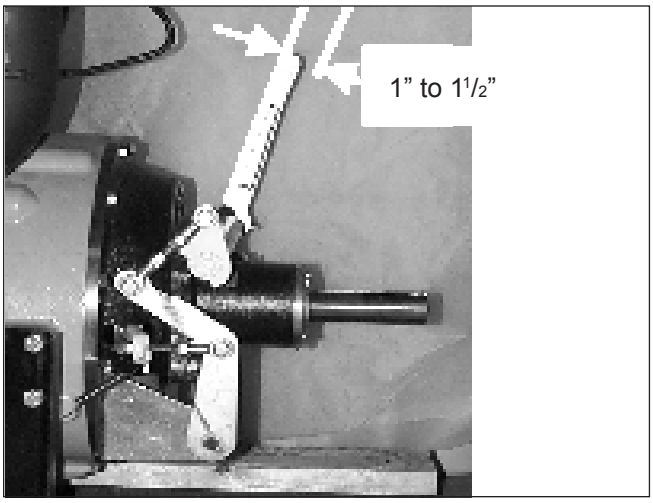

Figure 6.1 — Clutch Free Play

Fuel Tank

Fill the fuel tank at the end of each work shift leaving a gap at the top of the tank for expansion of fuel. A full tank will not only maximize the work shift but will also reduce the possibility of condensation forming in the tank and moisture entering the fuel lines.

Warning

Gasoline and diesel fuel are dangerous. First and foremost they are highly flammable, they are easy to ignite, and they burn explosively. Secondly, exposure to gasoline or diesel fuel liquid or vapor can affect health adversely. Always ensure proper handling and storage of fuels. Improper handling and storage of fuels can result in death, serious injury, or illness.

To Avoid Fire

- Turn off all ignition sources (chipper and tow vehicle).
- Keep fuel away from any flame or spark.
- Discharge potential static electric charge buildup by touching chipper metal away from fuel tank with your hand prior to touching the fueling nozzle to the fuel tank.
- Do not smoke.

Warning

Long term exposure to vapors has caused cancer in lab animals. Engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

To Minimize Health Risk

- Avoid prolonged breathing of vapors.
- Keep face away from nozzle and gas tank.
- Keep away from eyes and skin.
- Never siphon by mouth.

Battery

Warning

Battery acid can burn skin and cause severe eye injuries. Use eye and hand protection when performing battery maintenance.

After 100 hours of operation or once per month, whichever occurs first, inspect the battery for accumulated corrosion

at the terminals. If found, mix two tablespoons of baking soda to one pint of water and apply with a small brush to terminals. When finished, be sure to flush the surface of the battery with water. Remove any excess water and coat the terminals with light grease or petroleum jelly to reduce the possibility of corrosion forming. Also check the battery cables for wear and all cable connections and battery tie downs to be certain that they are not loose.

Fasteners

Fasteners should be visually inspected on a daily basis, physically torqued weekly for the first 30 days of operation and monthly thereafter. All fasteners must be in place at all times and properly torqued. Torque values are given for specific fasteners where applicable. For fasteners in general, refer to Torque Values in the Appendix.

Tires and Wheels

Refer to tire manufacturer specification for proper tire inflation. Make sure tires are in good condition.

Torque wheel lug nuts to the value in the Fastener Specific Torque Application Chart in the Appendix.

Tongue and Hitch

Warning

Never attempt to tow this chipper if the hitch or tongue tube is damaged or fatigued. Damage as a result of jackknifing the chipper may require the removal of the tongue tube (on units with removable tongue tubes) from the frame for a thorough inspection. Towing with a damaged tongue tube could result in death or serious injury if the tube fails while being transported.

Transporting with a damaged hitch or tongue tube can result in death, serious injury, or property damage.

- Inspect tongue and hitch cap screws for wear or elongation of the mounting holes.
- Grease all contact and moveable components of the hitch.
- If tongue or hitch show any wear they must be re-paired or replaced immediately.

Notice

Always utilize a spotter when backing to prevent jackknifing and the resulting serious damage that will occur.

Axle Bearings

Warning

Failure to properly maintain the wheel bearings can result in axle failure, additional equipment damage, death or serious injury.

Standard axles on Altec Environmental Products, LLC chippers have the E-Z Lube feature. This feature flushes and lubricates both the inner and outer wheel bearings. If your axle is equipped with the E-Z Lube feature, the bearings can be periodically repacked and lubricated without removing the hubs.

The procedure is as follows.

1. Remove the rubber plug from the end of the grease cap.
2. Place a standard grease gun onto the grease fitting located in the end of the spindle. Make sure the grease gun is fully engaged on the fitting.
3. Pump grease into the grease fitting. The old, displaced grease will begin to flow back out the cap around the grease gun nozzle.
4. When the new, clean grease is observed, remove the grease gun, wipe off any excess, and replace the rubber plug in the cap.
5. The trailer wheel bearings should be repacked once a year or every 20,000 miles (whichever comes first). Use a premium grade, high temperature lithium based EP #2 grease.

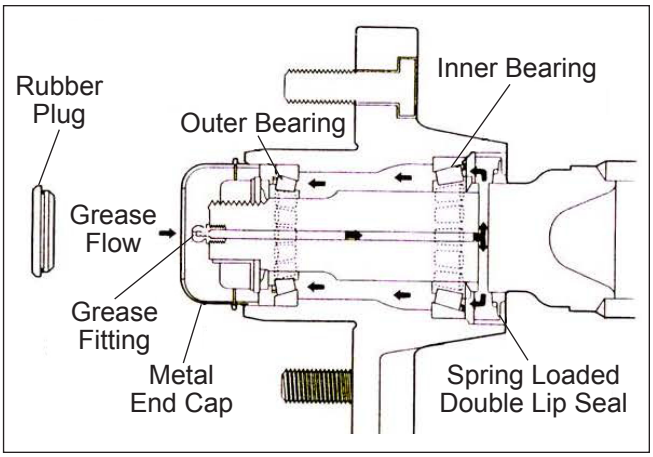

Figure 6.2 — E-Z Lube

Chipper Electric Braking System

The primary activation of the braking system is through the brake controller of the tow vehicle to the electrical chipper/tow vehicle connection through the chipper wiring harness and into the electrically operated brake assemblies. A secondary system starts with the chipper battery through the breakaway switch, chipper wiring harness and into the electrically operated brake assemblies. This secondary system is only operational when the breakaway switch is activated. This system should never be activated except for testing or in an emergency chipper/tow vehicle separation.

Synchronizing Tow Vehicle Controller

To ensure safe brake performance and synchronizing, read the brake controller manufacturer's instructions completely before attempting any synchronization procedure.

Caution

Before road testing, make sure the area is clear of vehicular and pedestrian traffic. Failure to brake safely could result in an accident and serious injury to yourself and others.

Make several hard stops from 20 mph (32.3 kph) on a dry paved road free of sand and gravel. If the trailer brakes lock and slide, slightly decrease the gain setting on the controller. If they do not slide, slightly increase the gain setting. Adjust the controller just to the point of impending brake lockup and wheel skid.

Notice

Not all trailer brakes are capable of wheel lockup. Loading conditions, brake type, wheel and tire size can all affect whether a brake can lock up. It is not generally considered desirable to lock up the brakes and slide the tires. This can cause unwanted spotting of tires and could also result in a loss of control.

For proper braking performance, it is recommended that the controller be adjusted to allow the trailer brakes to come on just slightly ahead of the tow vehicle brakes. When properly adjusted, there will be no sensation of trailer jerking or pushing the tow vehicle during braking.

Breakaway Braking System

To ensure proper operation of the breakaway system, the chipper battery and charging system must be operating properly. The chipper must be properly hitched to the tow vehicle. This must include the following.

- The hitch properly fastened and all retaining pins secured.
- Safety chains crossed in an X pattern under the tongue and secured to the tow vehicle. Allow enough slack in the chains for turning.
- Breakaway cable must be of shorter length than the chains.

In the event of an unwanted separation of the chipper from the tow vehicle, the tongue should drop into the cradle formed by the X pattern of the chains. The breakaway cable must pull the plunger from the switch before the entire tongue weight of the chipper comes to a rest in the chain cradle.

When the breakaway switch is activated, full voltage from the chipper battery is applied to the brakes. The chipper will come to a complete stop, but will not lock up the brakes.

Testing of the breakaway can be accomplished by jacking up the chipper, spinning the wheel, and pulling the plunger. The brakes should apply. Further testing can be done on a wet, icy, or gravel covered road surfaces. With the tow vehicle traveling at 10 to 15 mph (16.1 to 24.1 kph) activate the breakaway switch. The tires may lock up on a slick or unstable surface.

Notice

The breakaway switch is to be used for emergencies only. The breakaway system rapidly discharges the battery when the plunger pin is removed. Reinstall plunger immediately after completion of test.

Inspection and Maintenance

The chipper brakes must be inspected and serviced immediately if a loss of performance is indicated. With normal use, servicing at one year intervals is usually adequate. With increased usage, this work should be done more frequently as required. Magnets and shoes must be changed when they become excessively worn or scored, a condition which can reduce vehicle braking.

Brake Adjustment

Adjust brakes as follows.

- After the first 200 miles of operation when the brake shoes and drums have seated.
- At 3,000 mile intervals.
- As use and performance requires.

Hinge and Friction Points

Chipper operation and longevity can be improved by keeping all hinges and friction points lubricated. Altec Environmental Products, LLC recommends that lubrication be performed weekly. Use SAE 30 weight oil on hinges and a premium grade, high temperature lithium based EP #2 grease on friction points.

Drum and Feed Roll Bearings

Lubricate daily with a premium quality NLGI #2 grade multipurpose roller bearing grease. Some suggested greases are: Mobile Mobilith AW 2, Shell Alvaina Grease 2, Texaco 1939 Premium RB, Amoco Rykon Premium Grease #2 or an equivalent. Grease each bearing daily with three or four pumps using a standard grease gun.

Notice

Always lubricate bearings and fill fuel and hydraulic tanks at the end of each work day. This will displace any moisture in the bearings and tanks. Also lubricate thoroughly prior to any extended shutdown or storage.

Due to extended use or extreme conditions, additional maintenance intervals and/or component inspections may be necessary.

Blade/Anvil Replacement

Danger

Death or serious injury can occur when blade changing or adjusting procedures are not followed. Only properly trained, authorized personnel which have read and understand the entire manual, placards and decals shall access the cutter head or perform blade maintenance.

Accessing the Cutter Head

1. Reduce engine speed to low idle.
2. Turn engine off. Remove keys from the chippers ignition. Place these keys in your pocket.
3. Remove negative battery cable.
4. Properly lock-out chipper (refer to LOTO procedure).
5. Inspect rotor and drive train to ensure no movement of drive components.

Danger

Accessing rotor or drive areas prior to all movement coming to a complete stop will cause death or serious injury. Rotor and drive system continue to move after the clutch has been disengaged and the engine has been turned off. Make sure the drive system has come to a complete stop prior to accessing this area.

Warning

Never place any part of the body in a potential pinch point. This not only applies to the head and feed roller, but also rotor and engine sheave/belt contacts.

Blades are extremely sharp. Care must be taken to avoid contact with the blades and blade pinch points. Always wear appropriate hand protection when performing inspections or replacing blades. Failure to do so will result in severe injury.

The recommend service interval for blade maintenance is eight hours or daily. However the actual service interval may be more or less, depending upon the wood being chipped and the chipping conditions. Always complete a thorough inspection if foreign objects are fed through the chipper.

Warning

Always replace blades as sets. Rotor balance can be affected if matched blades are not kept together.

Blade Installation and Adjustment

1. Follow shutdown LOTO procedure.
2. Remove the six 1/2" cap screws securing the top rotor access cover.
3. Position the rotor and install rotor locking pin.
4. Remove anvil access cover (refer to Anvil Removal).
5. Loosen anvil screws (do not remove) and push anvil back to achieve maximum blade/anvil clearance.
6. Remove blade cap screws, Do not use impact tool to remove or install cap screws.
7. Make sure all mating surfaces between the cutter blades and drum are clean and free of debris and corrosion.
   a. When a blade is removed from the drum, the blade mounting surfaces must be clean of any debris

or corrosion and inspected for any damage. An uneven or damaged surface may cause blade separation.

b. Inspect threads in the threaded back-up bars for wear, corrosion, or damage. Replace as necessary.

8. Inspect blades for cracks or distortion. Replace if cracks or distortion are found.

   a. Thoroughly clean the blades and inspect both sides of each knife for cracks. If any cracks are found, discard the blade.

   b. Using a straight edge against the blade mounting surface. Check for any blade distortion by sliding the straightedge both perpendicular and parallel to the cap screws holes. Any light seen between the blade and the straightedge indicates a distorted blade. Any distorted blade must be discarded.

9. Inspect cap screws for damage or corrosion. Replace as necessary. Blade cap screws can be used twice. Always replace blade cap screws when using resharpened or new blades.

10. Inspect threaded blade keeper bars for corrosion or damaged threads. Replace if any damage or corrosion is found.

11. Install new or rotated blades with sharp edge out.

12. Tighten blade cap screws per specifications given in the fastener torque table. Do not use an impact tool.

13. Refer to anvil installation for anvil/blade clearance procedure.

14. Replace all guards and safety devices.

Danger

Death or serious injury can occur if using cracked or distorted blades. Inspect blades per required inspection intervals and discard cracked or distorted blades.

Death or serious injury can occur if blade separation occurs. Any debris left on the mounting surface can prevent the blade from lying perfectly flat on its matting surface. Improper cap screw torque or use of worn or damage cap screws can cause blade separation. Always make sure proper maintenance and replacement parts are used.

Notice

When installing new or sharpened blades, discard the existing mounting cap screws and use new Altec approved cap screws. Repeated reuse of the cap screws will decrease their clamping capacity.

Drum Inspection

The cutter drum, air paddles, and blade pockets must be thoroughly inspected for cracking or deformation. If cracking or deformation is found please contact Altec Environmental Products.

Blade Sharpening

Notice

The blades are double edged and have a minimum usable size of 2" (5.08 cm) measured from the centerline of the cap screw holes to the blade edge. Do not use a side of a blade that measures less than this.

- Sharpen blades at a 30 degree angle.
- Use a soft J grade grinding wheel with a 36 to 40 grit.
- Use adequate coolant while grinding.
- Hone blades between sharpening.

Notice

On resharpened blades, measure the distance from the mounting holes to the sharpened edges. Mount blades so edges with the same measurements are oriented the same way at both blade locations.

Anvil Removal/Installation

Danger

Blades and anvils are extremely sharp and can severely cut your hands. Anytime you are storing, handling or performing maintenance on blades or anvils you must wear good quality leather palm work gloves. This will greatly reduce the possibility of serious injury.

Falling objects can cause serious eye injury.

Always wear goggles when working overhead.

Anvil Removal

1. Remove the four $^{1}/_{2}$-13 cap screws securing the hinged anvil access cover and anvil/blade gap gauge.

2. If needed rotate the drum so cutter blades are not in the work area.

3. Remove the four $^{5}/_{8}$-11 cap screws.

4. Remove the anvil and thoroughly clean all anvil/drum head mating surfaces.

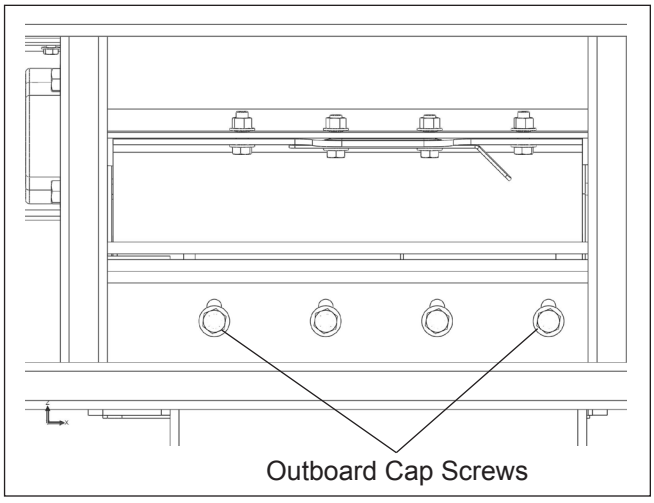

Figure 6.3 — Anvil

Anvil Installation

1. If blades are to be rotated or changed this should be completed first. Refer to blade installation.

2. With all areas in the anvil location clean and free of debris, install the anvil positioned with an unused cutting edge at the blade to anvil cutting point.

3. Install the four anvil cap screws, do not tighten.

4. Slowly hand rotate the drum. Using the anvil gap gauge, set the anvil to a blade clearance at the outboard cap screw to 1/8". Hand tighten this outboard cap screw.

5. Rotate the drum to the other blade, set the outboard gap and hand tighten the outboard cap screw.

6. While verifying correct gap setting. Slowly hand rotate the rotor across all anvil/blade contact points to ensure proper blade/anvil clearance. Adjust as necessary.

7. Torque anvil cap screws to specifications in the fastener torque table.

Warning

Death or serious injury can occur from blade separation. Never use an impact wrench to tighten blade or anvil cap screws. Always use a torque wrench.

Appendix

Glossary

2nd stage boom — see intermediate boom.

3rd stage boom — see upper boom.

A-frame outrigger — an extendible outrigger having two diagonal members which are connected at the top and joined near the midsection by a horizontal cross piece. Resembles a broad based "A."

above rotation — in reference to a position on or about a unit that is vertically above the rotation bearing.

absolute — a measure having as its zero point or base the complete absence of the item being measured.

absolute pressure — a pressure scale with the zero point at a perfect vacuum.

access hood — hinged part of the disc housing used to access the cutter disc.

accumulator — a container used to store fluid under pressure as a source of hydraulic power or as a means of dampening pressure surges.

actuator — a device for converting hydraulic energy into mechanical energy, such as a motor or cylinder.

adapter — a device used to connect two parts of different type or diameter.

adhesion promoter — surface prepping solvent for UV coating.

adjusting stud — a component of a cable drive system that is threaded on both ends and has a hex adjusting flat in the center. It secures the drive cable to the cylinder rod and can be used to adjust the tension of the drive cable.

aeration — the entrapment of air in hydraulic fluid. Excessive aeration may cause the fluid to appear milky and components to operate erratically because of the compressibility of the air trapped in the fluid.

aerial control valve — the control valve on the turntable of an elevator unit which operates the movement functions of the aerial device.

aerial device — a vehicle-mounted device with a boom assembly which is extendible, articulating, or both, which is designed and used to position personnel. The device may also be used to handle material, if designed and equipped for that purpose.

Allen wrench — a six-sided wrench that fits into the hex socket of a cap screw or set screw.

American National Standards Institute (ANSI) — a self-governing body of professionals whose primary objective is to prevent accidents by establishing requirements for design, manufacture, maintenance, performance, use and training for manufactured goods including aerial devices and digger derricks.

anaerobic adhesive — a bonding agent or adhesive that cures in the absence of air.

analog signal — an electrical signal that communicates information by the continuous variation of voltage or current level within a defined range, in proportion to an input parameter such as pressure or control lever position.

annular area — a ring shaped area. Usually refers to the piston area minus the cross-sectional area of the rod of a hydraulic cylinder.

ANSI — see American National Standards Institute.

anti-two-block (ATB) system – the system that helps prevent damage to the winch line or boom by preventing a two-blocking condition from occurring, by shutting off certain functions when the load hook, overhaul ball, hook block, or other lifting component that is attached to the winch line approaches near the boom tip.

antirotation fork — a two-pronged retainer which is fastened to the inside of the turntable and used to prevent movement of the rotary joint outer housing.

antifoam additive — an agent added to hydraulic fluid to inhibit air bubbles from forming and collecting together on the surface of the fluid.

antiwear additive — an agent added to hydraulic fluid to improve the ability of the fluid to prevent wear on internal moving parts in the hydraulic system.

anvil — The stationary blade on a chipper cutting mechanism.

arbor bar — the shaft or spindle that is used to support a cable reel.

arbor bar collar — a cylindrical device that is used to secure a cable reel on an arbor bar.

arm — **1:** the primary load-carrying structure of an articulating arm. **2:** the primary load-carrying structure of a single elevator. **3:** the articulating structure which supports the arbor bar for reel lifting.

arm cylinder — the hydraulic cylinder that moves the arm of a single elevator up and down.

articulating arm — a system located between the turntable and lower boom of an aerial device which is used for lifting the boom assembly to increase the platform working height. This system includes the arm, link(s), riser and articulating arm cylinder.

articulating arm cylinder — the hydraulic cylinder that moves an articulating arm up and down.

articulating-boom aerial device — an aerial device with two or more boom sections that are connected at joint(s) which allow one boom to pivot with respect to the adjacent boom.

ASTM — American Society for Testing and Materials.

atmosphere (one) — a pressure measure equal to 14.7 psi.

atmospheric pressure — pressure on all objects in the atmosphere because of the weight of the surrounding air. At sea level, about 14.7 psi absolute.

atmospheric vents — a vacuum prevention device designed to allow air to enter a hydraulic line that has encountered an internal pressure below that of the atmosphere (vacuum).

attention — information that must be followed to reduce the likelihood of property damage. Property damage could include structural damage to the unit, component failure, or damage to nearby property.

auger — the hole boring tool of the digger, consisting of a hollow tube with hardened teeth attached at one end to dig into and break up soil and/or rock as the auger is rotated. Several turns of flighting are welded to the tube to carry the loose material away from the teeth.

auger extension shaft — a shaft which fits into the auger tube to connect the digger output shaft to the auger.

auger rotation hydraulic system — the hydrostatic system on a pressure digger which operates the auger transmission gearbox.

auger stow bracket — the bracket on a digger derrick lower boom which stores the digger and auger assembly when it is not in use.

auger stow switch — a limit switch which is actuated by the auger to shut off digger operation in the stowing direction when the auger reaches its fully stowed position in the auger stow bracket.

auger transmission gearbox — the gearbox mounted on the mast weldment of a pressure digger that is used to rotate the kelly bar.

auger tube — the hollow tube at the centerline of an auger to which the auger flighting is welded.

auger windup sling — the cable or strap attached to the auger stow bracket which is used to store the digger and auger.

auxiliary engine — a separately mounted engine that is used to provide power for the unit's hydraulic system.

auxiliary hydraulic system — the secondary hydraulic system of a pressure digger that operates all the hydraulic functions except auger rotation.

AWS — American Welding Society.

back pressure — pressure existing in the discharge flow from an actuator or hydraulic system. It adds to the pressure required to operate an actuator under a given load.

backlash — the clearance at the tooth contact point between the adjacent gear teeth of two or more meshing gears.

baffle — a device, usually a plate, installed in a reservoir to separate the return line inlet from the suction line outlet.

band of arrows — decals used on extendible and articulating upper booms to define the boom tip area and the insulating portions of the upper boom and lower boom insert.

bare-hand work — a technique of performing live line maintenance on energized conductors and equipment whereby one or more authorized persons work directly on an energized part after having been raised and bonded to the energized conductors or equipment.

barrel — the hollow body of a hydraulic cylinder into which the piston and rod are assembled.

base boom — see lower boom.

base end — **1:** the closed end of a hydraulic cylinder, opposite from the end that the rod extends from. **2:** the end of an extendible boom that is

closest to the turntable. **3:** the end of an articulating boom that remains positioned closest to the turntable when the boom is fully unfolded.

basket — see platform.

battery charger — a device used to restore the electrical charge in a battery.

bearing — a machine part that is installed between two adjacent machine parts to allow those parts to rotate or slide with respect to each other. Commonly used to decrease friction or wear on components.

behind cab mount — a pedestal mounting position located immediately behind the vehicle cab on the longitudinal centerline of the chassis.

below rotation — in reference to a position on or about a unit that is vertically below the rotation bearing.

below rotation controls — controls that are located on the chassis, used for operating some or all of the functions of the unit.

bleed-off — to reduce the trapped pressure in a hydraulic system, line, or component, to a zero state by allowing fluid to escape under controlled conditions through a valve or outlet.

blocking valve — a two-position, two-way valve that blocks pump flow to a hydraulic circuit or system when it is not actuated, and opens to allow fluid when actuated.

body — a structure containing compartments for storage of tools, materials, and/or other payload which is installed on a vehicle frame or subbase.

body belt — a component in a personal fall protection system consisting of a strap which is secured about the waist of a person, with a means for attaching it to a lanyard. (As of January 1, 1998, the use of a body belt for personal fall protection is prohibited by OSHA.)

body harness — a component in a personal fall protection system consisting of an assembly of straps which are secured about the waist, chest, shoulders, and legs of a person, with a means for attaching the assembly to a lanyard.

bolt — a cylindrical fastener with external screw threads at one end and a head configuration such hexagonal, square, or round at the other end, which conforms to the dimensional and material specifications published for bolts. (These specifications are different from those for cap screws.)

boom — a movable, mechanical structure that is used to support a platform, material handling components and/or other attachments on a unit.

boom angle indicator — a device which indicates the angle between the boom centerline and a horizontal plane.

boom flares — steel structures mounted on the boom tip of a digger derrick which are used to protect the boom tip from loads and support poles carried on the winch line.

boom functions valve — the control valve on a digger derrick that directs hydraulic pressure and flow to the boom functions (boom, rotation, intermediate boom, upper boom) hydraulic circuits.

boom limiting system — the system of hydraulic cylinders or a combination of switches that prevent the platform from moving into a non-working position.

boom pin — the horizontal pin that connects the lower boom to the turntable or riser.

boom rest — the structural member attached to the chassis or body to support the lower boom in the travel or rest position.

boom stow switch — a limit switch which is actuated to shut off the boom lower function when the boom reaches its stowed position in the boom rest.

boom stow valve — a mechanically actuated hydraulic valve that limits the downward pressure of a boom as it is placed in its rest.

boom tip — the area at the end of an extendible or articulating upper boom that is farthest from the turntable when the boom assembly is extended or unfolded. This area includes all components at the end of the boom above the band of arrows.

boom tip idler sheave — the upper sheave in a digger derrick upper boom tip containing two sheaves, which carries the winch line as it travels from the winch to the lower sheave (boom tip sheave).

boom tip pin — a horizontal pin at the upper boom tip. Platform mounting bracket(s) and material handling devices are fastened to this pin.

boom tip sheave — **1:** the sheave in a digger derrick upper boom tip containing only one sheave, which carries the winch line as it travels from the winch to the load. **2:** the lower sheave in a digger derrick upper boom tip containing two sheaves, which carries the winch line as it travels from the upper sheave (boom tip idler sheave) to the load.

boom tip tools — see upper tool circuit.

boom tip winch — a winch located at the tip of a boom.

bore — the inside diameter of a pipe, tube, cylinder barrel, or cylindrical hole in any of various other components.

boss — protruding material on a part which adds strength, facilitates assembly, provides for fastenings, etc.

brake — a device used to slow or stop the rotation or movement of a component such as a rotation gearbox, winch, gravity leveled platform, or arbor bar.

brake caliper — mechanical assembly that houses the brake pads and piston used to apply stopping force on the brake rotor.

brake controller — interface between tow vehicle and electric trailer brakes. Can be inertia activated or based on time delay from activation of vehicle brakes. Typically in the tow vehicle's driving compartment with electrical line running to the trailer wiring connector. Most require the user to adjust brake gain to compensate for varying trailer load. Necessary for the use of electric trailer brakes.

brake rotor — rotating disk attached to a shaft that transfers the force from the brake caliper to the shaft.

break-away switch — a device which automatically activates the breaking system of a towed unit when unintentionally separated from the towing vehicle.

breather — a device that permits air to move in and out of a container or component to maintain atmospheric pressure.

bridge mount — a unit mounting configuration in which the turntable is mounted on a pedestal structure which forms a bridge over the cargo area.

broadband — a high speed telecommunication system utilizing fiber optic and/or coaxial cable.

bucket — see platform.

buckeye — see forged pin retainer.

bullwheel assembly — an assembly of steel rollers used as a portion of a cable stringing system.

burst pressure — the minimum internal pressure that will cause a hose, tube, cylinder, or other hydraulic or pneumatic component to rupture or split open.

button head — a type of cap screw with a rounded head containing a socket into which a tool can be inserted to turn the cap screw.

bypass — a secondary passage for fluid flow.

bypass valve — a hydraulic valve that allows for an alternate passage for fluid flow.

cable — **1:** a wire or wire rope by which force is exerted to control or operate a mechanism. **2:** an assembly of two or more electrical conductors or optical fibers laid up together, usually by being twisted around a central axis and/or by being enclosed within an outer covering.

cable chute — a device used to guide cable into strand for lashing the cable to the strand when placing cable. A trolley allows the device to ride on the strand as cable is fed through the chute.

cable drive system — an upper boom drive mechanism which utilizes cables to produce upper boom movement.

cable guide — a bracket which is mounted on a boom to guide the winch line.

cable keeper — **1:** a mechanical device attached to a cable that is used to maintain the position of the cable on a sheave. **2:** a component used to prevent a cable or winch line from coming off a sheave.

cable lasher — a mechanical device which wraps lashing wire in a spiral configuration around a length of suspension strand and adjacent communication cable.

cable lug — a mechanical device attached to a cable that is used to maintain the position of the cable on a sheave.

cable placer — a type of aerial device which contains a cable stringing system and associated components for use in erecting overhead communication cable.

cable slug — the steel end fitting at each end of the drive cable in an upper boom drive system. One end is attached to the cylinder rod and the other is secured in a pocket on the elbow sheave.

cable stringing system — the group of steel rollers, bullwheel assemblies, strand sheave assemblies and fairlead which directs communication cable or suspension strand from the reel it is stored on to the working position of the operator.

calibrate — to check, adjust, or determine by measurement in comparison with a standard, the proper value of each scale reading or setting on a meter or other device.

caliper — a measuring instrument with two legs or jaws that can be adjusted to determine the distance between two surfaces.

cam — a rotating or sliding piece that imparts motion to a roller moving against its edge or to a pin free to move in a groove on its face or that receives motion from such a roller or pin.

candling — a method of inspecting filament wound fiberglass booms by slowly passing a light through the inside of the boom in a darkened area. Cracks, crazing, and other damage show up as dark spots or shadows.

cap — a device located on the hand of a reel lifter that is used to retain the arbor bar.

cap end — see base end.

cap screw — a cylindrical fastener with external screw threads at one end and a head configuration such as hexagonal, hex socket, flat countersunk, round, or slotted at the other end, which conforms to the dimensional and material specifications published for cap screws.

capacitive coupling — the transfer of electrical energy from one circuit to another through a dielectric gap.

capacity chart — a table or graph showing the load capacity, rated capacity, or rated load capacity figures for a unit or accessory.

captive air system — a closed circuit, low pressure pneumatic system used to actuate a pressure switch by means of a manually operated air plunger.

cartridge — **1:** the replaceable element of a fluid filter. **2:** the replaceable pumping unit of a vane pump, composed of the rotor, ring, vanes and side plates. **3:** A removeable hydraulic valve that is screwed into place in a cavity in a hydraulic manifold or cylinder.

catrac — see hose carrier.

caution — information that indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

cavitation — the formation of gaseous voids in hydraulic fluid caused by a low pressure condition which typically occurs when inlet starvation prevents the pump from filling completely with fluid. The characteristic sound of cavitation is a high pitched scream.

center mount — see behind cab mount.

center of gravity — the point in a component or assembly around which its weight is evenly balanced.

centerline of rotation — the vertical axis about which the turntable of a unit rotates.

centrifugal pump — a pump in which motion and force are applied to fluid by a rotating impeller within a housing.

chain — a series of identical rigid segments connected to each other at joints which allow each segment to pivot with respect to adjacent segments, used to transmit mechanical force.

chain extension system — a mechanical system consisting of a motor, gearbox, chains, and sprockets that is used to extend and retract an extendible upper boom.

chain sling — an inverted Y-shaped length of chain used for lifting a strand reel with an aerial device and placing it in a strand carrier.

chamber — a compartment within a hydraulic component that may contain elements to aid in operation or control, such as a spring chamber or drain chamber.

channel — a fluid passage that has a large length dimension compared to the dimension of the cross-section.

charge — to fill an accumulator with fluid under pressure.

charge pressure — the pressure, above atmospheric pressure, at which replenishing fluid is forced into the hydraulic system.

charge pump — the hydrostatic hydraulic system pump that provides fluid at low pressure to make up for internal leakage, provides cooling fluid flow, and tilts the hydrostatic pump swash plate.

chassis — a vehicle on which a unit is mounted, such as a truck, trailer, or all-terrain vehicle.

check valve — a valve that permits flow of fluid in one direction, but not in the reverse direction.

chip curtain — rubberized deflection curtain attached to the infeed chute.

chip deflector — directs chip discharge.

circuit — the complete path of flow in a hydraulic or electrical system.

circuit breaker — a form of electrical switch which opens (trips) to interrupt a circuit when it senses excessive current flow that may be caused by a short circuit, to protect wiring and components from damage. Some types of circuit breakers reset automatically when the excessive current discontinues and others must be reset manually.

clean out — clean out area under the lower feed roll.

clevis — a U-shaped fastening device secured by a pin or bolt through holes in the ends of two arms.

closed center — a directional valve design in which pump output is blocked by the valve spool(s) when the valve spool(s) is in the center or neutral operating condition.

clutch — **1:** the device on a reel lifter which allows the connection and disconnection of the arbor bar and the driver. **2:** controlled transfer of rotational power from engine to output PTO shaft.

coaxial cable — a type of shielded cable used for conducting telecommunication signals, in which the signal carrier is a single wire at the core, surrounded by a layer of insulating material, which is in turn surrounded by a metallic, conductive layer which serves as a shield, with an overall outer layer of insulation.

combined digger derrick and platform use — the stability criteria for a digger derrick mobile unit which indicates that the load capacity chart and stability requirements apply to the use of the derrick for lifting of loads with the winch line at the upper boom tip or material handling jib tip, with the platform occupied.

come-along — a device for gripping and putting tension into a length of cable, wire, rope, or chain by means of two jaws or attaching devices which move closer together when the operator pulls on a lever.

communication cable — a copper wire, coaxial, or fiber optic cable used for conducting telecommunication signals.

compensating link — a mechanical linkage that serves as a connector between the turntable and the upper boom drive mechanism. As the lower boom is raised or lowered, this linkage causes the upper boom to maintain its relative angle in relationship to the ground.

compensator — a valve spool that is used to maintain a constant pressure drop regardless of supply or load pressure.

compensator control — a control for a variable displacement pump that alters displacement in response to pressure changes in the system as related to its adjusted pressure setting.

component — a single part or self-contained assembly.

compressibility — the change in volume of a unit volume of a fluid when it is subjected to a unit change in pressure.

conductive — having the ability to act as a transmitter of electricity. Electricity will flow through metal, therefore metal is conductive.

conductive shield — a device used to shield the lower test electrode system from capacitive coupling.

conductor — a wire, cable, or other body or medium that is suitable for carrying electric current.

constant resistivity monitor — device used to continuously measure the electrical resistance of the wash water in the tank of an insulator washer.

contaminate — to render unfit or to soil by introduction of foreign or unwanted material.

continuous rotation — a rotation system in which the turntable is able to rotate an unlimited number of revolutions about the centerline of rotation without restriction.

control — a device, such as a lever or handle, which is actuated by the operator to regulate the direction and speed of one or more functions of a unit.

control bar — when manually activated, controls the movement of feed roll(s) on a chipper.

control feed — a wood chipper which controls the infeed rate to the cutting mechanism.

control station — a position where controls for unit operation are located. These positions may include the platform, upper boom tip, turntable, pedestal or vehicle tailshelf.

control valve — a directional valve controlled by an operator, used to control the motion or function of an actuator or system.

cooler — a heat exchanger used to remove heat from hydraulic fluid.

corner mount — a pedestal mounting position located behind the rear axle(s) with the centerline of rotation located to one side of the chassis.

corona ring — see gradient control device.

counterbalance valve — a load holding valve that can be opened to allow flow in the normally blocked direction by applying hydraulic pressure to a pilot port, and which contains a relief capability to allow flow from the blocked direction if the blocked pressure exceeds a certain value.

courtesy cut — partial cut through limbs so as to allow limbs to fold towards tree trunks and allow ease of feeding chipper.

cracking pressure — the pressure at which a pressure actuated valve, such as a relief valve, begins to pass fluid.

crazing — a network of fine cracks on or below the fiberglass surface. Crazing often occurs when the fiberglass is struck with a blunt object, sometimes causing deformation and breakdown of the fiberglass resin.

crosstalk — a form of interference in which one circuit or channel receives some unintentional signal from another.

cross-ported — a hydraulic path connected between the two opposite flow paths of a hydraulic circuit that allows a route for flow between the two paths in lieu of flow thru an actuator. To allow sensing of the pressure in one path by a component installed in the other path.

cSt (centistoke) — a metric unit of kinematic viscosity. In customary use, equal to the kinematic viscosity of a fluid having dynamic viscosity of one centipose and a density of one gram per cubic centimeter.

curb side — the side of a vehicle which is opposite from oncoming traffic when the vehicle is traveling forward in the normal direction in a lane of traffic.

cushion — a device built into a hydraulic cylinder that restricts the flow of fluid at the outlet port to slow the motion of the rod as it reaches the end of its stroke.

custom option — an option which is not shown on a standard order form and which requires additional engineering work to supply.

cylinder — a device that converts fluid power into linear mechanical force and motion. It usually consists of a moveable piston and rod, or plunger, operating within a cylindrical bore.

danger — information that indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be used in the most extreme situations.

DC pump — a pump which is powered by a direct current electric motor.

dead band — the area or range near the center rest position of a hand control where the function does not respond to movement of the lever or handle.

decal — a thin sheet of flexible material which is attached to another surface by adhesive, and is used to convey instructions, information and warnings.

deenergize — to remove electrical power from a device, as from the coil of a solenoid valve.

delivery — the volume of fluid discharged by a pump in a given time, usually expressed in gallons per minute (gpm).

demulsibility — the ability of a liquid to expel another type of liquid. Commonly used to describe a fluid's ability to cause water to separate out rather than being held in suspension.

design voltage — the maximum rated line voltage for which an aerial device has been designed, and for which it can be qualified.

desolve — surface prepping solvent for low voltage coating.

detent — a device for positioning and holding one mechanical part in relation to another so that the device can be released by force applied to one of the parts.

diagnostic — relating to the practice of investigation or analysis of the cause or nature of a condition, situation, or problem.

diagonal brace — the structural member attached near the top of a corner mount pedestal and extending downward and forward to a point of attachment on the subbase or vehicle frame between the pedestal and the vehicle cab.

dial indicator — a meter or gauge with a calibrated circular face and a spring-loaded plunger, used as a measuring device.

diegrinder — a small, hand held, rotary grinding tool.

dielectric — nonconductive to electrical current.

differential cylinder — any cylinder that has two opposed piston areas that are not equal.

digger — the mechanism which drives the auger.

digger bail — a tubular housing attached to the gearbox portion of a digger, which surrounds the motor and provides an attachment point to the digger link.

digger derrick — a multipurpose, vehicle-mounted device with an extendible boom which may accommodate components that dig cylindrical holes, set utility poles, and position materials, apparatus, and/or personnel.

digger derrick use — the stability criteria for a digger derrick mobile unit which indicates that the load capacity chart and stability requirements apply to the use of the derrick for lifting of loads with the winch line at the upper boom tip or material handling jib tip, with the platform stowed or removed, if so equipped.

digger hanger bracket — the structural member on a digger derrick which supports the digger link on the extendible boom.

digger latch mechanism — a mechanism which secures the digger to the lower boom when it is stowed and to the extendible boom when it is unstowed.

digger link — the structural member which attaches the digger to the digger hanger bracket.

digger/winch valve — the control valve on a digger derrick that directs hydraulic pressure and flow to the digger and winch hydraulic circuits.

digital signal — an electrical signal that communicates information by the use of two distinct levels of voltage or current, a high "on" level and a low "off" level, which are sent in a series of pulses. The timing of the pulses is used to indicate the level of an input parameter such as control lever position, or information such as the address setting of a radio control transmitter linking it to its receiver.

diode — an electrical component that allows current flow in one direction but not in the reverse direction.

directional valve — a valve that selectively directs or prevents fluid flow through desired passages.

disc — the rotating component, housing the knifes on a disc chipper.

disc chipper — a wood chipper which utilizes a disc shaped, rotating cutter mechanism.

disc housing — weldment housing the cutting disc, comprising of the base, stationary hood and access hood.

discharge chute — directs chip discharge from the cutter mechanism in the desired direction.

displacement — the quantity of fluid that can pass through a pump, motor or cylinder in a single revolution or stroke.

docking station — a device used to mount a remote control transmitter on a platform.

dog clutch — see drum clutch.

double-acting cylinder — a cylinder in which fluid pressure can be applied to either side of the piston to move the rod in either direction.

double elevator — an elevator lift with two load carrying arms. The double elevator system includes a lower pedestal, lower arm, lower arm cylinder(s), riser, upper arm, upper arm cylinder(s), and upper pedestal, plus parallel links in both the lower and upper sections.

double-pole, double-throw (DPDT) switch — a six-terminal electrical switch or relay that connects, at the same time, one pair of terminals to either of two other pairs of terminals.

double-pole, single-throw (DPST) switch — a four-terminal electrical switch or relay that, at the same time, opens or closes two separate circuits or both sides of the same circuit.

down load — the downward force created when an external force is exerted on the boom, such as a winch pulling cable on a cable placer.

drain — a passage or a line from a hydraulic component that returns leakage fluid to the reservoir.

drift — **1:** a gradual, uncontrolled change from a set position of an actuator or component. **2:** a tool for ramming or driving something.

driver — the gearbox and motor assembly on a reel lifter which is connected to and disconnected from the arbor bar through the clutch assembly.

drop pocket — an open top tool storage area on the chassis of a unit.

drum — the rotating component, housing the knifes on a drum chipper.

drum chipper — a wood chipper which utilizes a drum shaped, rotating cutter mechanism.

drum clutch — a clutch consisting of two or more drive lugs that engage similar driven lugs to transmit torque. Commonly used between the gearbox and cable drum on front or bed mounted winches.

dump valve — a normally open, two-position, two-way valve that sends pump flow through a path going directly to the reservoir or bypassing hydraulic circuit when it is not actuated, preventing operation of the hydraulic system or circuit. When it is actuated, it closes off this path, redirecting flow to the hydraulic system or circuit to allow operation.

dynamometer — an instrument for measuring mechanical force or power.

earth anchor — see screw anchor.

eccentric ring — a ring with the center hole located in a position off the geometric center, commonly used to adjust the position of the rotation pinion with respect to the rotation bearing gear teeth.

eccentric ring lock — a device which engages a hole or notch in an eccentric ring to prevent the ring from rotating.

efficiency — the ratio of output to input. Volumetric efficiency of a pump is the actual output in gpm divided by the theoretical or design output. The overall efficiency of a hydraulic system is the output power divided by the input power. Efficiency is usually expressed as a percent.

elbow — the structure on an articulating-boom aerial device that connects the upper boom to the lower boom. The elbow allows the upper boom to pivot relative to the lower boom.

elbow bearing — the rotating member that allows the upper boom to rotate around the end of the lower boom. Used on aerial devices with the upper and lower booms mounted side by side.

elbow pin — the horizontal pin that attaches the upper boom to the lower boom on an articulating-boom aerial device. Used on aerial devices with the upper boom mounted over the lower boom.

electrical harness — an assembly of electrical wires that is used to deliver electrical current between components.

electrocution — receiving an electrical shock resulting in death.

electrohydraulic — a combination of electric and hydraulic control mechanisms in which an electrically controlled actuator is used to shift the spool in a hydraulic control valve.

electrohydraulic control system — a control system in which the function control handles are connected to electric controls. The electric controls actuate electrohydraulic valves to operate the functions of the unit.

electrohydraulic valve — a directional valve that receives a variable or controlled electrical signal which is used to control or meter hydraulic flow.

elevator lift — a system located between the turntable and subbase of an aerial device which is used for lifting the aerial device to increase the platform working height. This system may be configured as a single elevator or a double elevator.

elevator unit — the overall device including the subbase, elevator lift and the aerial device.

emergency operating DC pump — see secondary stowage DC pump.

emergency operating system — see secondary stowage system.

end gland — a hollow, cylindrical part that screws into or is retained in the open end of a hydraulic cylinder barrel, through which the rod protrudes.

end-mounted platform — a platform which is attached to a mounting bracket that extends beyond the boom tip, positioning the platform (and platform rotation pivot, if so equipped) beyond the end of the upper boom.

energize — to send electrical power to a device, as to the coil of a solenoid valve.

energized conductor — an apparatus that is transmitting electric current.

energy — the ability or capacity to do work, measured in units of work.

engine protection system — a system which detects when the auxiliary engine oil pressure or temperature is out of the proper range and shuts the engine off.

extendible — capable of linear movement of one or more portions of an assembly to increase the overall length or reach of the assembly.

extendible-boom aerial device — an aerial device with a telescopic or extendible boom assembly.

extension cylinder — a hydraulic cylinder which extends and retracts an extendible boom(s).

fairlead — the group of steel rollers at the platform of a cable placer which guide the cable or suspension strand during the placing process.

fairlead receptor tube — part of the pulling arms used to support the fairlead.

fall protection system — a system consisting of a body harness or body belt, a decelerating lanyard, connectors, and an anchor point at the boom tip, used to catch and hold a person who falls from a platform. (As of January 1, 1998, the use of a body belt for personal fall protection is prohibited by OSHA.)

fan — part of the disc or drum chipper which propels chipped debris and increases airflow into the discharge chute.

feed box — assembly housing the feed roll(s).

feed roll — a mechanical controlled roll or rollers used to control the feed rate to the cutter mechanism.

feed table — folding or fixed position guard which restricts operators access to the cutter mechanism.

feedback (feedback signal) — the return of part of an output signal to the input for the purpose of modification and control of the output.

feeder tube — a telescopic hydraulic tube assembly mounted on an extendible boom which carries pump flow to a device mounted on the extendible portion of the boom such as a digger or boom tip winch.

FeedSense® — Automatically maintains cutter mechanism speed.

fiber optic cable — a type of cable used for conducting control or telecommunication signals, in which the signal carrier(s) is one or more optical fibers, enclosed within an outer covering.

fiber optic receiver — an electronic module that collects fiber optic signals and converts them into electrical signals.

fiber optic transmitter — an electronic module that converts electrical signals into fiber optic signals and sends them through a fiber optic cable.

fiber optics — the use of transparent fibers of glass or plastic which transmit light signals throughout the length of the fiber. Commonly used to transmit signals from a remote control.

fiberglass — glass in fibrous form added as a reinforcement to a plastic for use in making various products.

filler breather cap — the component on the top of a reservoir that allows air to enter and exit the reservoir as the fluid level changes, and which can be removed to access a fill hole when adding hydraulic fluid to the reservoir.

filter — a device through which fluid is passed to remove and retain insoluble contaminants from a fluid.

filter cart — a portable device which can be connected to a unit's hydraulic system to filter water and/or other contaminants out of the hydraulic system fluid.

filter cartridge — a component containing filtration material which is installed within a filter housing or attached to a filter receptacle for use, and can be removed and replaced as a self-contained unit.

firm footing — outrigger placement and extension in accordance with the instructions in a unit's operator's manual to ensure proper leveling of the vehicle and adequate stability when operating the unit.

fixed displacement pump— a pump in which displacement is constant, so that the output flow can be changed only by varying the drive speed.

flange — on a flange and lug pin retaining system, an end plate that is welded to one end of the pin. The purpose of the flange is to position the pin in the connection.

flange and lug pin retaining system — a connecting pin retention system in which an end plate is welded to one end of the pin and a retaining plate is attached with cap screws to the other end to hold the pin in position.

flashover — a disruptive electrical discharge at the surface of electrical insulation or in the surrounding medium, which may or may not cause permanent damage to the insulation.

flats from finger tight (F.F.F.T.) — a method of counting the number of wrench flats when tightening a hydraulic adapter to establish a torque value.

flat-shoe outrigger — an outrigger which has a shoe that is fixed in a horizontal position.

flighting — a curved plate or series of curved plates welded together, spiraling along the axis of an auger tube or screw anchor rod.

flow — the movement of fluid generated by pressure differences.

flow control valve — a valve that regulates the rate of fluid flow.

flow rate — the volume, mass or weight of a fluid passing through any conductor per unit of time.

flow straightener — a component part of a nozzle used to straighten or remove any swirling motion of fluid going through the nozzle.

flowmeter — an instrument used to measure the flow rate of fluid in a hydraulic tube or hose.

fluid — a liquid that is specially compounded for use as a power transmitting medium in a hydraulic system.

fold — to move a pivoting structure such an articulating upper boom toward its stowed position.

fold-up shoe outrigger — an outrigger which has a shoe that pivots into a vertical position when the outrigger is fully retracted.

force — any push or pull measured in units of weight.

forged pin retainer — a pin retainer made from forged steel, consisting of a slender, cylindrical body with a flattened, circular head at one end, with a mounting hole through the head perpendicular to the body. The body is inserted through a hole in the pin to be retained, and the head is fastened to the adjacent structure with a cap screw.

four-way valve — a valve having four ports for direction of fluid flow.

FPS — Fluid Power Society.

frequency — the number of times an action occurs in a unit of time.

gasket — a packing made of a deformable material, usually in the form of a sheet or ring, used to make a pressure tight fit between stationary parts.

gate valve — see shutoff valve.

gauge pressure — a pressure scale that ignores atmospheric pressure by establishing atmospheric pressure as its zero point. Its zero point is 14.7 psi absolute.

gauge snubber — see snubber valve.

gearbox — an assembly with internal speed changing gears; a transmission. Gearboxes are commonly used to transmit power from a hydraulic motor to operate a function through an output shaft.

gelcoat — a protective coating used on fiberglass components to prevent the wicking of moisture into the fiberglass strands and to retard the degrading effect of ultraviolet light on the fiberglass.

GFI — ground fault interrupter.

gib assembly — secures cutter knives in place on drum chippers.

gin pole — a vertical phase-holding apparatus which is attached to a platform or upper boom tip.

gpm — gallons per minute.

gradient control device — a device at the upper end of an insulating boom that reduces electrical stress level(s) below that considered to be disruptive.

gravity leveling system — a system which uses the force of gravity to keep the bottom of a platform parallel to level ground as the boom is raised or lowered. One means of accomplishing this is by allowing the platform to pivot freely about a horizontal shaft attached above the platform's center of gravity.

grease fitting — a small fitting that acts as the connection between a grease gun and the component to be lubricated.

gripper tool — a component used for grasping an object or electrical lines through the use of an articulated mechanism.

ground — 1: a large conducting body with a potential of zero volts used as a common current return for an electric circuit. **2:** an object that makes an electrical connection with a ground or with the earth.

ground fault interrupter (GFI) — a fast acting form of circuit breaker that opens to interrupt an electrical circuit if it senses a very small current leakage to ground, to protect personnel against a potential shock hazard from defective electrical tools or wiring. It does this by monitoring for any difference in current flow between the hot and neutral wires in the circuit. An imbalance exceeding a very small preset value indicates that current is finding an improper path to ground, and causes the breaker to trip.

guard ring — see conductive shield.

hand — an extension of the reel lifter arm that allows for loading the arbor bar.

hand control — a hand operated control lever or handle located at a control station used to regulate a function of a unit, where the speed of the function is proportional to the distance the control is moved.

hand latch — mechanical device used to retain the arbor bar in the reel lifter or strand carrier hand.

heat — the form of energy that has the capacity to create warmth or to increase the temperature of a substance. Any energy that is wasted or used to overcome friction is converted to heat. Heat is measured in calories or British thermal units (Btu). One Btu is the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit.

heat exchanger — a device that transfers heat through a conducting wall from one fluid to another or into the atmosphere.

hertz (Hz) — a unit of frequency equal to one cycle per second.

high tooth — the individual tooth out of all the gear teeth on a rotation bearing at which the minimum backlash occurs with the rotation pinion. This is because of a slight difference between the actual and theoretical tooth pitch lines due to manufacturing tolerances.

HLIW — hot line insulator washer.

holding valve — see load holding valve.

hood pin — in conjunction with bolts, secures the two top halves of the disc housing together.

HOP — see hydraulic overload protection system.

horsepower (HP) — the power required to lift 550 pounds one foot in one second or 33,000 pounds 1 foot in one minute. One horsepower is equal to 746 watts or to 42.4 British thermal units per minute.

hose carrier — a flexible component which contains hydraulic, electrical, and/or air lines, usually mounted inside or along the side of an extendible boom. As the boom is extended, the hose carrier unfolds in a rolling motion to allow the lines to extend with the boom.

hose carrier tube — a rigid, enclosed tube which contains hydraulic, electrical, and/or air lines, and may contain components for upper controls. It is usually attached to a hose carrier on the side of an extendible boom.

hot line insulator washer (HLIW) — a vehicle-mounted device which is designed and used for cleaning pole and structure mounted transmission and distribution insulators.

HTMA — Hydraulic Tool Manufacturer's Association.

Huck bolt — a bolt-like fastener that is placed in position and then stretched while an end fitting is swaged on. Commonly used to attach a pedestal, subbase, and/or outriggers to a vehicle frame.

hydrant — a discharge pipe with a valve and spout at which water may be drawn from a water main.

hydraulic control — a control that is actuated by hydraulically induced forces.

hydraulic leveling system — an automatic hydraulic control system which keeps the bottom of a platform parallel to or at a fixed angle to the turntable base plate as the boom is raised or lowered. One means of accomplishing this is by transferring hydraulic fluid between a master cylinder actuated by movement of the lower boom and a slave cylinder mounted between the platform and the upper boom.

hydraulic overload protection (HOP) system — the system on a digger derrick that shuts off certain functions to help prevent damage to the digger derrick structure when an overload is applied to the boom in the downward direction.

hydraulic schematic — a drawing that uses common hydraulic symbols to represent the hydraulic system of the unit.

hydraulic swivel — a fluid conducting fitting having two joined parts that are capable of pivoting freely about each other to accommodate motion of an attached hydraulic line.

hydraulically extendible jib — a jib boom that may be extended or retracted by hydraulic power.

hydraulics — an engineering science pertaining to liquid pressure and flow.

hydrostatic hydraulic system — any hydraulic drive in which a positive displacement pump and motor transfer rotary power by means of fluid under pressure.

individual address setting — the code that identifies a specific transmitter as the one emitting the signal corresponding to a specific receiver's reception address.

infeed chute — tapered weldment attached prior to the feed/cutter mechanisms, assisting in the centering of the tree canopy.

in-line — the installation of a component in series between two portions of a hydraulic line or electrical conductor so that flow in the line or conductor toward the component passes through the component and continues on in the line or conductor on the other side.

instability — a condition of a mobile unit where the sum of the moments tending to overturn the mobile unit is equal to or exceeds the sum of the moments tending to resist overturning.

insulating aerial device — an aerial device with dielectric components designed and tested to meet the specific electrical insulating rating consistent with the manufacturer's name plate.

insulating digger derrick — a digger derrick designed for and manufactured with a fiberglass boom(s) for use around energized conductors at a maximum of 46 kV phase to phase.

insulating liner — see platform liner.

insulating portions — those sections which are designed, maintained, and tested in accordance with the electrical requirements of ANSI A92.2.

insulator — a device that isolates the energized conductor of a power line from the support structure.

intercom system — a transmitter and receiver system that allows two-way verbal communication between a platform operator and a person at ground level.

interference — any energy that inhibits the transmission or reception of electrical or radio signals.

intermediate boom (INT BOOM) — an extendible boom section which is located between the upper boom and the lower boom in an extendible boom assembly.

ISO — International Standards Organization.

jam nut — a nut that is screwed down firmly against another nut to prevent loosening.

jaw clutch — see drum clutch.

jib — an auxiliary boom which attaches to the upper boom tip to extend the reach of the boom.

JIC — Joint Industry Conference.

joystick — a two or three axis control lever which allows the operator to simultaneously control multiple functions.

junction box — an enclosed central connecting point for electrical wiring.

kelly bar — **1:** for derricks see auger extension shaft. **2:** the auger drive shaft of a pressure digger which is extendible from the ram cylinder.

key — a parallel-sided piece that fits into grooves in two adjacent parts to prevent movement between the parts. Often used as the driving member between a shaft and a sheave or winch drum.

keyway — a groove that is cut in a shaft or bore for a key to fit into.

kilovolts (kV) — a unit of potential difference equal to 1,000 volts.

knife — the rotating blade on a chipper cutting mechanism.

knuckle — see elbow.

L-bracket — an L-shaped weldment that is used to connect a splicer platform to the upper boom tip.

lanyard — a component in a personal fall protection system consisting of a flexible, nonmetallic strap or rope with a connector at each end for connecting a body harness or body belt to a specified anchor point provided at the boom tip, used to catch and decelerate a person in a fall from the platform. (As of January 1, 1998, the use of a body belt for personal fall protection is prohibited by OSHA.)

lashing wire — a thin, solid wire which is wrapped in a helix configuration around a length of suspension strand and adjacent communication cable so that the suspension strand carries the weight of the cable.

lay — the length of wire rope in which one strand makes one complete spiral around the rope.

layer — all wraps of winch line on a winch drum which are on the same level between drum flanges.

leakage monitor system — a means by which current leakage is measured through the insulating section(s) of a boom to confirm of dielectric integrity.

leveling cable — the wire rope portion of a mechanical leveling system that passes over the sheaves.

leveling chain — the chain portion of a mechanical leveling system that passes over the sprockets.

leveling cylinder — **1:** a cylinder that is used in a master/slave arrangement in a hydraulic leveling system to hydraulically level the platform. **2:** the hydraulic cylinder that is used to tilt the pivot and mast weldments of a pressure digger to either side of the vertical position.

leveling rod — a slender, round, fiberglass rod used in a mechanical leveling system that passes through a unit's boom to connect the leveling chains or cables at each end of the boom.

leveling system — see platform leveling system.

leverage — a gain in output force over input force; mechanical advantage or force multiplication.

lift cylinder — the hydraulic cylinder that moves the lower boom up and down on a digger derrick or extendible-boom aerial device.

lifter cylinder — the hydraulic cylinder that moves the reel lifter arms.

lifting eye — a shackle or weldment used for attaching chain, cable, rope, etc. to a boom for material handling.

light emitting diode (LED) — a semiconductor diode that emits light when subjected to an applied voltage. LEDs are used for electronic display.

line — a tube, pipe or hose used as a passageway to move hydraulic fluid.

linear — in a straight line.

linear actuator — a device for converting hydraulic energy into linear motion such as a cylinder or ram.

linear position transducer — an extendible length measuring device which produces a variable electrical signal that is proportional to the length to which the device is extended.

liner — see platform liner.

link — the secondary load-carrying structure of an articulating arm.

load capacity — (as defined by ANSI for digger derricks) the maximum load, specified by the manufacturer, that can be lifted by the mobile unit at regular intervals of load radius or boom angle, through the specified ranges of boom elevation, extension and rotation, with options installed and inclusive of stability requirements.

load holding valve — a hydraulic valve which blocks fluid flow from a hydraulic actuator, such as a cylinder or motor, to prevent motion when the control valve is not being operated or in case of a hydraulic line failure.

load radius — the horizontal distance from the centerline of rotation to the winch line load attachment point.

load sensing — (see sense line) the signal when a function is operated that tells the hydraulic pump to stroke up from a non-stroked (neutral) position to supply oil to that function.

lock washer — a solid or split washer that is placed underneath a nut or cap screw to help prevent loosening by exerting pressure against the fastener.

locknut — see self-locking nut.

lockwire — a wire that is installed to prevent loosening of fasteners or components.

low voltage coating — a sprayed on layer that provides low voltage insulating properties.

lower arm — the primary load-carrying structure of a double elevator which is located between the lower pedestal and the riser.

lower arm cylinder — the hydraulic cylinder that moves the lower arm of a double elevator up and down.

lower boom (LWR BOOM) — the boom section in a boom assembly which is attached to the turntable or riser, and which supports the upper boom or intermediate boom.

lower boom cylinder — the hydraulic cylinder that moves the lower boom about its pivot point on an articulating-boom aerial device.

lower boom insulator — the part of the lower boom made of high dielectric strength material (usually fiberglass reinforced plastic or equivalent) to interrupt the conductive path for electricity through the lower boom.

lower boom winch — a winch that is located on the lower boom.

lower control valve — the hydraulic valve on the vehicle, turntable, or pedestal of an aerial device used for operating some or all of the functions of the aerial device.

lower controls — the controls on the vehicle, turntable, or pedestal, used for operating some or all of the functions of the unit.

lower pedestal — the structure within an elevator lift that connects the elevator lift to the subbase.

lower test electrode system — a system on an insulating aerial device utilizing conductive bands installed permanently on the inside and outside surfaces of the insulating portion of the upper boom and conductive connections to components inside that portion of the boom such as leveling rods and hydraulic lines. All the bands and component connections are connected to a common pickup point for use in measuring current leakage to confirm of dielectric integrity.

lower tool circuit — a hydraulic tool circuit with quick disconnect couplings located on the pedestal or on the vehicle.

lug — a metal part which serves as a cap, handle, support, or fitting connection.

lunette eye — a round metal ring used in place of a ball coupler on a trailer. It attaches to a pintle hook on the towing vehicle.

magnetic suction separator filter — see magnetic suction strainer.

magnetic suction strainer — a suction filter consisting of a strainer which contains one or more magnets to trap ferrous metallic contaminants that are small enough to pass through the strainer.

mainframe — see pedestal.

man-and-a-half platform — an oversized one-man platform.

manifold — a fluid conductor that provides multiple connection ports.

manual lowering valve — a manually operated hydraulic valve used to lower the boom in the event of power failure.

manual override — a means of manually actuating an automatically or remotely controlled device.

manually extendible jib — a jib that is capable of being extended and retracted by human force.

mast — the structure on a pressure digger which supports the auger transmission gearbox, ram cylinder, kelly bar, and pole setter.

master control panel — the primary derrick lower control panel which contains the electrical connections between the derrick control system and components such as the power module and the dump or blocking valve. The master control panel is used in conjunction with a slave panel to provide dual station lower controls.

master cylinder — a cylinder in which motion of the piston under an external force transfers hydraulic fluid to a slave cylinder to produce corresponding motion.

material handling — having the ability to use the boom or attachments on the boom to lift and position materials.

material handling system — the system on an aerial device that consists of a jib and winch used to lift material to the upper boom tip.

mechanical leveling system — a mechanical system which keeps the bottom of a platform parallel to or at a fixed angle to the turntable base plate as the boom is raised or lowered. One means of accomplishing this is by utilizing a parallelogram arrangement of leveling rods attached to cables or chains operating around sheaves or sprockets at boom pivot points.

mercury switch — a switch that is closed or opened when an internal globule of mercury moves to or away from the contacts when the switch is tilted.

meter — to regulate the amount of fluid flow.

meter-in — to regulate the amount of fluid flow into an actuator or system.

meter-out — to regulate the flow of the discharge fluid from an actuator or system.

micron (micrometer) — one-millionth of a meter or about 0.00004″.

micron rating — the minimum size of the particles that a filter is designed to remove.

microswitch — a small electrical device that is used to turn an electrical current on or off, or to change the connections in a circuit.

minimum approach distance — the three dimensional area surrounding a conductor into which a person may not enter nor bring any conductive object unless they are: qualified electrical workers, wearing insulating gloves (and sleeves when required), protected against contact with any other objects at a different electrical potential.

mobile operation — the use of the aerial device or digger derrick while the mobile unit is traveling.

mobile unit — the combination of a unit, its chassis and related permanently attached equipment.

modified A-frame outrigger — an extendible outrigger that is configured like a large broad based "A" with an open top.

modulation ratio — the "on" time vs. the "off" time of a pulse width modulated digital signal. This ratio is determined by dividing the on time during one cycle by the total cycle time.

moly — see molybdenum disulfide.

molybdenum disulfide — a black inorganic chemical that is used as a dry lubricant and as an additive for grease and oils. Molybdenum disulfide has a very high melting point and is insoluble in water.

molydisulfide — see molybdenum disulfide.

moment — a force multiplied by the perpendicular distance from the line of action of the force to an axis or point. The force may be the weight of an item, with the vertical line of action located at the item's center of gravity. Moment is measured in units of force times distance; for example, pound-feet or foot-pounds.

monitor head — remotely controlled articulated assembly with a nozzle, mounted at the upper end of an HLIW.

motor — a device that converts hydraulic or electrical energy into continuous rotary motion and torque.

multiple-part line — the arrangement of the winch line in which the winch line is routed between the boom tip and the load two or more times. A snatch block is used at the load and a snatch block or additional boom tip sheave(s) is used on the boom to reverse the direction of the winch line. The end of the winch line is connected to a stationary attachment point on the boom or lower snatch block. A multiple-part line is used to reduce the tension in the winch line to a value below the winch line rated working load when a lifting load that exceeds the winch line rated working load.

multiplexing — a process by which signals from multiple inputs are combined and transmitted simultaneously over a single channel.

multiviscosity — the viscosity characteristic of a fluid which contains additives that increase the viscosity index. The fluid does not become as thin at high temperatures or as thick at low temperatures as a fluid without these additives. This allows the fluid to be used over a wider temperature range.

nonconductive — the characteristic of a substance that allows it to transmit electricity only in a very small degree when it is clean, dry and properly maintained.

noncontinuous rotation — a rotation system in which the turntable is prevented from rotating more than approximately one revolution about the centerline of rotation.

non-insulating aerial device or digger derrick — an aerial device or digger derrick which is not designed, manufactured, or tested to meet any dielectric rating.

nonmetallic — formed of materials which are not any type of metal.

non-overcenter aerial device — a type of articulating-boom aerial device on which the upper boom will not unfold from the stored position to beyond a vertical position regardless of the position of the lower boom.

nontransferable boom flares — boom flares that are permanently attached to the boom tip of a digger derrick.

nontransferable upper controls — an upper control panel on a digger derrick that is permanently attached to the upper boom tip.

normally closed switch — a switch which is closed to allow current to flow through it when it is not actuated, and opens to interrupt current flow when actuated.

normally closed valve — a two-way valve which is closed to block fluid from flowing through it when it is not actuated, and opens to allow flow when actuated.

normally open switch — a switch which is open to prevent current from flowing through it when it is not actuated, and closes to allow current flow when actuated.

normally open valve — a two-way valve which is open to allow fluid to flow through it when it is not actuated, and closes to block flow when actuated.

nozzle — a tube-like device for accelerating and directing the discharge flow of fluid.

NPT — National Pipe Thread.

NPTF — National Pipe Thread Fluid, a pipe thread form which is modified from the NPT form to improve the resistance to fluid leakage through the threads in a connection.

O-ring — a ring of material with a circular cross section that is used as a gasket, usually made of synthetic rubber.

ohmmeter — an instrument used to measure the resistance in ohms between two points in an electrical component or circuit.

on/off circuit — circuit that supplies constant electrical power to a solenoid or other component when a relay or switch is closed and removes the power when the relay or switch is opened.

one-man platform — a platform designed to carry one person. It is usually 24″ wide x 30″ wide or 24″ wide x 24″ wide.

open center — a directional valve design in which pump output returns freely to the reservoir when the valve spool(s) is in the center or neutral position.

open circuit — an electric circuit that has infinitely high resistance, resulting in no current flow. An open circuit may be caused by a loose connection, broken wire, corrosion or poor contact where an electrical component is grounded to the unit structure.

operational area — the area surrounding a chipper effected by chip discharge, noise, or any chipper operations.

operator — a person trained, authorized and engaged in the operation of the unit.

optical fiber — a thin strand of transparent glass or plastic used to transmit signals using light throughout the length of the strand.

orifice — a restriction in a hydraulic or pneumatic circuit, the length of which is small in respect to its diameter.

OSHA — Occupational Safety and Health Administration.

out and down outrigger — an outrigger that has independently-controlled horizontal and vertical extendible outrigger legs.

outboard bearing — a bearing which supports the end of a gearbox output shaft farthest from the gearbox.

output signal — a radio wave intended to pass communication from a source to a destination.

outrigger — a structural member, which when properly extended or deployed on firm ground or outrigger pads, assists in stabilizing the mobile unit.

outrigger controls — the controls for operating the outriggers.

outrigger cylinder — the hydraulic cylinder which extends and retracts or unfolds and folds an outrigger leg.

outrigger interlock system — a system which requires all outriggers to be extended to a specified position before other unit functions are allowed to operate.

outrigger interlock valve — a valve which prevents above rotation sense line signals from reaching the pump until the outriggers have been lowered.

outrigger leg — **1:** the moveable structural component of an outrigger which extends or unfolds to position the outrigger shoe on the ground, and which retracts or folds to return the outrigger shoe to the stored position. **2:** the stationary structural component of an extendible outrigger from which the moveable outrigger leg extends.

outrigger motion alarm — an audible warning system to alert personnel that outriggers are being lowered or moved.

outrigger pad — a portable piece of rigid material which is placed under an outrigger shoe to increase the contact area with the ground surface when the ground surface is not firm enough to support direct contact from the outrigger shoe.

outrigger shoe — the component of an outrigger that is attached to the moveable leg and that contacts the ground or outrigger pad to stabilize the mobile unit.

outrigger signal valve — a valve used to provide a signal to the pump when the outriggers are being operated and to allow a separate signal system to control the aerial device operation.

outrigger spread — the distance between the outer edges on fixed shoes, or between pin centerlines on pivoting shoes, of opposite outriggers which have been extended or deployed to a given position.

over travel — movement of a mechanism beyond its normal stopping point.

overcenter aerial device — a type of articulating-boom aerial device on which the upper boom can unfold from the stored position to beyond a vertical position.

overframe — an outrigger weldment mounting position located above the vehicle chassis frame.

overload — the condition existing when a load greater than the rated capacity or design lead is applied to a unit or component.

override — the takeover of boom movement control functions from the platform controls by the activation of the lower control station controls.

overtighten — to torque a threaded fastener beyond the recommended torque value.

oxidation — the reaction of a substance with oxygen.

paddle — part of the disc assembly which propels chipped debris into the discharge chute.

panic bar — a safety system which when manually activated stops movement of the feed roll(s) on a chipper.

parallel link — the secondary load-carrying structure of an elevator lift.

particle count — a visual count of the numbers of particulate contaminants in a quantity of a hydraulic fluid.

passage — a machined or cored fluid conducting path that lies within or passes through a component.

payload — any tools, materials, fuel and occupants carried by the mobile unit that are not permanently attached.

pedestal — the stationary base of a unit that supports the turntable and is attached to the subbase or vehicle frame.

pedestal mount — a mounting configuration for an aerial device in which the turntable is mounted on a pedestal consisting of a box-like structure.

penetration — the distance the vehicle frame is lifted after the outriggers contact the ground surface.

phase — a conductive wire or cable used for transmitting high voltage electrical current. The phrase “phase to phase” can be referenced as any two conductors of a three-phase electrical power line system.

pilot operated — condition in which a valve is actuated by hydraulic fluid pressure.

pilot operated check valve — a check valve that can be opened to allow flow in the normally blocked direction by applying hydraulic pressure to a pilot port.

pilot pressure — auxiliary pressure used to actuate or control hydraulic components.

pilot valve — an auxiliary valve used to control the operation of another valve.

pin — a cylindrical structural device used to allow a pivoting joint or to connect mating parts.

pin retainer — a device which is used to hold a pin in place in an assembly.

pinch point — a particular location in which a human body or a part of the body may become pinched or pinned between moving mechanical parts.

pinion — a gear with a small number of teeth that has been designed to mesh with a larger gear.

pintle hitch — a common heavy duty coupling type which utilizes a pintle hook attached to a tow vehicle to pull a trailer having a lunette eye.

pintle hook — the "jaw" portion of a pintle hitch which attaches to the tow vehicle.

piston — a cylindrically shaped part that fits within a cylinder or cylindrical bore and transmits or receives linear motion by means of a connecting rod or other component.

piston pump — a pump in which motion and force are applied to fluid by a reciprocating piston(s) in cylindrical bore(s).

pivot weldment — the structure located above the slide frame on a pressure digger which supports the mast.

placard — **1:** a thin sheet of rigid material which is attached to another surface by adhesive and/or mechanical fasteners, and is used to convey instructions, information and warnings. **2:** May also refer to a decal.

planetary gear set — an assembly of meshed gears consisting of a central gear (sun gear), a coaxial internal tooth ring gear and several intermediate pinions (planet gears) supported on a revolving carrier.

planetary gearbox — a gearbox containing one or more planetary gear sets.

platform — the personnel-carrying component of a unit, mounted at the upper boom tip.

platform elevator — a mechanism, at the boom tip, to which the platform is mounted, allowing vertical motion of the platform with respect to the rest of the boom tip.

platform heater — an electrically powered device mounted in a splicer platform which is used to warm the occupant.

platform leveling system — a system which keeps the bottom of a platform parallel to or at a fixed angle to the base plate of the turntable, or parallel to level ground, as the boom is raised or lowered. The system may be mechanically, hydraulically, or gravity operated.

platform liner — a component made of material having a high dielectric strength which is designed to be inserted into a platform to cover the walls and bottom of the platform.

platform pin — the horizontal pin that is used to fasten a platform mounting bracket to the upper boom tip. The mounting bracket pivots about this pin for platform leveling or positioning.

platform rest — the structural member attached to the chassis or body to support and cushion the platform in the travel or rest position.

platform ring — a metal band around the lip of a splicer platform which supports and guides the platform as it is rotated about its vertical centerline.

platform rotation override system — a system which allows the zone of platform rotation to extend beyond a predetermined limit when actuated by the operator.

platform rotator — a system which allows the operator to rotate the platform about a vertical axis. This permits the position of the platform to be changed with respect to the boom tip.

platform tilt system — a system which allows the operator to adjust the orientation of the platform about a horizontal axis. Some systems allow the operator to adjust the working position of the platform floor and tilt the platform for cleaning. Other systems allow tilting of the platform for cleaning but do not provide for operator adjustment of the working position.

platform use — the stability criteria for a digger derrick mobile unit which indicates that the load capacity chart and stability requirements apply to the use of the derrick with the platform occupied, with no lifting of loads with the winch line.

plunger — a cylindrically shaped part that is used to transmit thrust; a ram.

pole — a long cylindrical piece of material such as wood, metal, or concrete which is installed in a vertical position for use as a support structure for power and communication lines.

pole guide — a mechanism at the tip of a boom used for guiding and stabilizing a utility pole while using the winch line to raise or lower the pole.

pole guide tilt cylinder — the hydraulic cylinder which is used to tilt (raise or lower) the pole guide.

pole guide tong cylinder — the hydraulic cylinder which opens and closes the pole guide tongs.

pole guide tongs — moveable arms on a pole guide used to stabilize and guide a utility pole as it is being raised or lowered with the winch line.

pole puller — an apparatus consisting of a hydraulic cylinder, chain and other components used to loosen a utility pole from the ground.

pole setter — an assembly attached to the mast of a pressure digger that is used to pick up, position, and set a pole.

polyethylene — a moisture proof plastic.

poppet — that part of certain valves that prevents flow when it closes against a seat and allows flow when it moves away from the seat.

port — an internal or external opening for intake or exhaust of fluid in a component.

portable resistivity tester — a device used for testing the electrical resistance of water. Commonly used for testing the wash water for insulator washers.

position — a term which describes the number of possible positions a valve spool or mechanism can be shifted to.

post mount — a mounting configuration for an aerial device in which the turntable is mounted on a pedestal which utilizes a round vertical tube as its primary load-carrying structure.

potentiometer — a variable resistor that is connected to act as an electrical voltage divider.

pour point — the lowest temperature at which a fluid will flow or pour under specific conditions.

power — work per unit of time, measured in horsepower (HP) or watts.

power module — the central connection point between the chassis and unit electrical systems. This device is used to provide battery power to the unit when the truck/machine selector is in the machine position.

power take-off (PTO) — a supplementary mechanism enabling vehicle engine power to be used to operate non-automotive apparatus such as a pump.

precharge pressure — the pressure of compressed gas in an accumulator before any fluid is added.

pressure — the force applied in a given area. It can be expressed in pounds per square inch (psi).

pressure compensator — a device on a variable displacement pump that adjusts pump output flow to develop and maintain a preset maximum pressure.

pressure differential — the difference in pressure between two points in a system or component.

pressure drop — the reduction in pressure between two points in a line or passage due to the energy required to maintain flow.

pressure gauge — an instrument which displays the hydraulic or pneumatic pressure sensed at a port on the device.

pressure line — the line carrying fluid from a pump outlet to the pressurized port of a valve or actuator.

pressure override — the difference between the cracking pressure of a valve and the pressure reached when the valve is passing full flow.

pressure reducing valve — a pressure control valve whose primary function is to limit its outlet pressure.

pressure switch — an electric switch which is actuated when the hydraulic or pneumatic pressure applied to a port on the switch reaches a specified value.

pressure transducer — a pressure measuring device which produces a variable electrical signal that is proportional to the hydraulic pressure applied to a port on the device.

proportional circuit — a circuit that supplies a varying voltage to a coil in a pilot valve as electrical current applied to the circuit is varied by a hand control.

proximity alarm — a system which measures the distance from a detector to another object, and sounds an alarm when this distance is less than a specified value. Commonly used to inform the operator of an HLIW of the distance between the boom tip nozzle and a power line insulator or support structure.

psi — pounds per square inch.

PTO — see power take-off.

pulling arms — mechanical structure used to attach the platform to the boom tip and supports the fairlead receptor tube.

pullout upper controls — an upper control panel on a digger derrick which is mounted on a housing that can be extended from inside an outer housing when additional length is needed, such as to attach the control panel to a personnel jib with the outer housing attached to the upper boom tip, or to attach the upper control panel to the upper boom tip with the outer housing attached to the transferable boom flares.

pulse width modulation (PWM) — a means of transmitting a digital signal in continuous cycles of pulses where the total length of time for a cycle of one "on" pulse and the following "off" period is constant, and the length of time (width) of the "on" pulse within each cycle is varied (modulated) in proportion to the level of an input parameter such as control lever position.

pump — a device that converts mechanical force and motion into hydraulic flow and pressure.

purge system — a system of check valves that allows hydraulic fluid flow in a reverse manner through the hydraulic system, usually from the lower control valve to the upper controls. This actions frees or purges the control system of any trapped air and restores a solid column of fluid for precise control. The purge system may also be used to warm up the control system in cold weather conditions if the fluid in the reservoir is warm.

purge/upper/lower controls selector valve — a valve which is used to direct hydraulic fluid to the purge system, the upper control valve, or the lower control valve.

PWM — pulse width modulation.

quick disconnect couplings — hydraulic fittings designed for fast and easy attachment and separation.

radial ball bearing — an antifriction bearing with rolling ball contact in which the direction of action of the load transmitted is perpendicular to the axial centerline of the bearing.

radial outrigger — an outrigger in which the moveable outrigger leg pivots in an arc around a pin connection between the leg and a supporting structure as the leg is lowered and raised.

radio communication — communication by means of radio waves.

ram — **1:** a single-acting cylinder with a single diameter plunger rather than a piston and rod. **2:** the plunger in a ram-type cylinder.

ram cylinder — the hydraulic cylinder that is used to retract and extend the kelly bar on a pressure digger.

ramp — an adjustable delay to govern the response of the hydraulic valve when a unit is operated from the electronic controls.

range diagram — a diagram which shows the load radius and sheave height of a digger derrick at all the configurations of boom extension and boom angle covered by the corresponding load capacity chart

rated capacity — (as defined by ANSI for digger derricks) the maximum load, specified by the manufacturer, that can be lifted by the digger derrick at regular intervals of load radius or boom angle, through the specified ranges of boom elevation and extension, with specified options installed, and exclusive of stability requirements.

rated line voltage — the nominal voltage, phase to phase, at which electrical systems are rated.

rated load capacity — (as defined by ANSI for aerial devices) the maximum loads, specified by the manufacturer, which can be lifted by the aerial device through the specified range of boom elevation and extension with specified options installed and in consideration of stability requirements.

reach diagram — a drawing that shows the horizontal and vertical limits of travel of the platform, upper boom tip, and/or jib tip throughout all possible configurations of lower boom angle, boom extension, upper boom angle, articulating arm travel, and/or elevator lift travel.

rear jack stand — adjustable rear support used when the chipper is in operation and not coupled to the tow vehicle.

rear mount — a pedestal mounting position located over or near the rear axle(s) on the longitudinal centerline of the chassis.

receiver — a device that converts radio waves into electrical signals for communication and/or control purposes.

reel brake — a component of the reel driver which prevents the overrunning of cable reels carried by a strand carrier and reel lifter. The brake is used to maintain tension in the cable or suspension strand when used with the reel driver.

reel driver — a component of a strand carrier and reel lifter used for paying in or paying out cable or suspension strand.

reel lifter — a device used to support and move cable reels from the ground to the vehicle.

reel lifter arms — the structure on a reel lifter used to lift and store reels of cable or suspension strand on the chassis.

reengage — to repeat the activation of a function after it has been momentarily halted.

relay — an automatic switch with contacts that can be closed or opened by electrical current in a coil.

relief valve — a pressure operated valve that bypasses pump delivery to the reservoir to limit system pressure to a predetermined maximum value.

remote arm — a remotely operated jib used to handle equipment or electrical lines.

remote assist — a vehicle-mounted device with a boom assembly which is extendible, articulating, or both, which is designed and used to accommodate attachments for performing operations such as supporting or cutting electrical conductors, lifting or holding objects, or cutting tree branches. It is operated by remote control from the ground or from the platform of an adjacent personnel lifting device. It may be mounted on the vehicle by itself or in addition to a personnel lifting device.

remote control system — a system used for operating some or all of the functions of a unit from a portable control station. The control station may be a transmitter which sends signals by radio waves to a receiver on the unit, or a control module which sends signals through a fiber optic or electrical cable to the unit.

remote operated auxiliary control system (ROACS) — a radio controlled system for starting and stopping certain functions of the mobile unit.

remote start/stop system — the components used to actuate a function of the unit from a location other than for normal operation. The most common functions controlled are engine start/stop and the secondary stowage DC pump.

reservoir — a container for storage of liquid in a fluid power system.

resistance — the opposition to the flow of electricity or hydraulic fluid.

restriction — a reduced cross-sectional area in a line or passage that produces a pressure drop.

retaining ring — a hardened, washer-like ring that may be spread apart or compressed and installed into a groove or recess to serve as a retaining device.

return line — a hydraulic line used to carry discharge flow from a hydraulic system or actuator back to the reservoir at low pressure.

return line filter — a filter located in a hydraulic system return line or at the inlet of a hydraulic reservoir which cleans fluid flowing from the hydraulic system to the reservoir.

reversing valve — a four-way directional valve used to change the direction of movement of a double-acting cylinder or reversible motor.

ribbon hose — a group of hoses that are attached side by side to produce a flat bundle. Commonly used to carry hydraulic fluid, air and/or electrical cable(s) to the boom tip or upper controls.

riding seat — an operator's control station attached to the side of the turntable, with a seat on which the operator rides with the rotation of the unit.

riser — **1:** the structure on a double elevator that connects the lower elevator arm to the upper elevator arm. **2:** the structure within an articulating arm to which the lower boom is connected.

ROACS — see remote operated auxiliary control system.

rod — the cylindrically shaped part of a cylinder which extends and retracts from the barrel to actuate or move a component.

rod end — the end of a cylinder that the extending component or rod is on.

roller — a cylindrical device which spins freely about a pin or shaft, used to guide the motion of another component.

rollpin — a pin that has been formed by rolling up a thin, flat strip of metal to form a cylinder. Commonly used by being driven into a hole to serve as a retaining device.

rope — a stout, flexible cord, which consists of many strands of wire or fibers that are twisted or braided together.

rotary actuator — a device for converting hydraulic energy into rotary motion and torque in which the rotary motion is restricted to within certain angular limits.

rotary joint — a multiple port manifold that has a rotating portion and a stationary portion, used to provide a continuous hydraulic connection between rotating and stationary hydraulic lines. Commonly used at the centerline of rotation of units equipped with continuous rotation.

rotate frame — the structure located above the stationary frame on a pressure digger that is used to support and rotate the slide frame.

rotating platform — a platform which can be rotated about a vertical axis to change its position in relationship to the boom tip.

rotation bearing — the rotating member, usually a shear ball bearing, located between the pedestal and the turntable which allows the turntable to rotate and which contains gear teeth that mesh with the rotation pinion.

rotation chain — a chain attached to the stationary frame of a pressure digger that is used by the rotation gearbox to rotate the rotate frame.

rotation gearbox — the gearbox which drives the rotational motion of the turntable.

rotation pinion — the gear on the output shaft of the rotation gearbox which meshes with the rotation bearing gear teeth and drives the turntable rotational motion.

rotation resistant wire rope — wire rope which is constructed to resist the tendency to untwist or rotate when carrying a suspended load. This is accomplished by laying the outer strands in the opposite direction to the lay of the inner strands or core.

rotation system — the system which drives the rotation of the turntable about the centerline of rotation. It typically consists of a rotation bearing, rotation gearbox, hydraulic motor, and load holding valve.

rpm — revolutions per minute.

running torque — the torque produced by a rotating device such as a motor or gearbox at a specified rotational speed.

SAE — Society of Automotive Engineers.

safety belt — see body belt.

safety chains — the chains that are attached to the trailer tongue with hooks on their free ends. These chains keep the trailer connected to the tow vehicle should the coupler or hitch ball detach from the tow vehicle. Safety chains must be secured every time you tow.

saybolt universal viscosity — A measure of viscosity equal to the time it takes in seconds for 60 milliliters of fluid to flow through a capillary tube in a Saybolt universal viscosimeter at a given temperature.

scissor link — the mechanical linkage on a reel lifter used to connect the lifter cylinder to the arm.

screw anchor — a rod with an eye on one end and auger flighting on the opposite end. It is designed to screw into the ground and serve as an anchor to hold an attached cable such as a guy wire.

seating in — an initial microscopic surface deformation of components that are clamped together with threaded fasteners. This causes a slight reduction in the dimension of the components, reducing the clamping force applied by the fasteners.

secondary stowage DC pump — a low flow hydraulic pump driven by a direct current electric motor. This pump is used to provide hydraulic flow to stow the unit when the system for normal operation has failed.

secondary stowage system — those components used to stow the unit when the system for normal operation has failed.

selector switch — a switch which is used to direct electrical current to one of two or more electrical circuits.

selector valve — a valve which is used to direct hydraulic fluid to one of two or more hydraulic circuits.

self feed — a wood-chipper with no control of the infeed rate to the cutting mechanism.

self-locking nut — a nut which contains a built-in device or shape to increase thread friction so as to resist loosening due to vibration or repeated loading.

self-lubricating bearing — an antifriction bearing in which lubricating material is incorporated in the bearing.

sense line — a line that carries a hydraulic pressure signal from a valve or actuator to the compensator control on a variable displacement pump.

sense selector valve — a valve which prevents hydraulic fluid in the sense line from reaching the pump until a certain function(s) is operated.

sequence — **1:** the order of a series of operations or movements. **2:** to divert flow to accomplish a subsequent operation or movement.

sequence valve — a pressure operated valve that diverts flow to a secondary actuator while holding pressure on the primary actuator at a predetermined minimum value after the primary actuator completes its travel.

sequential extension — the operation by which one boom section in an extendible boom assembly reaches full extension or retraction before the next boom section begins movement.

set screw — a short screw, typically with an Allen type head, that is used as a clamp to bind parts together.

shackle — see clevis.

shear — an action or stress resulting from opposing applied forces that attempt to separate a part into two pieces that would then slide along each other in opposite directions along the plane of separation.

shear ball bearing — an antifriction bearing with rolling ball contact in which the direction of load transmitted through the balls is parallel to the axial centerline of the bearing, producing shear loading on the balls. The bearing can support axial, radial, and tilt loading. Commonly used as a rotation bearing.

shear pin — a replaceable pin which prevents motion between two adjacent parts by the production of shear loading in the pin, and which may be designed to fail under overload to protect other parts.

shear stability — resistance of a hydraulic fluid viscosity index improver additive to shearing.

shearing — molecular damage or breakdown of the viscosity index improver additive in hydraulic fluid. Shearing can occur when the fluid flows through fine clearances at high velocity. Shearing can cause permanent loss in fluid viscosity.

sheave — a grooved wheel used to support and guide a winch line or leveling cable at a point of change in the direction of motion of the line or cable.

sheave height — the vertical distance from ground level to the centerline of the boom tip sheave in a digger derrick upper boom tip.

short circuit — an inadvertent path of low resistance established between two points of an electrical circuit. A short circuit will result in excessive current flow.

shutoff valve — a device which is used to stop hydraulic fluid flow.

shuttle valve — a three-port valve that accepts hydraulic fluid pressure from two inlets and allows only the highest pressure fluid to pass through it to a single outlet while keeping the inlet fluid pressure isolated from one another.

side gun — a hand held water nozzle and hose that can be used from the ground for washing or fire fighting.

side load — an external horizontal load placed on a boom from one side.

side load protection system — the system on a digger derrick that helps prevent damage to the digger derrick structure when excessive side loads are applied to the booms.

side-mounted platform — a platform which is attached to a mounting bracket that extends from one side of the boom tip, positioning the platform (and platform rotation pivot, if so equipped) beside the boom tip.

sideslip — sideways motion of a component caused by an externally applied sideways force which overcomes resistive forces from hydraulics, friction, etc. Commonly used to describe rotation of a digger derrick boom caused by side loading which exceeds the side load protection setting.

signal — a command or indication of a desired position, velocity, flow or pressure.

signal line — see sense line.

single-acting cylinder — a cylinder in which fluid pressure can be applied to move the rod in only one direction. Return motion is produced by an external force such as a spring or gravity.

single elevator — an elevator lift with one load carrying arm. The single elevator system includes a lower pedestal, arm, arm cylinder(s), parallel links, and upper pedestal.

single handle control — a control, with an interlock trigger incorporated in the handle, which allows the operator to simultaneously control multiple functions of the booms and turntable from the platform.

single-pole, double-throw (SPDT) switch — a three-terminal electrical switch or relay that connects one terminal to either of two other terminals.

single-pole, single-throw (SPST) switch — a two-terminal electrical switch or relay that opens or closes one circuit.

slave control panel — a secondary derrick lower control panel that is configured as a remote terminal of the master panel. The slave panel is used in conjunction with a master panel to provide dual station lower controls.

slave cylinder — a cylinder in which motion of the piston is produced by the transfer of hydraulic fluid from a master cylinder, resulting in corresponding motion.

slide frame — the structure on a pressure digger used to support the auxiliary engine, hydraulic reservoir, control station, and pivot weldment. The slide frame can be extended horizontally from its stowed position to adjust the distance of the kelly bar from the rotate frame.

slide pad — a rectangular block used as a bearing between extendible boom or outrigger sections, usually composed of a non-metallic material.

slip ring — an assembly of one or more conductive, rotating rings and stationary brushes used to provide a continuous electrical connection between rotating and stationary conductors. Commonly used at the centerline of rotation of units equipped with continuous rotation.

slug face — the extreme end of the cable slug which is secured to the cylinder rod or adjusting stud.

SMA connector — metal connector used for connecting fiber optic components.

snatch block — a device which has a means of attachment to connect it to a boom or load, and which can be opened to receive a winch line around an internal sheave.

snubber valve — a two-port valve with a manually adjustable orifice that restricts the flow of fluid through the valve.

socket head — a cylindrical cap screw head design containing a hexagonal (six-sided) female socket into which an Allen wrench can be inserted to turn the cap screw.

solenoid — a coil of insulated wire that produces a magnetic field within the coil when electrically energized. When attached to a hydraulic valve, the magnetic field acts upon the valve to move internal valve parts.

solenoid valve — a valve which is actuated by a solenoid to controlling the flow of hydraulic fluid.

speed reducer — see gearbox.

spherical bearing — a bearing with a spherically shaped inner race that is allowed to move freely inside a stationary outer race to accommodate misalignment.

splicer platform — a fiberglass platform equipped with a door and latch.

spline — one of a number of equally spaced, load carrying teeth that have been cut on the outside diameter of a shaft or inside diameter of a bore, parallel to the shaft or bore centerline.

spool — a moving, cylindrically shaped part of a hydraulic valve that moves to direct flow through the valve.

spring lockouts — a mechanical system which is engaged to keep a vehicle's suspension system from flexing during operation of the unit.

sprocket — a wheel with teeth along the circumference which are shaped so as to engage with a chain, used to support and guide the chain at a point of change in the direction of motion of the chain.

SSU (Saybolt Second Universal) — the unit of measure for Saybolt universal viscosity.

stability — a condition of a mobile unit in which the sum of the moments which tend to overturn the mobile unit is less than the sum of the moments tending to resist overturning; the mobile unit's ability to resist tipping.

stabilize — to provide adequate stability for a mobile unit to allow operation of the vehicle-mounted device(s).

stabilizer — a device used to assist in stabilizing a mobile unit, such as an outrigger, torsion bar or spring lockout.

stake — to slightly deform the threads of a fastener or material at the joint between two components by placing the blade of punch or chisel on the threads or joint and tapping on the handle with a hammer. The deformed material serves to prevent loosening of the components.

stall torque — the torque produced by a rotating device such as a motor or gearbox at zero rotational speed.

standard option — an option which can be ordered from a standard order form and can be supplied without additional engineering work.

start/stop control module — an electrical device that relays signals from the unit's remote start/stop system to the component(s) or system(s) being controlled, such as the secondary stowage DC pump and/or vehicle ignition system.

static mixer — a tube with no moving parts used to combine two or more fluids.

stationary frame — the structure attached to the subbase of a pressure digger that supports the outriggers and rotate frame.

stationary hood — normally non-removable part of the disc housing in which the discharge chute attaches.

stationary platform — a platform which can not be rotated about a vertical axis to change its position in relationship to the boom tip.

stow — to place a component such as a boom or digger derrick auger in its rest position.

strainer — a coarse filter.

strainer basket — a coarse, basket shaped filter which is mounted in the fill hole of a reservoir and projects into the reservoir.

strand — **1:** one of the groups of individual fibers or wires within a synthetic winch line or wire rope. **2**: see suspension strand.

strand carrier — a device used to support and transport strand reels on a vehicle.

strand reel — a reel or spool used for carrying suspension stand.

street side — the side of a vehicle toward oncoming traffic when the vehicle is traveling forward in the normal direction in a lane of traffic.

stroke — **1:** total linear movement in either direction of a piston or plunger. **2:** to change the displacement of a variable displacement pump or motor.

subbase — a structural mounting interface between the pedestal and the vehicle frame. It provides torsional stiffness and strength in addition to that which would be provided from the vehicle frame alone.

subweldment — a smaller welded subassembly used within a more complex welded structure.

suction filter — a filter located in a hydraulic system suction line or at the outlet of a hydraulic reservoir which cleans fluid flowing from the reservoir to the pump inlet.

suction line — the hydraulic line connecting the pump inlet port to the reservoir outlet.

surge — a momentary rise of pressure in a circuit.

surge brake system — a surge brake system is entirely self-contained on the trailer and is activated when the tow vehicle decelerates. The momentum of the trailer pushes the surge brake housing forward. This drives the push rod that is connected to the coupler into the master cylinder. Brake fluid is then forced out of the master cylinder into the wheel cylinders or pistons that apply the trailer brakes. The entire activation process is completed in less than one second.

suspension strand — a type of wire rope which is used to support the weight of an attached communication cable suspended between poles or other overhead support structures.

swage — to taper or reduce the diameter of a rod, tube or fastener by forging, squeezing or hammering.

synthetic winch line — a winch line made from nonmetallic synthetic fibers which are formed into strands that are then braided together to make a complete rope.

T-stand — a "T" shaped weldment for mounting lower controls to the vehicle.

tachometer — an instrument used for displaying the speed of rotation of an engine output shaft.

tailshelf — the rear portion of the mobile unit above and behind the rear axle.

tailshelf tools — see lower tool circuit.

tank — the hydraulic reservoir.

telescopic — having sections that slide within or over one another to change overall length.

tension spring — springs controlling downward force of the upper feed roll.

terminal block — an insulating mounting used for making electrical terminal connections.

test block — a manifold with ports for connecting a hydraulic pressure source, pressure gauge and a cartridge valve such as a counterbalance valve or relief valve used for testing and adjusting the relief setting of the valve.

thimble — a metal ring around which a rope is passed and spliced to make a loop or eye.

thread locking adhesive — an anaerobic adhesive that is applied to fastener threads to prevent loosening due to vibration or repeated loading.

three-phase — a system for transmitting high voltage, alternating current, electrical power along three separate conductors, with 120 degrees between the voltage waveform cycles of any two conductors.

three-position valve — a valve having three positions for direction of fluid flow, such as neutral, flow in one direction, and flow in the opposite direction.

three-way valve — a valve having three ports for direction of fluid flow.

threshold — the amount of signal (starting power) given to a control valve when the control is just moved from neutral position.

throttle control — a manual, hydraulic, or electrical device used to regulate vehicle or auxiliary engine speed.

toggle switch — an electrical switch operated by a short projecting lever combined with a spring to quickly open or close a circuit when the lever is pushed through a small arc.

tongue weight — the downward weight applied by the towable equipment on the hitch ball. Generally tongue weight should not be more than 10 percent of the gross trailer weight.

topping cylinder — see lift cylinder.

torque — **1:** a rotational twisting force. **2:** to preload a threaded fastener by application of a rotational twisting force.

torque converter — a rotary device for transmitting and amplifying torque, especially by hydraulic means.

torsion bar — a rod-like spring which is flexed by being twisted about its axis, used to assist in stabilizing a mobile unit.

tow line winch — a winch located on a cable placer which is used for tensioning suspension strand or self-supporting cable or towing a cable lasher.

tow vehicle (towing vehicle) — the vehicle that pulls a trailer or towed vehicle.

trace element analysis — analysis of a small sample of hydraulic fluid to determine contamination level and condition of additives.

tracking — a current leakage path created across the surface of insulating material when a high-voltage current forms a carbonized path within a foreign material on the surface.

transducer — a device that converts input energy of one form into output energy of another, such as hydraulic pressure into an electrical signal.

transferable boom flares — boom flares, on which a pole guide may be mounted, that can be pinned to either the intermediate boom tip or the upper boom tip of a digger derrick.

transferable upper controls — an upper control panel on a digger derrick that can be attached to either the upper boom tip or the transferable boom flares by the use of a detent pin.

transition — the area between the feed box and the cutter mechanism.

transmitter — a device used to generate and emit a radio frequency carrier signal. The signal is sent to a receiver which translates the signal into usable information.

trim pot — a potentiometer which is used to make fine adjustments in a circuit during manufacture or calibration, typically by turning a slotted adjusting screw.

troubleshoot — to locate and diagnose problems in a system or a component.

trunnion — a mounting device consisting of a pair of opposite, projecting cylindrical pivots on which something can be rotated or tilted.

trunnion bearing — a bearing that a trunnion pin pivots in.

trunnion pin — a cylindrical pivot pin that is a part of a trunnion.

turnbuckle — a link with screw threads at both ends that is turned to bring the ends closer together for tightening purposes.

turns from finger tight (T.F.F.T.) — a method of counting the number of turns of a hydraulic adapter to establish a torque value.

turntable — the structure located above the rotation bearing which supports the lower boom or articulating arm, and rotates about the centerline of rotation.

turntable winch — a winch located on the turntable.

turret — see turntable.

two-blocking — a condition in which the load hook, overhaul ball, hook block, or other lifting component that is attached to the winch line comes in contact with the boom tip during winch or boom operation.

two-man platform — a platform designed to carry two people. It is usually 24″ wide x 48″ wide.

two-part line — a multiple-part line on a digger derrick in which the winch line is routed from the boom tip sheave down to a snatch block at the load and then back up to a stationary attachment point on the boom.

two-position valve — a valve having two positions for direction of fluid flow, such as open and closed.

two-speed motor — a motor which has two operating speed and torque modes (a low-speed, high-torque mode, and a high-speed, low-torque mode) that can be selected by the operator.

two-way valve — a valve having two ports for direction of fluid flow, with one internal flow path which can be open or blocked.

ultraviolet inhibitor coating — a sprayed or brushed on layer that provides ultraviolet light resistant properties.

UNC — Unified National Coarse, a thread description.

underframe — an outrigger weldment mounting position located beneath the unit subbase or vehicle chassis frame.

undertighten — to torque a threaded fastener below the recommended value.

UNF — Unified National Fine, a thread description.

unfold — to move a pivoting structure such as an articulating upper boom away from its stowed position.

unit — the Altec device(s), subbase, outriggers, body and associated interface items mounted on a chassis, but not including the chassis itself.

unload — to release hydraulic flow, usually directly to the reservoir, to prevent pressure buildup.

unloaded vehicle weight — the total weight of the completed mobile unit without payload.

unloading valve — a valve that bypasses flow to the reservoir when a set pressure is maintained on its pilot port.

upper arm — the primary load-carrying structure of a double elevator which is located between the riser and the upper pedestal.

upper arm cylinder — the hydraulic cylinder that moves the upper arm of a double elevator up and down.

upper boom (UPR BOOM) — the boom section in a boom assembly which is farthest from the turntable when the boom assembly is fully extended or unfolded, and which supports the boom tip sheave and/or platform(s).

upper boom cylinder — the hydraulic cylinder that moves the upper boom about its pivot point on an articulating-boom aerial device.

upper boom drive mechanism — the components used to produce upper boom movement on an articulating boom-aerial device, such as linkage, cables, sheaves and/or gears.

upper boom rest — the structural member that supports the upper boom in the rest or travel position.

upper boom tip — the boom tip of an upper boom.

upper control valve — the hydraulic valve on or beside the platform of an aerial device used for operating some or all of the functions of the aerial device.

upper controls — the controls located on or beside the platform used for operating some or all of the functions of the unit.

upper controls primary battery — the preferred source of power for fiber optic upper controls.

upper controls secondary battery — the backup power source for fiber optic upper controls.

upper pedestal — the structure within an elevator lift that connects the elevator lift to the aerial device rotation bearing.

upper tool circuit — a tool hydraulic circuit with quick disconnect couplings located at the upper boom tip.

vacuum — the absence of pressure. A perfect vacuum is the total absence of pressure; a partial vacuum is some condition less than atmospheric pressure. Vacuum is measured in inches of mercury (in. Hg.).

valve — a device that controls fluid flow direction, pressure or flow rate.

vane pump — a type of pump with a rotor and several sliding vanes in an elliptical chamber. Hydraulic fluid enters the expanding area and is forced out as the fluid is moved to the decreasing chamber area.

variable displacement pump — a pump in which the size of the pumping chamber(s) can be changed, so that the output flow can be changed by moving the displacement control or varying the drive speed or both.

vehicle — a carrier for a unit.

velocity — the speed of linear motion in a given direction.

velocity fuse — a hydraulic valve that is used to stop fluid flow through it when the flow rate reaches a predetermined cut-off value.

vent — an air breathing device on a fluid reservoir or hydraulic line.

VI — see viscosity index.

viscosity — a measure of the internal friction or resistance to flow of a fluid.

viscosity index (VI) — a measure of the resistance to change in viscosity of a fluid with change in temperature. The higher the number, the less the viscosity will change as the temperature changes.

voltmeter — an instrument used to measure the potential difference in volts between two points in an electrical circuit.

volume — **1:** the size of a space or chamber in cubic units. **2:** loosely applied to the output flow of a pump in gallons per minute (gpm).

vortex — a whirlpool of liquid.

waist harness — a belt device worn by the operator of a radio remote control system to which the transmitter is attached.

walking beam outrigger — an extendible outrigger which has a pivot point at the top of the nonextending leg and a linkage attached to the extending leg, so that the leg assembly rotates about the pivot point to increase the outrigger spread as it is extended.

warning — an instruction that indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

water monitor — an articulating mechanism that is used to direct the flow of a high pressure water stream.

water removal filter cartridge — a special filter cartridge designed to absorb and remove water from hydraulic fluid. It is not intended for use during normal operation, but is for use when water removal is required.

way — a term which describes how many ports are in a valve or valve section.

weldment — a structural unit formed by welding together an assembly of pieces.

wheel chock — a wedge or block placed on the ground in front of or behind the wheel of a vehicle to block the movement of the wheel.

winch — a mechanism consisting of a gearbox with a cylindrical rotating drum on which to coil a line for load hoisting or line tensioning.

winch capacity — the maximum load, specified by the manufacturer, that can be pulled on the first layer of line on the winch drum at rated system pressure.

winch line — a load hoisting line consisting of a synthetic or wire rope.

winch line rated working load — the average breaking strength of a winch line (as specified by the line manufacturer) divided by the appropriate design factor as specified by ANSI.

wire rope — a rope made from steel wires which are formed into strands that are then twisted about each other in a spiral configuration.

wood chipper — reduces above ground tree materials to uniform chips.

work — the exertion of a force moving through a definite distance. Work is measured in units of force multiplied by distance; for example, pound-feet.

worm gearbox — a gearbox that utilizes a gear which has a continuous helix tooth or teeth similar to a large screw thread along shaft (worm), that drives a gear which has teeth cut at an angle along a its outside diameter (worm gear). The rotational axis of the worm is perpendicular to the rotational axis of the worm gear.

wrap — a single coil of winch line on a winch drum.

X-frame outrigger — an extendible outrigger having two diagonal members which are connected at the top in an overlapping manner. Resembles a broad based “X”.

Y-cable — an electrical cable assembly which contains three branches joined at a common point, similar to a “Y.”

zerk — see grease fitting.

Torque Values

Fasteners

Bolt Size - Thread Pitch	Grade 5 Hex Head Cap Screw	Grade 8 Hex Head, Socket Head, and 12 Point Cap Screw	Button Head Cap Screw and Flat Head Socket Screw
1/4″ - 20	5 (7)	7 (10)	6 (8)
5/16″ - 18	10 (14)	15 (20)	13 (17)
3/8″ - 16	19 (25)	26 (35)	22 (30)
7/16″ - 14	30 (40)	42 (57)	36 (49)
1/2″ - 13	45 (61)	64 (87)	55 (74)
9/16″ - 12	65 (89)	92 (125)	79 (107)
5/8″ - 11	90 (122)	127 (172)	109 (148)
3/4″ - 10	160 (217)	226 (306)	193 (262)
7/8″ - 9	258 (349)	364 (493)	312 (422)
1″ - 8	386 (524)	545 (739)	467 (633)

[1] Values are foot-pounds (N•m).
[2] Values apply for both lubed and not lubed applications with any style nut or threaded hole.
[3] Values apply for torque applied to either the head of the bolt or the nut.
[4] This chart only applies for general application fasteners where a specific torque is not defined. Refer to the fastener section for special applications where the torque is specifically defined.

Bushing-Sheave

Bushing Size	Cap Screw Size and Thread	Torque ft-lbs (N•m)
SK	5/16-18	15 (20)
SF	3/8-16	30 (41)
E	1/2-13	60 (81)
F	9/16-12	75 (102)
J	5/8-11	135 (183)

Fastener Specific Torque Application [Ft-lbs (N•m)]

Item Description	Fastener	WC126A 166A	CFD 1217	DC 912A	DC 1317	DC 1317 HP	DC 1419	DC 1820 Two Axle
Blade/Anvil								
Anvil cap screws	Hex head	226 (306)	160 (217)	107 (145)	107 (145)	107 (145)	160 (217)	160 (217)
Blade/cap screws	Flat socket Holo-Krome	N/A	N/A	70 (95)	70 (95)	70 (95)	140 (190)	140 (190)
Blade cap screws	Hex head, Bowmalloy	N/A	210 (285)	N/A	N/A	N/A	N/A	N/A
Blade gib cap screws	Square head	105 (142)	N/A	N/A	N/A	N/A	N/A	N/A
Bearings								
Cutter bearing cap screws	Ferry cap or hex head	226 (306)	160 (217)	160 (217)	160 (217)	160 (217)	160 (217)	160 (217)
Feed roller bearing cap screws	Hex head, Bowmalloy	N/A	127 (172)	127 (172)	127 (172)	127 (172)	127 (172)	127 (172)
Structural								
Pintle ring cap screws	Hex head 5/8-11	211 (286)	211 (286)	211 (286)	211 (286)	211 (286)	211 (286)	211 (286)
Removable tongue	Hex head	200 (271)	N/A	N/A	N/A	N/A	N/A	N/A
Engine/frame cap screws	Hex head 1/2-13	107 (145)	107 (145)	107 (145)	107 (145)	107 (145)	107 (145)	107 (145)
Head/frame cap screws	Hex head 3/4-10	376 (510)	N/A	N/A	N/A	N/A	N/A	N/A
Disc paddle cap screws	Hex head 5/8-11	N/A	N/A	160 (217)	160 (217)	160 (217)	160 (217)	160 (217)
Disc draw ring cap screws	Hex head	N/A	N/A	127 (172)	315 (427)	315 (427)	315 (427)	315 (427)
Feed plate	U bolt 1/2-13	107 (145)	N/A	N/A	N/A	N/A	N/A	N/A
Axle								
Axle mounting cap screws	Hex head	115 (156)	160 (217)	160 (217)	160 (217)	160 (217)	160 (217)	160 (217)
Axle spindle nut	Hex nut	150 (203)	150 (203)	150 (203)	150 (203)	150 (203)	150 (203)	150 (203)*
Wheel lug nuts	Wheel lug	105 (142)	105 (142)	105 (142)	105 (142)	105 (142)	300 (407)	105 (142)*
Specific Component								
Hydraulic motor shaft nut	Hex nut	N/A	265 (359)	265 (359)	150 (203)	265 (359)	N/A	N/A

* DC 1820 single, 10K axle – wheel lug 200 (271)/spindle nut 125 (170)

Daily Preoperational Checklist

Equipment # _____ VIN # _____

	Completed
Check engine fuel, coolant, and oil levels (refer to engine operator's manual)	
Check radiator fluid level (refer to engine operator's manual)	
Check clutch handle free play	
Check radiator fins and ensure free passage of air through the radiator	
Check all cap screws and nuts to make sure they are tight	
Inspect anvil to make sure all attachment and adjustment cap screws are secure	
Check all controls for free and proper operation	
Inspect the chipper frame and structure for any bent, broken, cracked, missing, or loose parts	
Check all guards to make sure they are undamaged, in place, and properly secured	
All decals must be in place and legible prior to operating the chipper	
Hydraulic fluid level must be within 2" to 3" (5.08 to 7.62 cm) of top of the tank when the fluid is cold	
Lubricate cutter and feed roll bearings	
Inspect and operate panic bar	
Inspect for hydraulic leaks	
Make sure the tires are secure and properly inflated	
Make sure a complete AEP Operator's Manual is available for all operators to review	

Signature _____ Date _____

Weekly Checklist

Equipment # _____ VIN # _____

	Completed
Complete daily preoperational checklist	
Check hitch, safety chains, and tongue for damage or wear	
Check general condition of tires and tire pressure	
Lubricate clutch bearings (refer to clutch operator's manual)	
Check the engine air filter (refer to engine operator's manual)	
Check cutting knives to make sure all attachment cap screws are tight and knives are in good condition	
Lubricate all hydraulic valve connecting linkages	

Signature _____ Date _____

Monthly Checklist

Equipment # _____ VIN # _____

	Completed
Complete weekly checklist	
Where applicable check battery water level	
Check drive belt tension and alignment	
Where applicable check pump belt and alignment	
Lubricate clutch lever and linkage (refer to clutch operator's manual)	
Lubricate drive roller bearings	
Lubricate chute rotation and slide box	
Lubricate all pivot points and pins	

Signature _____ Date _____

Yearly Checklist

Equipment # _____ VIN # _____

	Completed
Complete monthly checklist	
Change hydraulic oil filter	
Lubricate trailer wheel bearings	
Replace fuel filter (refer to engine operating manual)	
Flush and replace hydraulic fluid	

Signature _____ Date _____