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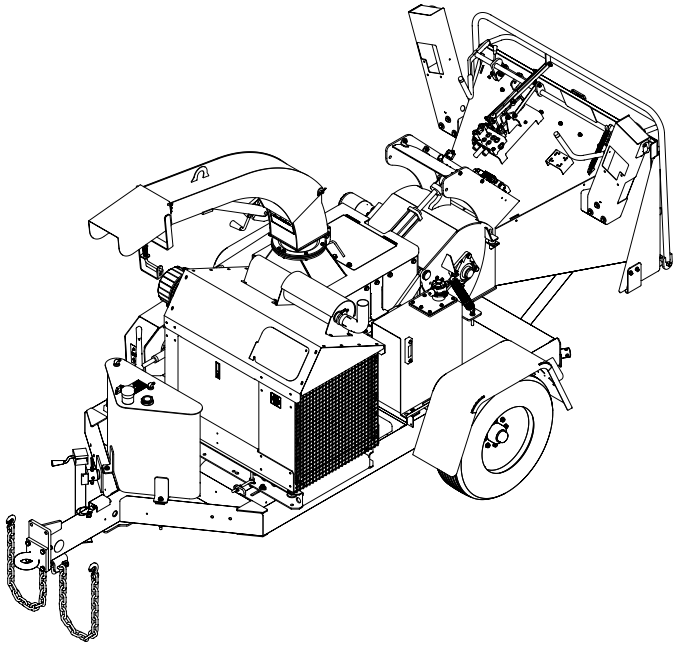

Operator's, Maintenance, and Parts Manual

www.altec.com

Altec Industries, Inc. reserves the right to improve models and change specifications without notice.

Operator's and Maintenance Manual: 970413435 Parts Manual: 970413436

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.

No unit can provide absolute safety when in proximity to energized conductors. No unit is designed or intended to replace or supersede any protective device or safe work practice relating to work in proximity to energized conductors. When in proximity to energized conductors, this unit shall only be used by trained personnel using their company's accepted work methods, safety procedures, and protective equipment. Training manuals are available from a variety of sources.

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.

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Section 1 — Introduction

About This Manual…

This manual provides instruction for the operation and maintenance 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, operation, and maintenance.

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.

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

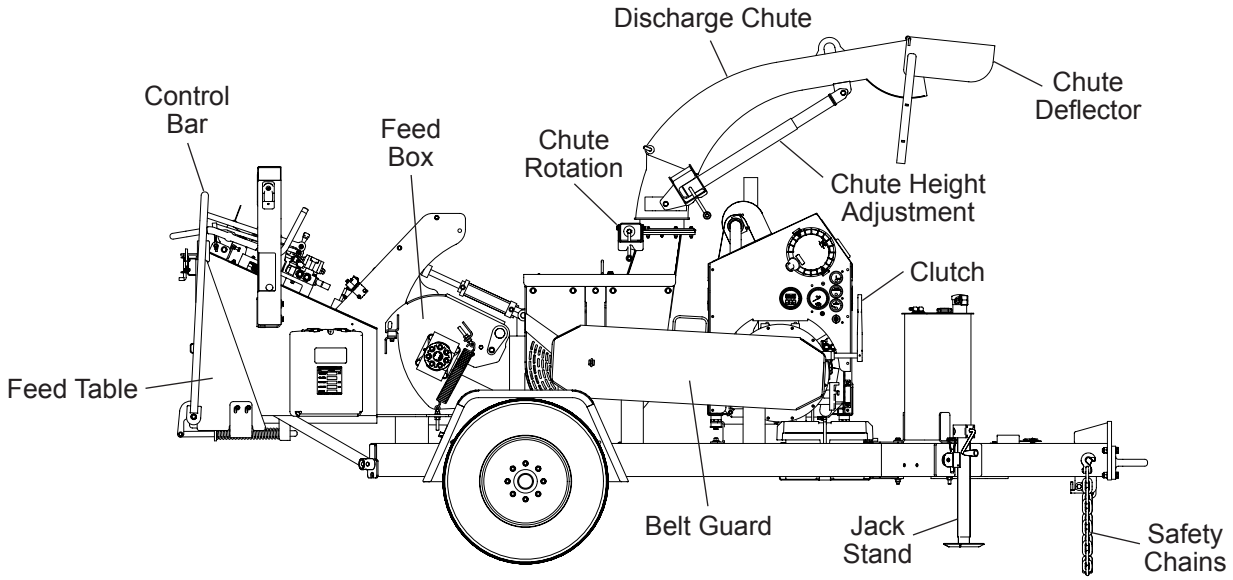
This unit is a 12″ (30.5 cm) capacity, controlled feed drum chipper. The chipper mechanism is permanently mounted on the towable frame assembly. The chipper mechanism is belt driven by a self contained engine. Material is fed utilizing one horizontally mounted, hydraulically controlled feed roll. Chip discharge is designed for 360 degree rotation for chip body and road side discharge applications.

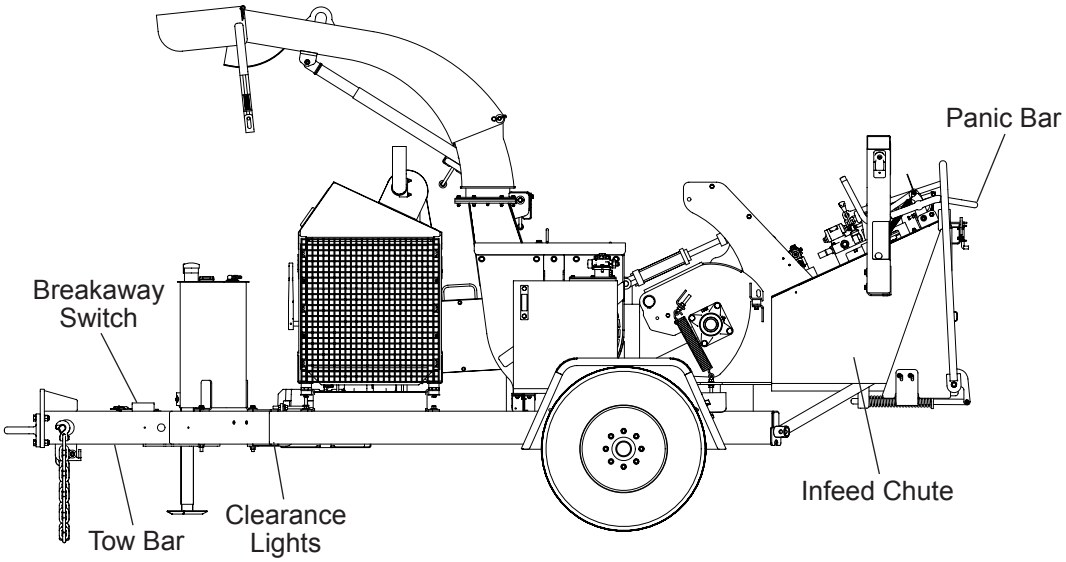
Item	Specification
Chipping capacity	12″ (30.5 cm)
Engine horsepower	85 horsepower (63 kW)
Weight	5,310 pounds (2,408 kg)
Tongue weight (may vary)	530 pounds (240 kg)
Travel height	8’ 2″ (2.5 m)
Width	6’ 8″ (2 m)
Travel length	15’ (4.5 m)
Operational length	16’ 11″ (5.2 m)
Feed roller opening	17″ (43.18 cm) wide x 12″ (30.5 cm) high
Feed table dimensions	50″ (127 cm) wide x 30″ (76.2 cm) deep
Infeed chute opening	50″ (127 cm) wide x 30″ (76.2 cm) high
Length to feed roll nip point[1]	94″ (2.4 m)
Drum dimensions	20″ (50.8 cm) wide x 21″ (53.3 cm) diameter
Drum weight	520 pounds (236 kg)
Drum rpm	2,230 rpm
Feed rolls	16 1/2″ (41.9 cm) wide x 20″ (50.8 cm) diameter
Feed rate	111 feet per minute (34 mpm)
Feed wheel motor rating	32.2 cu in displacement (528 cu cm)
Hydraulic pressure	2,500 psi (172.4 bar)
Hydraulic tank capacity	12 gallon (45.4 l)
Fuel tank capacity	18 gallon (68.1 l)
Discharge chute rotation	360°

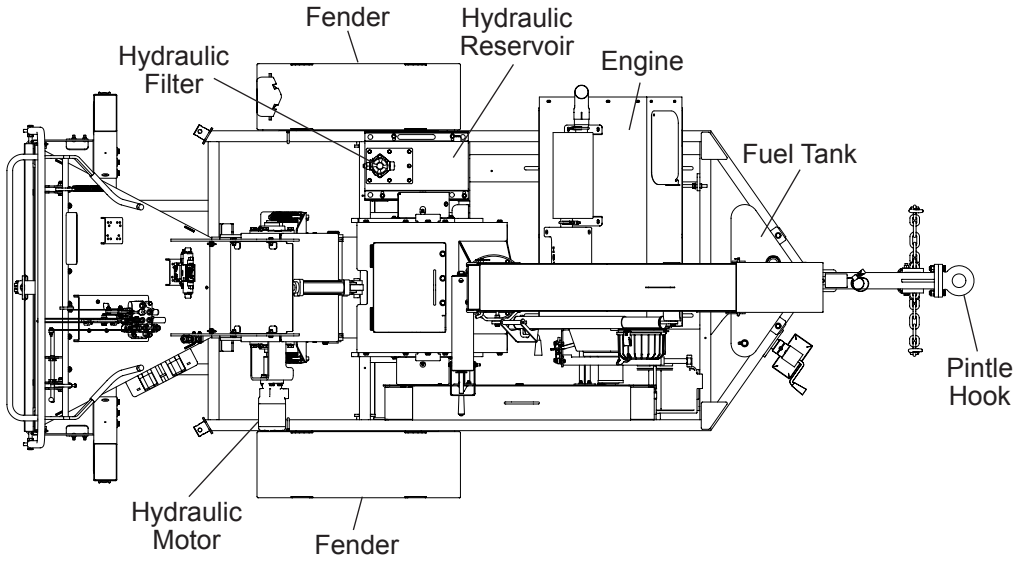
[1] Measured from ground level at infeed chute, through the center of the feed table.

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. Always wear the proper protective equipment for the task being performed. 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

Death or serious injury can result from unexpected movement. Follow the lock-out tag out procedure before accessing internal components of the unit.

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 drum 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.
- Verify there are no loose tools or materials on the chipper or in the infeed chute.

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

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

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 result when operating this unit. Safety devices are not a substitution for proper operation. Read the entire manual and all safety decals and placards.

Panic Bar Assembly

In the event of an unforeseen situation the panic bar (refer to Figures 3.1 and 3.2) 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.

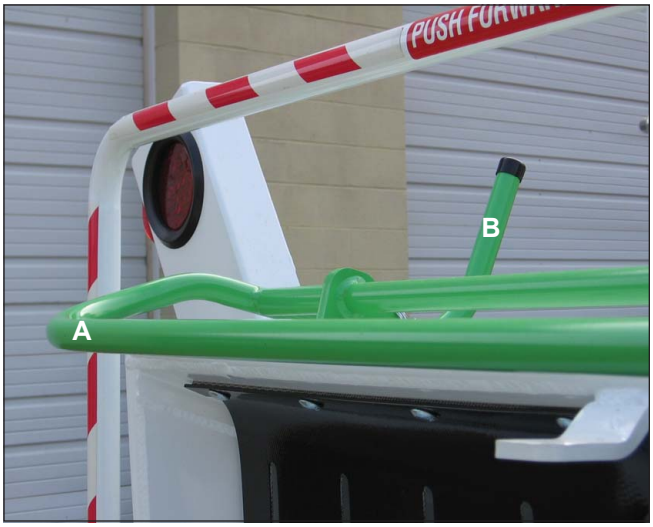


Figure 3.1 — Panic Bar Assembly

Warning

Death or serious injury can result from unexpected 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.

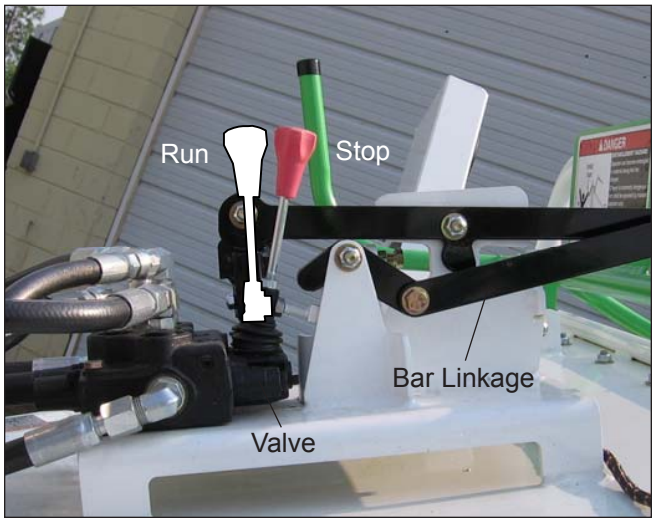


Figure 3.2 — Valve and Bar Linkage

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.

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 infeed 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.

Chip Curtain

The kickback curtain (refer to Figure 3.3) stops or deflects chips and small debris from leaving the infeed chute area. This also helps in decreasing the amount of clean up around the chipper.

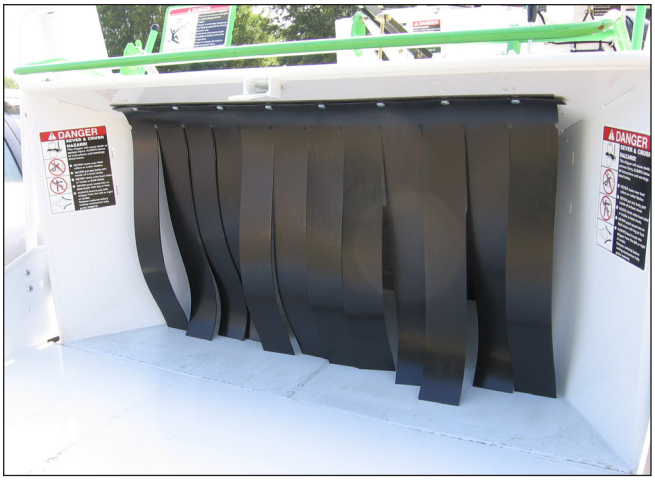


Figure 3.3 — Chip Curtain

Warning

Death or serious injury can result from flying objects. The chip curtain must be properly installed and in good condition. Wear appropriate safety equipment.

Inspect chip curtain for damage or missing segments. Replace the chip curtain if damaged.

Rotational Indicator

The rotational indicator (refer to Figure 3.4) is located on the belt guard. Movement of the bolt head seen through this guard indicates movement of the drum and drive components.

Figure 3.4 — Rotational Indicator

Warning

Death, serious injury, or property damage can result when attempting to access moving components. Make sure components have come to a complete stop before performing inspection or maintenance.

Inspect visibility of the rotational indicator. Make sure no debris is blocking view.

Drum Blade Change Pin

Complete LOTO procedures prior to performing maintenance on the blades.

A pin (refer to Figure 3.5) is used to lock drum while performing blade maintenance. After the drum hood has been opened, rotate the pin, and slide it into the slot. Engage the pin directly in front of the drum blade. Rotate drum 180 degrees, lock to perform maintenance on the second blade. Prior to closing the drum access hood, lift and rotate the pin back to the start position.

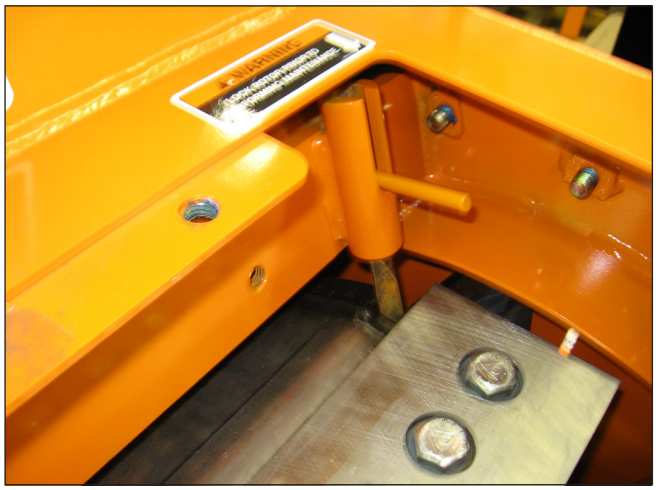


Figure 3.5 — Drum Blade Change Pin

Warning

Death or serious injury can result while performing blade maintenance. Wear appropriate safety equipment.

Wear cut resistant gloves when performing blade maintenance or inspection.

Guards

The chipper is equipped with safety guards (refer to Figure 3.6) to protect you from injury. Do not start or operate the chipper with these guards removed. Inspect all guards to make sure they are in place, in good condition, and properly secured. Never attempt to install a guard or close the drum hood while the chipper is running. Make any necessary repairs prior to starting the chipper.

Figure 3.6 — Guards

Warning

Death, serious injury, or property damage can result from starting or operating the chipper without the guards in place. Make sure all guards are in place before operating the chipper.

Feed Roll Lock Pin

The feed roll lock pin (refer to Figure 3.7) holds the feed roll in the raised position to assist operators in clearing infeed material clogs. Make sure pin is in good condition and tethered to the chipper. Make sure the lift cylinder operating system is operating properly.

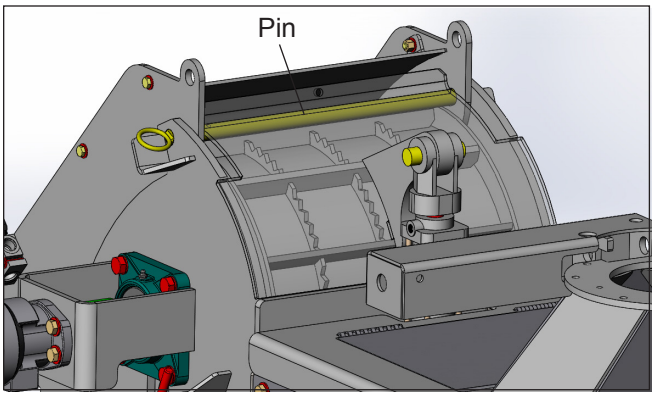


Figure 3.7 — Feed Roll Lock Pin

1. Disengage clutch and wait for all drum movement to stop.

2. With the lift cylinder controls, fully raise the feed roll. Hold while inserting pin.

3. Feed the pin though the feed roll box and feed roll assembly. Make sure the pin goes completely through both feed roll assembly and box uprights.

4. Using the lift cylinder control, slowly lower the feed roll. Do not apply down pressure.

5. Perform LOTO procedures.

6. Slowly lower the feed roller.

Warning

Death or serious injury can result if the upper feed roller is not returned to the proper position. Do not feed material into the chipper with the upper feed roller in the locked open position.

Caution

Injury can result from being pinched or trapped between moving components. Keep hands clear.

Safety Tow Chains

Tow chains (refer to Figure 3.8) are to be utilized every time a chipper is transported. Chains must be routed under the trailer tongue in an X pattern between the tow vehicle and trailer.

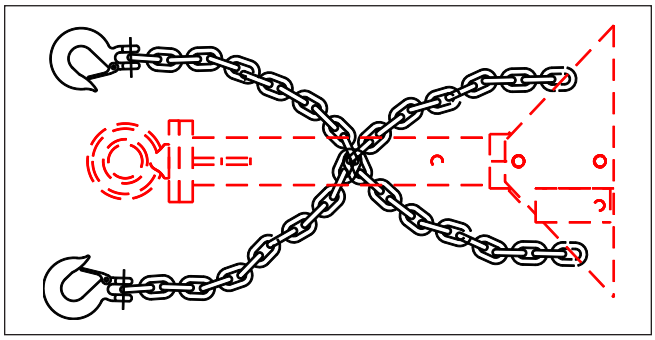


Figure 3.8 — Chain Routing

Slack in the chain should be adjusted by installing the hook in the proper chain link to permit turning but not dragging on the ground. Inspect chain, clevis, and hook for damage or excessive wear.

Breakaway Switch

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 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 wheels.

Testing of the breakaway can be accomplished by jacking up the chipper, spinning the wheel and pulling the plunger. The brakes should apply. This test only ensures the basic braking circuit is properly functioning. For complete testing and tow vehicle controller set-up, refer to the chipper brake section in this manual.

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.

Disclaimer of Liability

Altec Environmental Products, LLC will not be liable for unauthorized alterations or modifications of the unit. Altec Environmental Products, LLC will not be liable for improper or abusive operation of the unit.

Do not alter or modify this unit in any way that might affect its structural integrity, dielectric integrity, or operational characteristics without specific written approval from Altec Environmental Products, LLC.

Unauthorized alterations or modifications will void the warranty. However, of a greater concern is the possibility that unauthorized changes could adversely affect the unit's operation that could endanger personnel and/or damage property. Altec will not be responsible for unauthorized alterations or modifications that cause death, serious injury, and/or property damage.

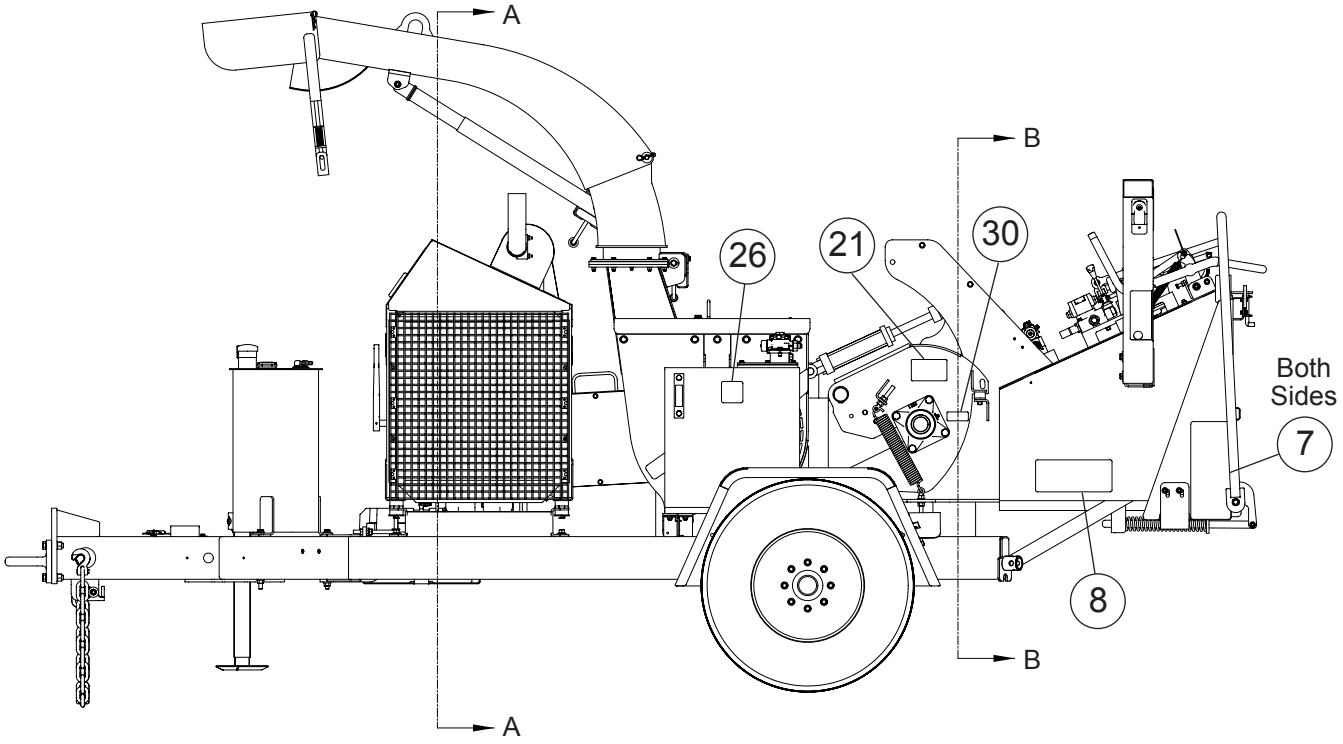
Altec Environmental Products, LLC assumes no liability for any personal injury and/or property damage related to the use of this manual when performing testing, operating, maintenance and/or repair procedures on this Altec unit.

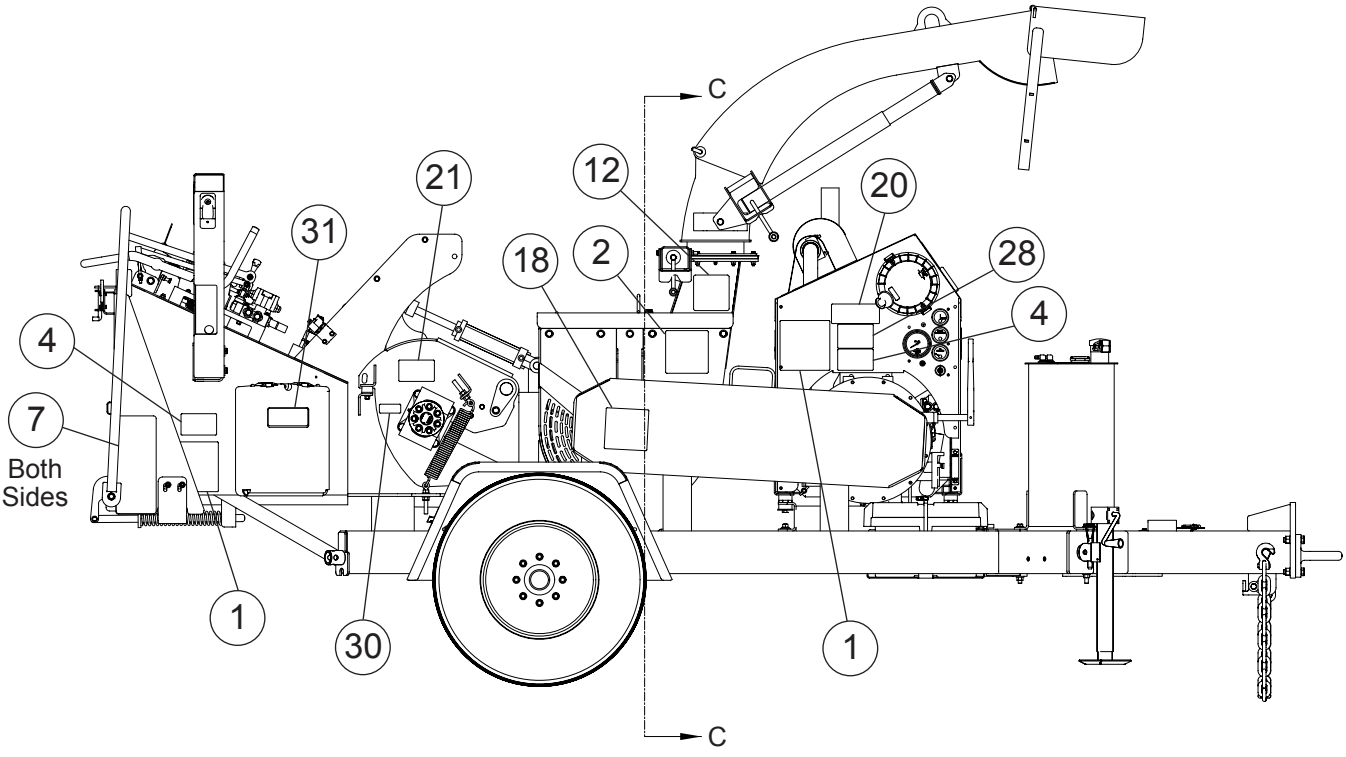
Accident Prevention Signs

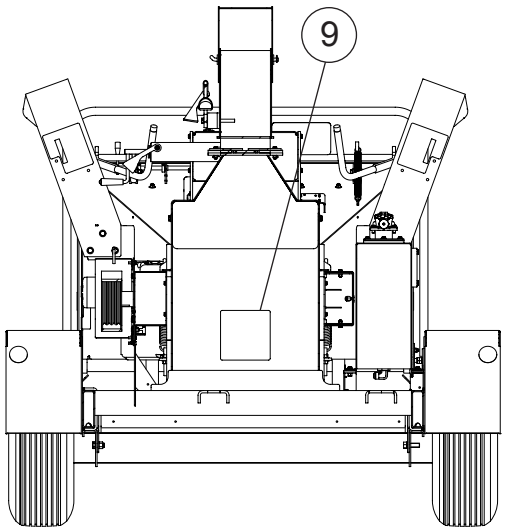
This unit was equipped with accident prevention signs at the time of manufacture. If any of these are lost or become illegible, obtain replacements from your Altec representative.

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.

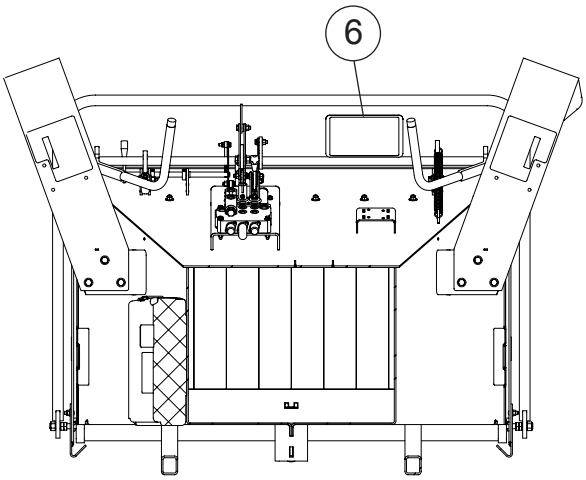
Accident Prevention Signs Diagram







Section A - A



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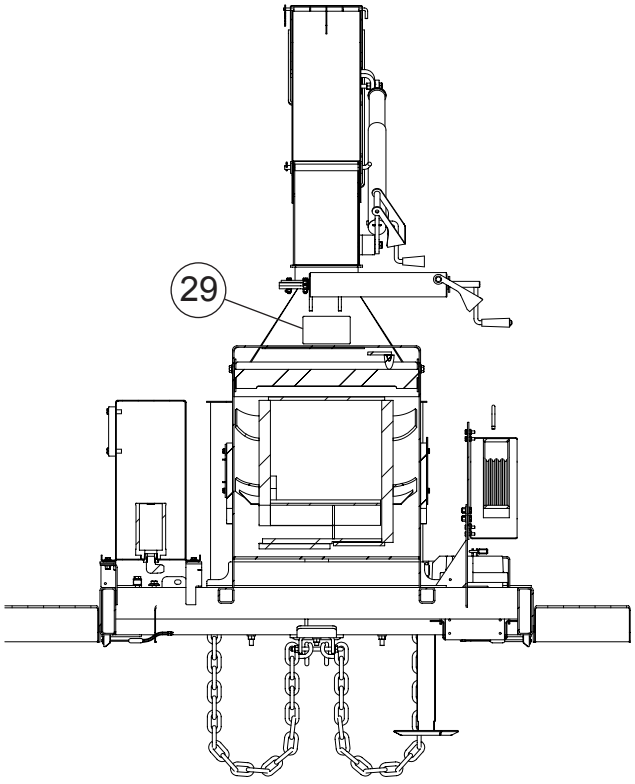

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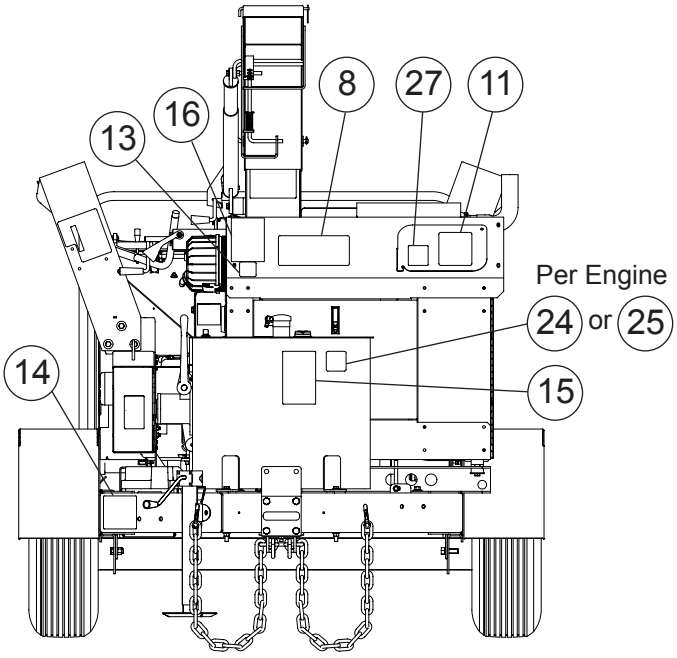
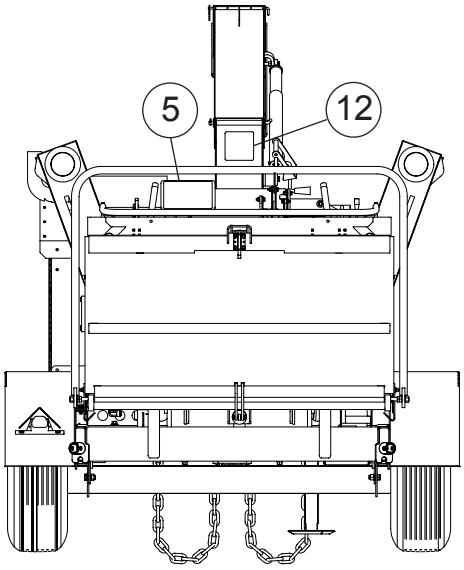
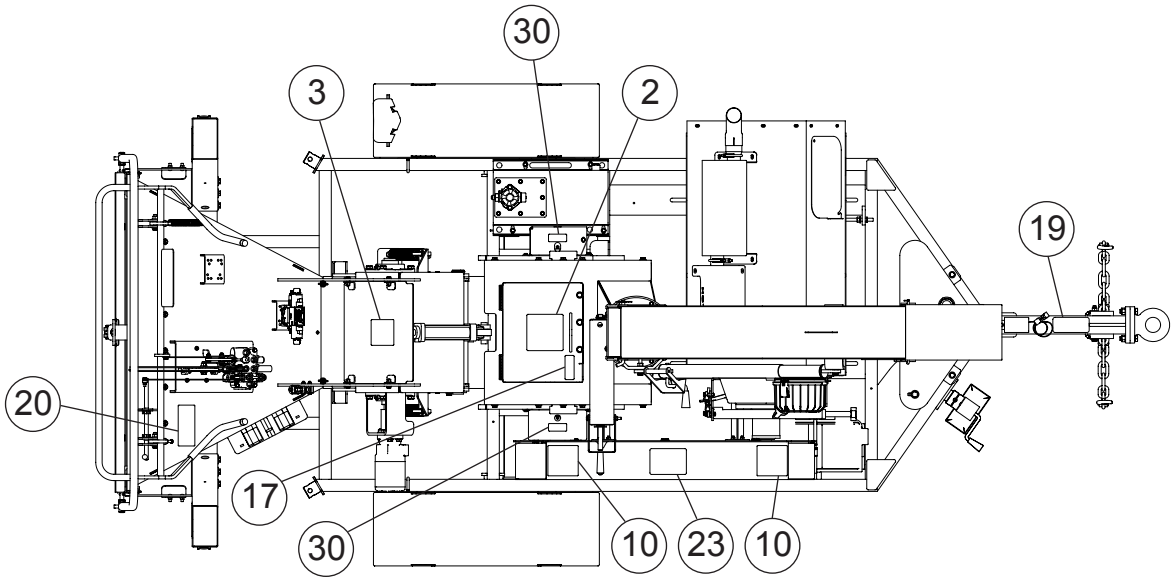


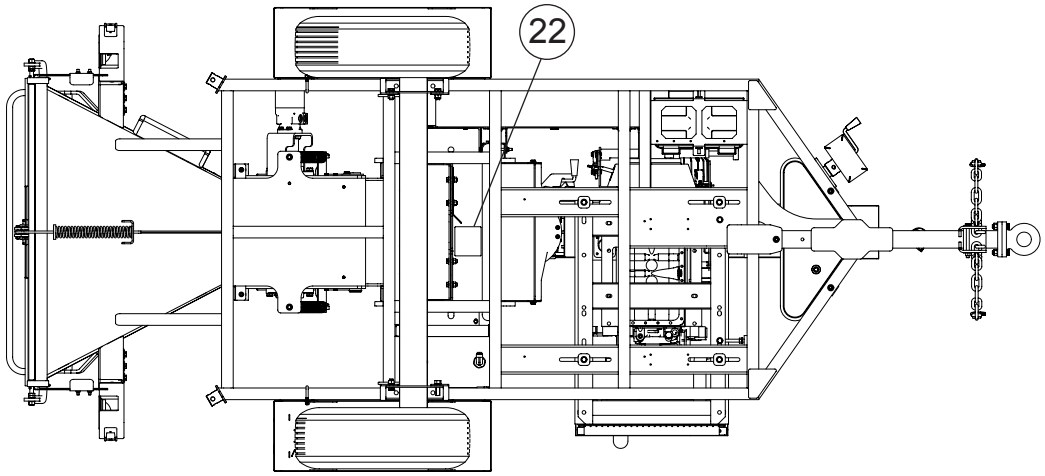
Front View



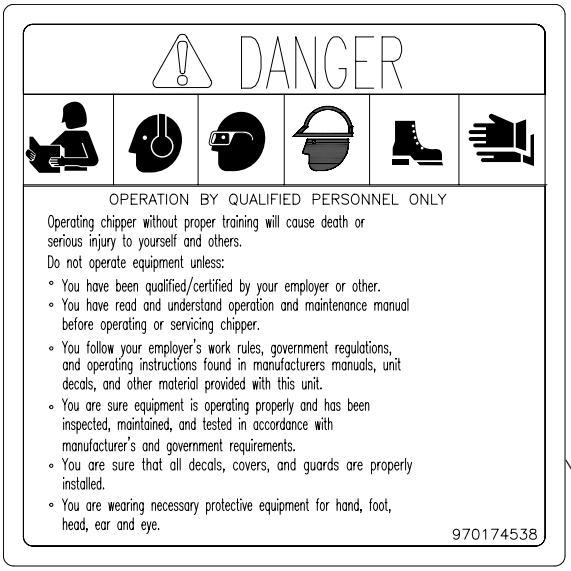
Rear View



Top View



Bottom View


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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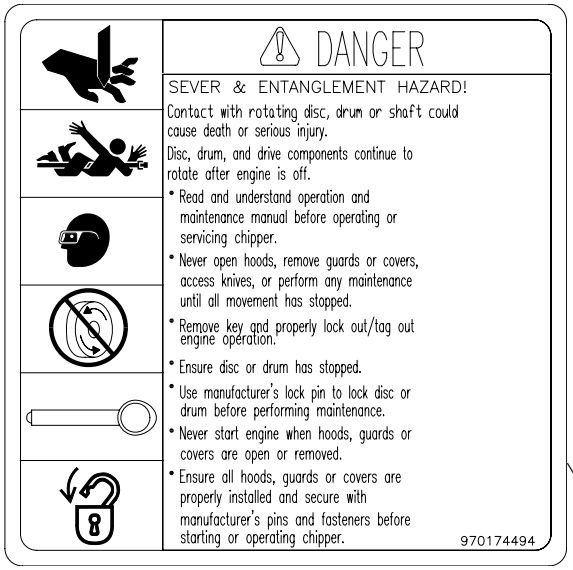
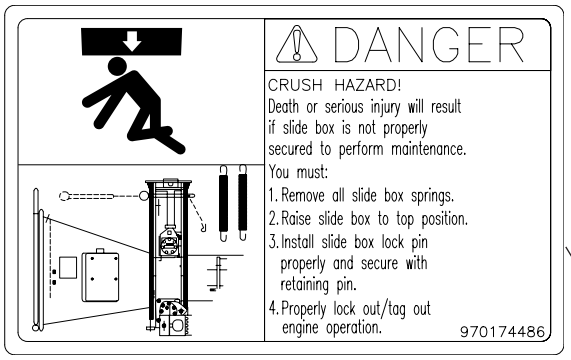

DANGER
SEVER & ENTANGLEMENT HAZARD!
Contact with rotating disc, drum or shaft could cause death or serious injury.
Disc, drum, and drive components continue to rotate after engine is off.
• Read and understand operation and maintenance manual before operating or servicing chipper.
• Never open hoods, 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.
970174494

2


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.
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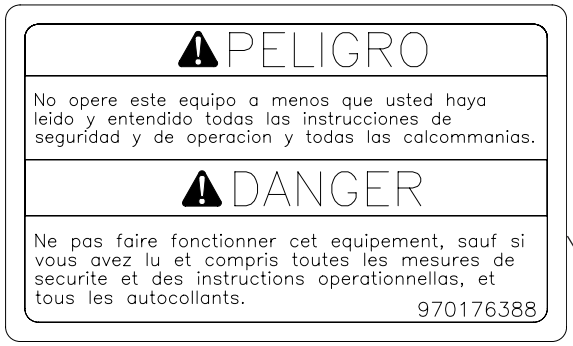
3


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.
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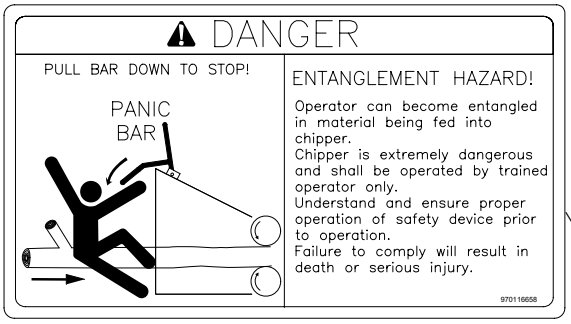
DANGER
PULL BAR DOWN TO STOP!
PANIC BAR
ENTANGLEMENT HAZARD!
Operator can become entangled in material being fed into chipper.
Chipper is extremely dangerous and shall be operated by trained operator only.
Understand and ensure proper operation of safety device prior to operation.
Failure to comply will result in death or serious injury.
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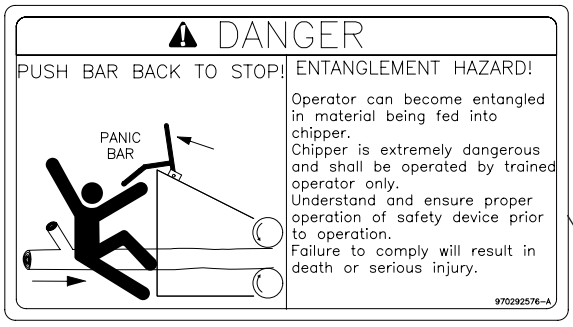
DANGER
PUSH BAR BACK TO STOP!
PANIC BAR
ENTANGLEMENT HAZARD!
Operator can become entangled in material being fed into chipper.
Chipper is extremely dangerous and shall be operated by trained operator only.
Understand and ensure proper operation of safety device prior to operation.
Failure to comply will result in death or serious injury.
970292576–A

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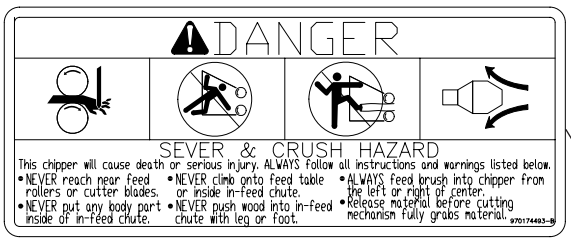
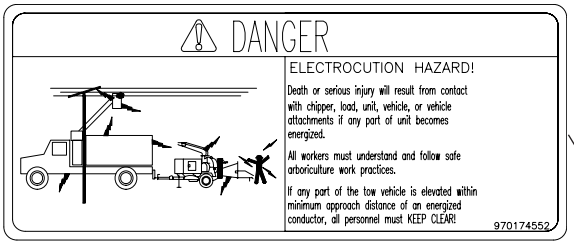

DANGER
SEVER & CRUSH HAZARD
This chipper will cause death or serious injury. ALWAYS follow all instructions and warnings listed below.
• NEVER reach near feed rollers or cutter blades.
• NEVER put any body part inside of in-feed chute.
• NEVER climb onto feed table or inside in-feed chute.
• NEVER push 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.
970174493–B

7


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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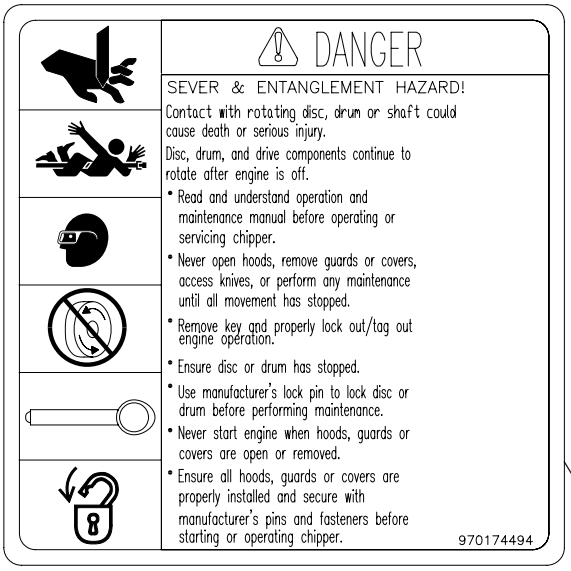

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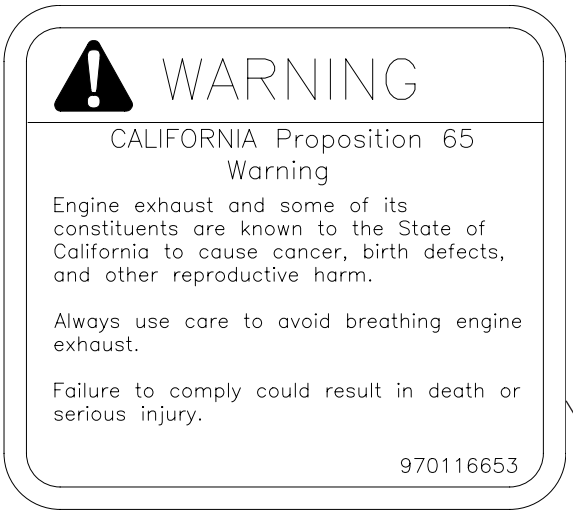

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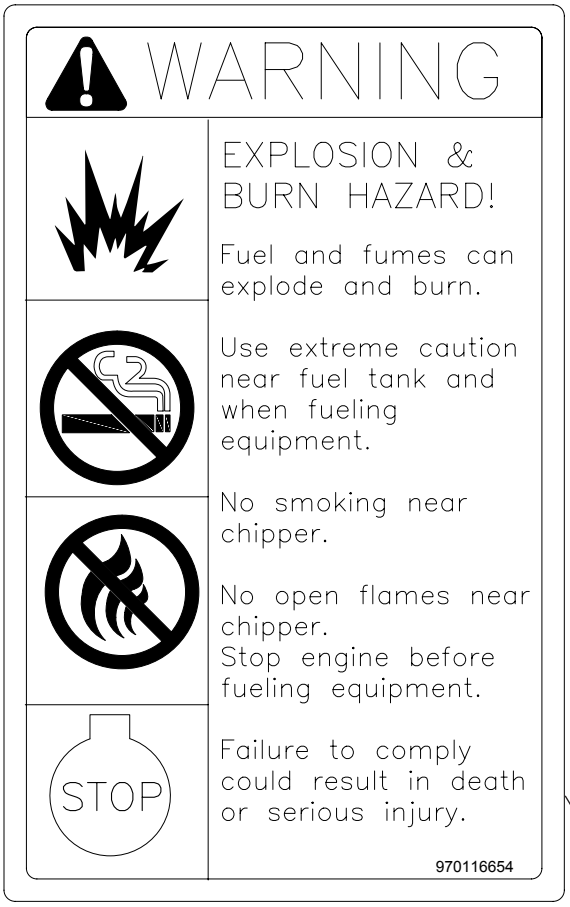

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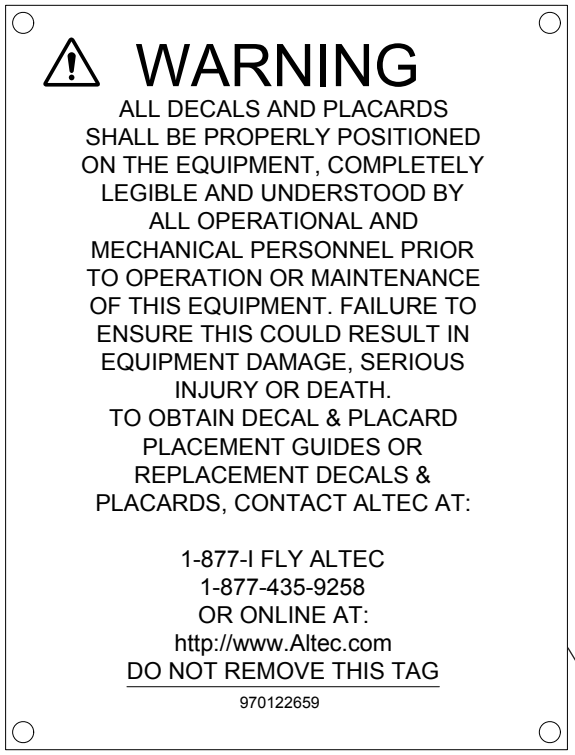

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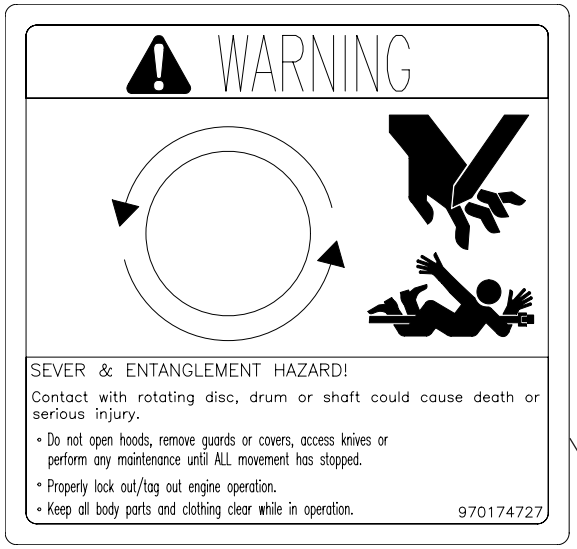

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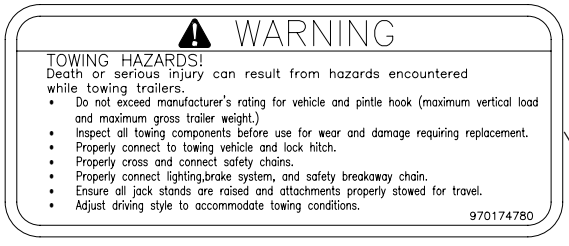

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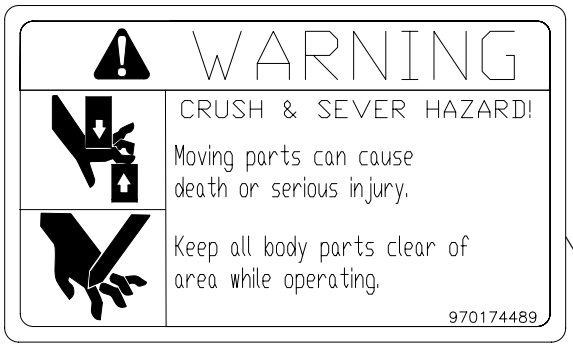

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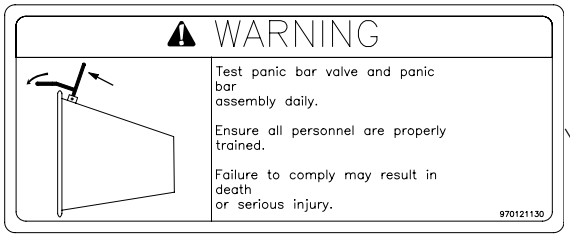

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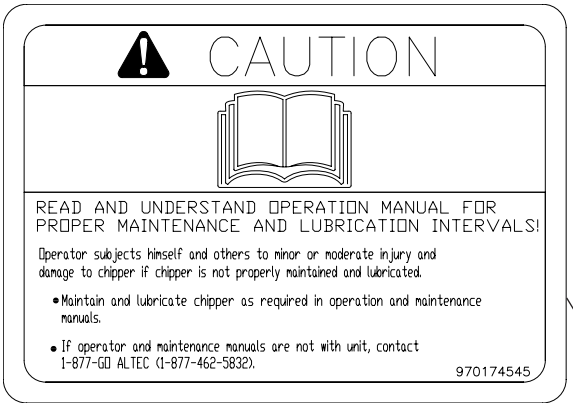

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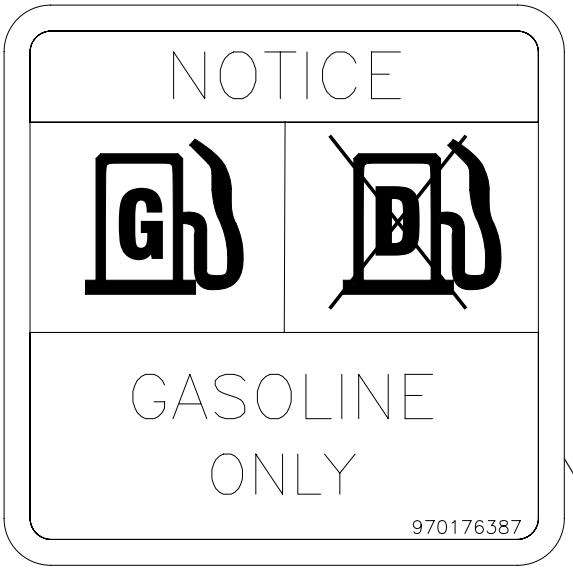

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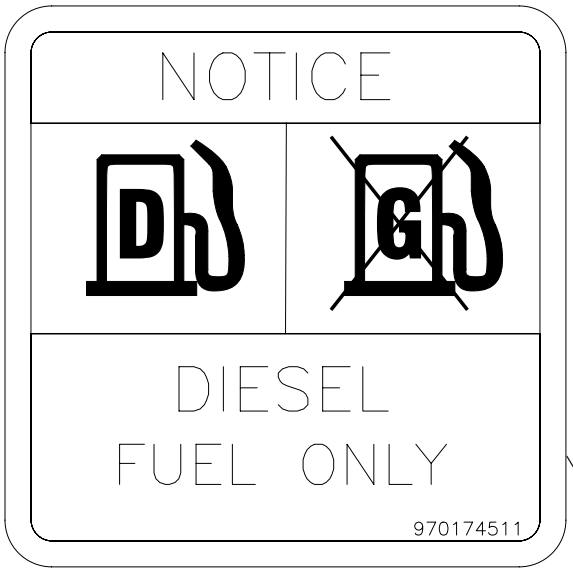

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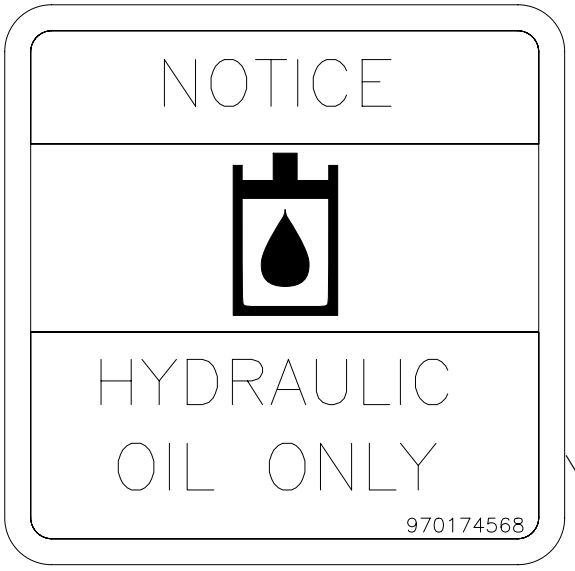

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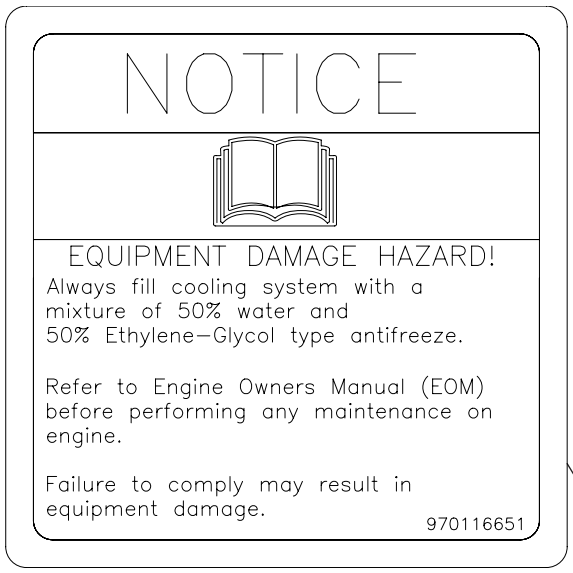

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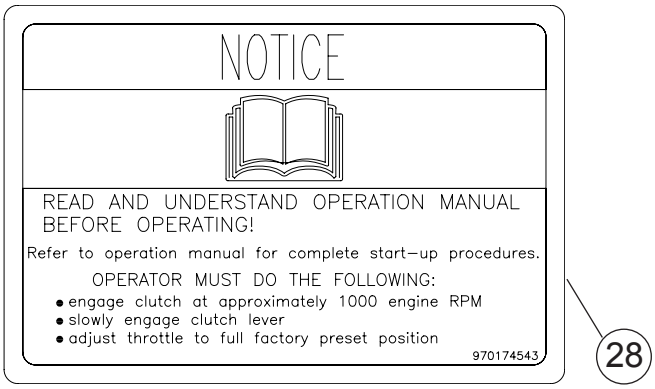
NOTICE
READ AND UNDERSTAND OPERATION MANUAL BEFORE OPERATING!
Refer to operation manual for complete start–up procedures.
OPERATOR MUST DO THE FOLLOWING:
• engage clutch at approximately 1000 engine RPM
• slowly engage clutch lever
• adjust throttle to full factory preset position
970174543

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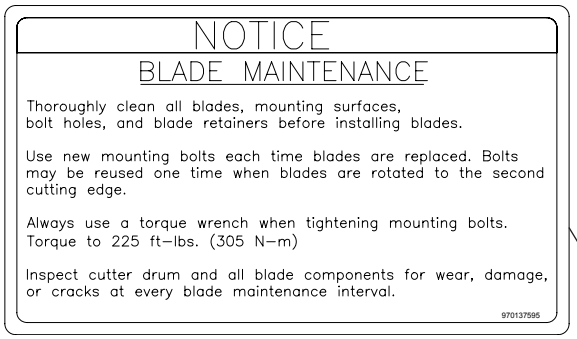
NOTICE
BLADE MAINTENANCE
Thoroughly clean all blades, mounting surfaces, bolt holes, and blade retainers before installing blades.
Use new mounting bolts each time blades are replaced. Bolts may be reused one time when blades are rotated to the second cutting edge.
Always use a torque wrench when tightening 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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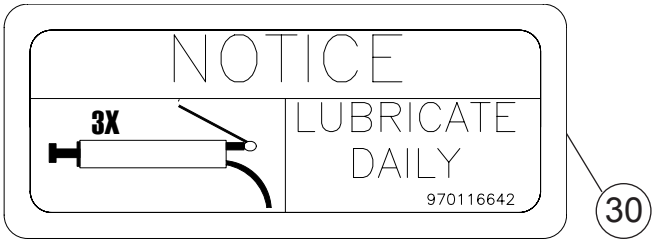
NOTICE
3X
LUBRICATE DAILY
970116642

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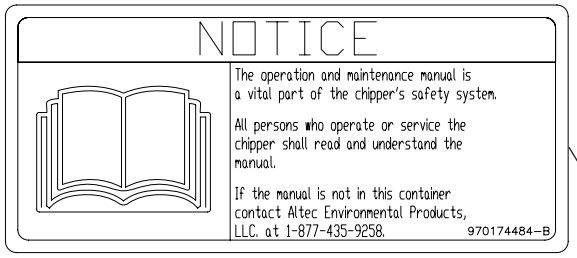
NOTICE
The operation and maintenance manual is a vital part of the chipper's safety system.
All persons who operate or service the chipper shall read and understand the manual.
If the manual is not in this container contact Altec Environmental Products, LLC. at 1-877-435-9258.
970174484–B

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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.

Warning

Death, serious injury, or property damage can result when attempting to access moving components. Make sure components have come to a complete stop before performing inspection or maintenance.

Do not access the drum 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. Complete LOTO procedures.

Warning

Serious injury can result while performing blade maintenance. Wear appropriate safety equipment.

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. A Daily Preoperational Checklist is provided in the Appendix.

- Check engine fuel, coolant, and oil levels (EOM).
- Lubricate cutter bearings and feed roller bearings, if applicable.
- Check the engine air filter (EOM).
- Check radiator fins and ensure free passage of air through the radiator.
- Check clutch handle free play, if applicable.
- Check all cap screws and nuts to make sure they are tight.
- Check cutting blades to make sure all attachment cap screws are tight and blades are in good condition.
- Inspect the anvil to make sure all attachment and adjustment cap screws are secure.
- Verify rotation indicator is clear of debris and fully visible.
- Drum cover padlock is in place and key is in responsible party's possession, if applicable.
- Drum hood switch is working properly, if applicable.
- Inspect safety tow chain for wear or damage.
- 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. When the system is cold, the fluid must be between 2" to 3" (5.08 to 7.62 cm) from the top of the tank or within the sight gauge, if applicable.
- 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 chip curtain is properly fastened and in good condition.
- Make sure the folding feed table 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 infeed 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

Death, serious injury, or property damage can result when attempting to access moving components. Make sure components have come to a complete stop before performing inspection or maintenance.

Never open the drum hood while the drum is in motion.

Hitching to Tow Vehicle

Warning

Death, serious, or property damage can result from uncontrolled movement of the chipper and/or tow vehicle. 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.

Caution

Injury can result from being pinched or trapped between moving components. Keep hands clear.

The chipper and tow vehicle, as well as the hitch and receiver create pinch points. Stay clear of these points during all operations and be aware as they change during movement of vehicles.

Caution

Injury can result when attempting to lift the chipper.

The chipper tongue weight is too great for one person to lift safely.

Warning

Death or serious injury can result from being trapped between moving components. Maintain a safe distance from the tow vehicle and 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.

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

- Chipper secured to tow vehicle and safety pin/latch or hitch locking devices secured.
- Secure jack stand in the travel position.

Warning

Death, serious injury, and/or property damage can result from uncontrolled movement. Check and adjust for proper weight distribution when towing the chipper.

- 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.
- For proper towing weight distribution make sure the discharge chute is properly secured in the forward pointing position, if applicable.
- Make sure the folding feed table is secured in its closed position.
- 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.
- Verify there are no loose tools or materials on the chipper or in the infeed chute.
- Check all cones, wheel chocks, signs, or other support tools and materials to ensure proper stowage.

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

Death, serious injury, and/or property damage can result from improper handling and storage of fuels. Gasoline and diesel fuel are highly flammable. Exposure to gasoline or diesel fuel liquid or vapor can adversely affect health.

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

Death or serious injury can result from breathing engine exhaust. 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 fuel tank.
- Keep away from eyes and skin.
- Never siphon by mouth.

Controls

Danger

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

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

Property damage can result from improper engine operation. Refer to the Engine Operations Manual before 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 infeed chute. The three control positions are as follows.

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

Neutral – stops movement of the feed rollers.

Feed – pulls material into the chipper cutting zone.

Warning

Death or serious injury can result if controls are not operating properly. Do not operate the chipper if the components are damaged or do not operate smoothly, completely, and without binding.

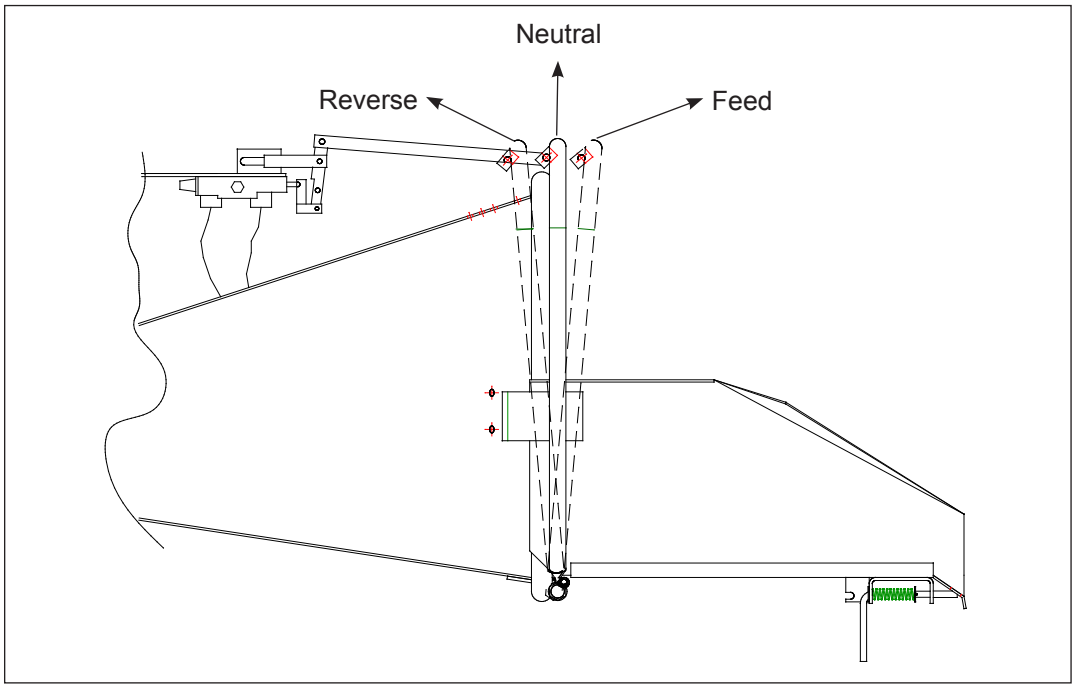


Figure 4.1 — Feed Roller Control Arm Movement

PTO/Clutch Engagement

Warning

Death or serious injury can result from being trapped between moving components. Maintain a safe distance while components are in motion.

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

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/drum has stopped.

Notice

Figure 4.2 shows a Stein PTO. The PTO supplied with the chipper may operate in a different manner. Please familiarize yourself with the proper operation of your PTO prior to chipper operation.

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

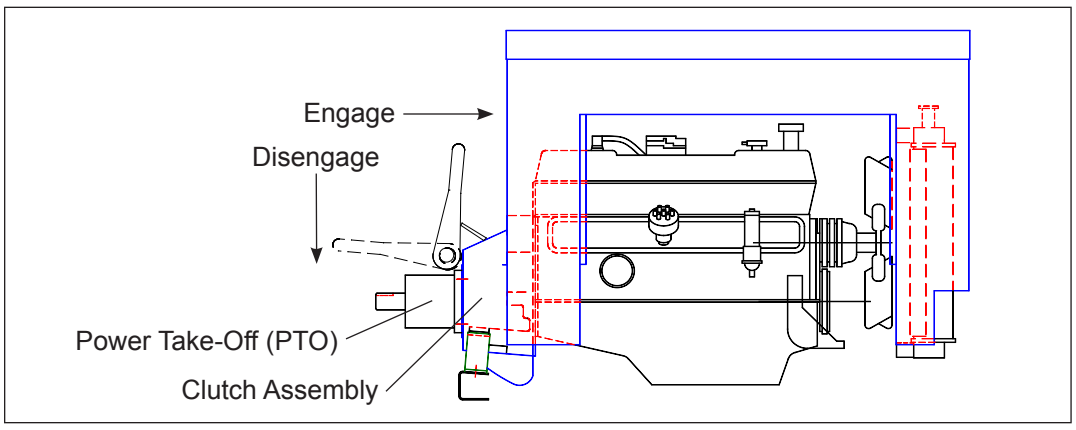


Figure 4.2 — PTO/Clutch Engagement

Warning

Death or serious injury can result from airborne materials. Make sure no personnel are in the path of material that might be discharged from chipper.

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.

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

Equipment damage can result 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.

FeedSense® (Electronic Feed Control)

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.

Warning

Death or serious injury can result from unexpected movement. Material will advance automatically when the FeedSense® is activated.

After material has been engaged by the chipper always stay clear of possible entanglement hazards.

Work Site Preparation

Warning

Death or serious injury can result from improper chipper setup or work site preparation.

When 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.

The chipper tongue weight is too great for one person to lift safely. Serious muscle strains can result 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.

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

Prior to starting the engine, check the infeed 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

Death or serious injury will result from contact with or proximity to equipment that has become electrically energized. Maintain safe clearances from all energized conductors and any grounded device, material, or equipment.

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 result from airborne materials. Make sure no personnel are in the path of material that might be discharged from 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

Death, serious injury, and/or property damage can result from feeding material that is not wood into the chipper. Inspect all material before it is fed into the chipper.

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.

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 cutter.

Caution

Injury can result from improper handling of materials. Do not attempt to lift material that is too heavy to be lifted safely.

Be sure to cut all trees, tree limbs, and brush into lengths that can be safely handled by the operating personnel available.

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.

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.

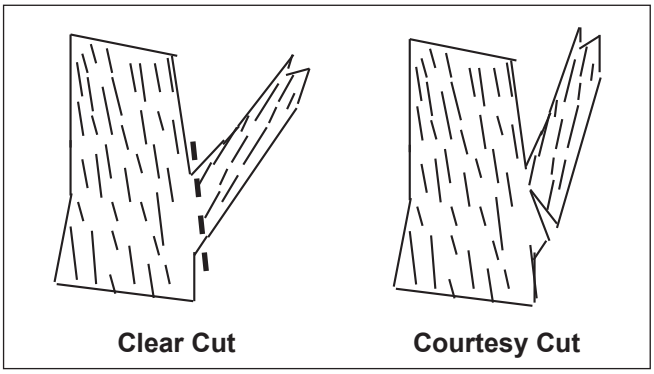


Figure 4.3 — Type of Cut

Starting the Engine

Danger

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

You must read and understand the entire Operator's Manual and all safety decals/placards prior to operation of the chipper.

Warning

Death or serious injury or property damage can result from airborne objects. Make sure all guards are in place before operating the chipper.

Never start the engine with the drum hood open.

Before starting the engine, check the infeed 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 the Cutter Head

Engaging

Warning

Death or serious injury can result from airborne materials. Make sure no personnel are in the path of material that might be discharged from chipper.

Caution

Injury can result from potential hazards of operating and being in the operational area of this unit. Wear appropriate safety equipment.

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 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 cutter 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

Warning

Death, serious injury, or property damage can result when attempting to access moving components. Make sure components have come to a complete stop before performing inspection or maintenance.

Caution

Injury can result from being pinched or trapped between moving components. Keep hands clear.

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

2. Reduce engine speed to idle.

Figure 4.4 — Rotational Indicator

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

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

After the engine has stopped and the clutch has been disengaged, the cutter and drive system will continue to rotate, making the hydraulic feed system operational.

Do not remove guards, attempt repairs, or leave shipper unattended, until the cutter and drive system have come to a complete stop.

5. Engage the clutch and inspect the rotation indicator on the cutter and belt at the clutch output shaft to make sure there is no movement in the drive system.

Feeding Brush to the Chipper

Danger

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

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 unit.

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.

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 table, 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.

Notice

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 infeed chute. In the event there is debris in the transition, use another piece of wood to clear the transition area before standing behind the infeed 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.

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.

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

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 table during chipping operations.

Never reach into or lean over the feed table or into the infeed chute.

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

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

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

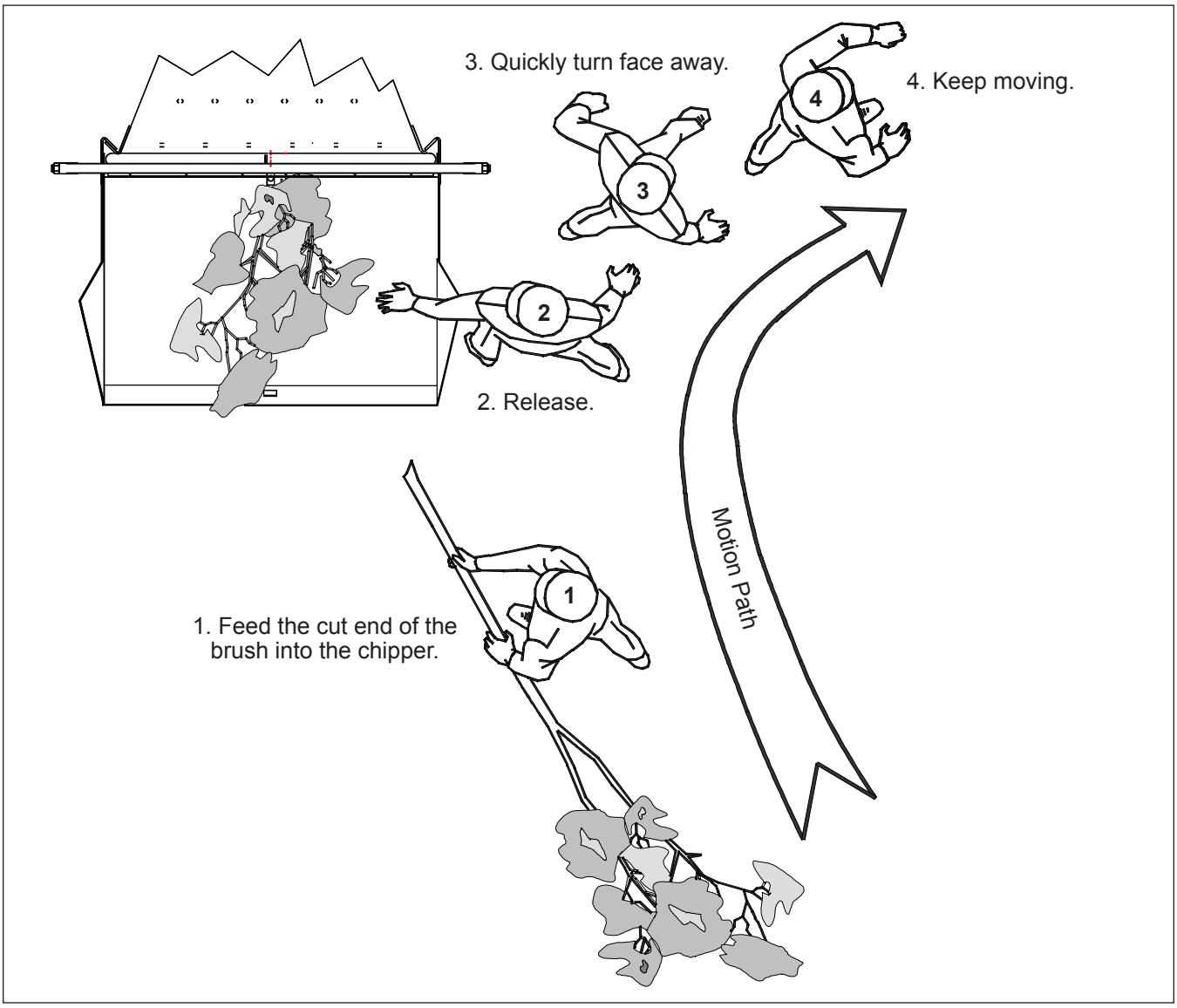


Figure 4.5 — Proper Brush Feeding Technique

2. Place the brush on the feed table and 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 table and do not wait for the brush to finish 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 table during this operation. Stand to the curb side of the table.

6. Do not attempt to feed or re-feed small pieces of brush which remain on the feed table. 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 table.

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.

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

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

Warning

Death or serious injury can result 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 direct impact or entrapment between the material being fed and the chipper infeed chute.

Figure 4.6 — Releasing the Material

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

Winch Safety and Operation (Optional Equipment)

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

Danger

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

Only those properly trained and authorized by the employer shall operate the winch.

Warning

Death, serious injury, and/or property damage can result from feeding material that is not wood into the chipper. Inspect all material before it is fed into the chipper.

Always remove the cable assembly prior to feeding material into the chipper.

Warning

Death or serious injury can result from 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 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 winch line, 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. 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 unspooling. 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. 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.

Section 5 — Clearing Feed System and Discharge Chute

Feed System

Warning

Death or serious injury can result if proper feed roller 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.

Caution

Injury can result from being pinched or trapped between moving components. Keep hands clear.

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.

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.

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, disc, and feed roller have come to a complete stop. Remove keys from the ignition and place in pocket. Complete 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 infeed chute.

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

1. Push forward on the control bar to 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.

Raising the Feed Roll Assembly

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 (refer to Figure 5.1).

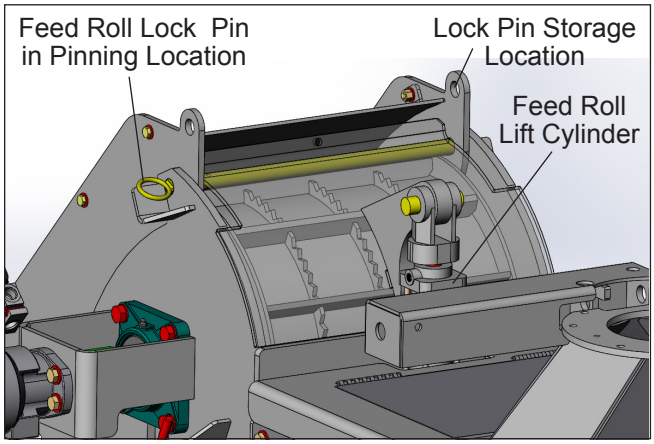


Figure 5.1 — Feed Roll Lock Pin

4. Turn engine off and remove keys.
5. Remove negative battery cable.
6. Lock battery box.

Warning

Death, serious injury, or property damage can result when attempting to access moving components. Make sure components have come to a complete stop before performing inspection or maintenance.

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.

10. Restart engine.

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

Warning

Death or serious injury can result if the upper feed roller is not returned to the proper position. Do not feed material into the chipper with the upper feed roller in the locked open position.

Discharge Chute

Warning

Death or serious injury can result if proper discharge chute 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.

Complete 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 split ring attachment 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 drum 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 blades. Change blades.
- Dull or damaged anvil. Change anvil.
- Incorrect anvil/blade clearance. Adjust to proper gap.
- Improperly sharpened blades.

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. For chippers not equipped with FeedSense®, engine speed is controlled by using the control bar and through proper brush preparation and feeding techniques.

A clogged, or partially clogged, discharge chute may also cause poor chip discharge velocity. Make sure the chute is clear of all obstructions.

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.

Drum 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

Death, serious injury, and/or property damage can result from improper maintenance of the unit. Do not perform maintenance procedures on this unit without proper training.

Notice

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

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

Death or serious injury can result from unexpected movement. Follow the lock-out tag out procedure before accessing internal components of the unit.

Death, serious injury, or property damage can result when attempting to access moving components. Make sure components have come to a complete stop before performing inspection or maintenance.

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.

Caution

Injury can result from contact with engine components that are hot. Use caution when accessing the engine cowling or in the vicinity of the engine exhaust.

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

Caution

Injury can result from contact with engine components that are hot. Use caution when removing the radiator cap.

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.

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 buildup of airborne particles in the engine radiator area. Directing chipper discharge downwind of the engine radiator area, discharging into a chip body, and using chip body screens or canvases will greatly reduce this condition. 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 1 1/2" 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 resulting from improper clutch adjustment will not be covered under warranty. Refer to PTO owner's manual for detailed adjustment procedures.

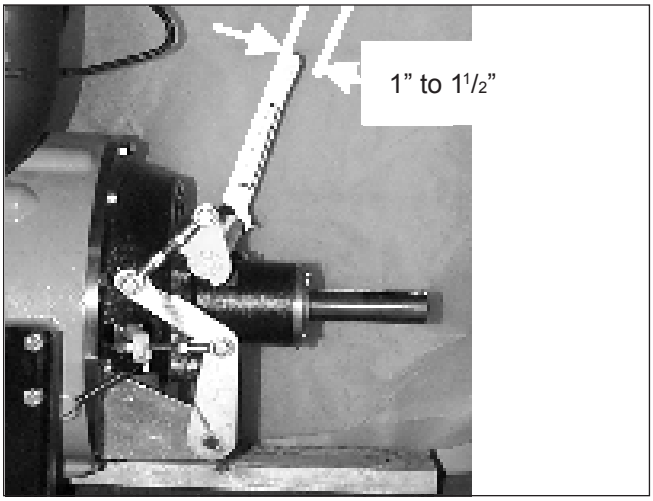


Figure 6.1 — Clutch Free Play

Battery

Caution

Injury can result from exposure to battery acid. Wear appropriate safety equipment.

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. Tire inflation pressure can be found on the tire.

Torque wheel lug nuts to the value in the axle owners manual.

Tongue and Hitch

Warning

Death, serious injury, and/or property damage can result from towing the chipper with a damaged hitch or tongue tube. Thoroughly inspect the hitch and tongue tube before towing the chipper. Make repairs as necessary.

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.

- 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 repaired or replaced immediately.

Notice

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

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.

Brake Adjustment
Adjust brakes at the following intervals. Refer to the axle owners manual.

- 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.

Feed Roller Pivot Points
Feed roller pivot points have a non-greaseable, oil impregnated bushing. Lubrication of these points will inhibit the designed method of lubrication and may cause excessive wear of the bushings and shaft.

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.

Section 7 — Maintenance

This unit is the result of Altec'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 section of this manual.

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.

The scope of this manual is limited to periodic maintenance. It does not cover methods that may be required to inspect and repair major damage to the unit. Impacts to and excessive forces on the unit, through vehicular accidents, rollovers, excessive loading, and the like, may result in structural damage not obvious during a visual inspection. If the unit 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 for additional instructions.

Warning

Death or serious injury can result from component failure. Continued use of the unit 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 Industries, Inc. 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.

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.

Danger

Death or serious injury can result when performing maintenance on the unit.

Maintenance personnel must be trained in safe service procedures.

Proper unit maintenance will reduce downtime, lower operating and repair costs, and extend equipment life. Safety alone justifies a preventive maintenance program. This type of program is less expensive than making major repairs.

This section contains information on properly inspecting the hydraulic system, structures, individual unit components, and lubrication.

Checklists are provided in the Appendix. Use these checklists when performing routine maintenance and inspections to make sure no areas are overlooked. Keep permanent, written, and dated records of all service performed on the unit.

More frequent maintenance may be necessary if the unit is operated under severe conditions.

It is essential that all personnel involved in the care of this unit read and understand the manual. Safety alerts throughout the manual highlights situations in which accidents can occur. Give special attention to all safety alerts.

The safety information in this section applies only to the maintenance of this unit. Although procedures have been written to protect the mechanic and other personnel, there is no safety system to account for human error or negligence.

Warning

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

Work practices may expose maintenance personnel to hazardous materials. Before using any chemical, read and understand the manufacturer's label and the material safety data sheet (MSDS). These sheets explain emergency and first aid procedures and waste disposal methods. Properly dispose of oil and hazardous materials.

Caution

Injury can result from slipping and falling. Use care and suitable work platforms during maintenance.

Maintenance procedures may require the use of ladders, platforms, scaffolding, etc., to access the unit. Provide suitable work surfaces clear of obstructions for maintenance procedures. Do not stand or walk on surfaces that are not intended as such.

General Maintenance Information

- Read and understand the complete procedure before beginning.
- Remove the pressure in a hydraulic circuit before disconnecting its components.
- Use lifting devices of suitable capacity to support and handle components.
- Use a test block to adjust the relief setting on counterbalance holding valves.
- Be aware of your surroundings.
- Fully open all shutoff valves after servicing the unit.
- Complete the required procedures before returning the unit to operation.
- After completing a procedure, check the oil level in the hydraulic reservoir and add oil if necessary.
- Many inspections require the removal of covers. After the inspection is complete, replace the covers before returning the unit to service.

Equipment Storage

Mobile hydraulic equipment needs maintenance when stored, or not used, for extensive periods of time. Depending upon the climate, lack of use may begin to have a negative effect in as little as two weeks. Storage for a period of several months will almost certainly produce some deterioration of the equipment.

Rust will form on unprotected ferrous metal surfaces very quickly and water will collect inside unit structures. In dry climates, gaskets will begin to shrink during long periods of non-use, and lubricants will lose their ability to provide lubrication. In cold climates, condensation may occur in fluid reservoirs and other components.

Even when protective measures have been taken prior to storage, some degradation of performance must be expected when the equipment is put back into use.

Protective Measures

If it is known that equipment will be stored for a month or more, some steps should be taken to preserve the equipment.

1. The best preservative is to fully cycle (operate) the equipment once weekly if even for a short time.

2. Coat exposed ferrous (iron or steel) bare metal surfaces with a light grease or heavy oil compatible with system hydraulic oil. This includes cylinder rods, shafts, gears, linkages, and unpainted parts.

3. Top off fluid reservoirs to allow as little air space as possible, to limit the effects of condensation. Remove excess oil before operating to limit the chance of overflow when cylinders are cycled.

4. Cover or wrap exposed rubber or neoprene parts with an ultraviolet resistant covering to shield the parts from sun exposure.

5. Unplug electrical connectors and apply a dielectric grease or an aerosol product designed for protecting electrical connectors. Plug the connector back together.

6. Cover switch panels and control panels to prevent direct intrusion of rain or moisture, while allowing air to circulate over the panel.

7. While greasing slowly rotate all bearings until new grease is seen purging from the bearing.

8. Repack axle wheel bearings.

9. Refer to engine manufacturer's recommendations on storage procedures.

10. Make sure the engine exhaust system and air intake system are protected from water intake.

11. Secure all padlocks and remove keys from ignition.

12. Disconnect or remove battery.

Extended Storage

Engine Storage

Prior to extended storage, please refer to your engine owner's manual for proper storage procedure.

Chipper Storage

Things to do prior to extended chipper storage.

- Let the chipper cool to ambient temperature.

- While slowly rotating the drum, grease both bearings until new grease is seen purging from the bearing shaft/seal area.

- Repack wheel bearings.

- While slowly rotating the drive rollers, grease all drive roll bearings until new grease is seen purging from the shaft seal area.

- Make sure the fuel tank is full and not containing water.

- Make sure the hydraulic tank is full and not containing water.

- Make sure the exhaust system is protected from water intake.
- Make sure the air intake system is protected from water intake.
- Disconnect or remove the battery.
- Make sure the chipper has a secure "footing" and that the supporting jack stand is properly positioned.
- Make sure the tires are properly inflated.
- Secure all padlocks and remove the ignition keys.

Hydraulic System

Maintaining the hydraulic system is critical to the proper operation of the unit. Using the proper type of oil helps to prevent many hydraulic system problems. Maintaining the oil is also important. If the oil is dirty or contaminated, components may be damaged.

Notice

Only use hydraulic oil as recommended. Other fluids added to the hydraulic system can increase component wear and affect the lubricating characteristics of the oil.

Check the oil level in the reservoir with the vehicle level. The proper oil level is between 2" and 3" (5.08 to 7.62 cm) from the top of the tank.

Cleanliness Precautions

Contamination will ruin any hydraulic system. It is very important that no contamination enter the system. Dirt, water and air are types of contaminants. They can enter the hydraulic system in many ways. Contaminants can enter the system when filling the reservoir or changing filters. They can also enter when changing components or performing other service procedures.

The following precautions will help protect the cleanliness of the hydraulic system.

- Filter new oil with a 10 micron filter as it is added to the reservoir.
- Clean hydraulic connections before opening them.
- Cap or plug ports and lines opened for service.
- Keep replacement hoses and other components plugged while stored.
- Clean the reservoir and return line filter covers before opening them.
- Make sure components are clean before installation.
- Clean the filler breather cap before opening it.
- After servicing the reservoir, immediately replace the cover.
- Make sure quick disconnect couplers are clean before connecting them.
- Do not spray water on the reservoir filler breather cap. This could force contaminants into the reservoir.

Filtration

The unit is equipped with a complete filtration system. When properly maintained, this system will reduce contamination of the hydraulic system. The filtration system must be serviced regularly to be effective.

Breather

The breather is located on the side of the fill hole on the reservoir. The breather allows air to flow in and out of the reservoir as the oil level changes. It contains a filter that cleans the air as it enters the hydraulic system.

Notice

When adding oil, always pump oil through a 10 micron filter prior to adding.

Replace the filler breather as needed. If the unit is operated in an extremely dusty environment, it may be necessary to replace the breather more often.

Suction Filter

Hydraulic oil leaving the reservoir through the suction line, on its way to the pump, passes through a suction filter which is accessible from inside the hydraulic tank. The suction filter contains a 100 micron wire mesh element. Although the element may be cleaned, it is also available as a service part.

Clean the filter whenever the hydraulic oil is changed. Oil will not flow into the pump fast enough if the filter becomes clogged. If the pump does not receive sufficient oil flow, pump damage will result.

Warning

Death or serious injury can result from improper use of solvents. Follow the manufacturer's label for proper use and disposal.

Caution

Injury can result from airborne particles entering the eyes. Wear appropriate safety equipment.

Clean the filter element by flushing it with solvent. Blow it dry with an air hose from the inside of the screen to the outside. Check for holes or other damage.

Return Line Filter
The return line filter is a cartridge type 10 micron filter that cleans the oil before it enters the reservoir.

The return line filter head contains a filter bypass valve. This bypass valve opens when there is a pressure drop of 15 psi (1.03 bar) across the filter cartridge. When the valve is open, oil flows directly into the reservoir bypassing the filter. This prevents the cartridge from bursting during cold start ups or if it is clogged.

If the filter becomes clogged the oil flows directly into the reservoir bypassing the filter. The lack of filtration will eventually damage hydraulic components.

During the break-in period of a new unit, the hydraulic components will deposit break-in wear particles in the return line filter cartridge. Change the return line cartridge after the first 15 to 25 PTO hours. Then, change the cartridge as recommended by the checklists in the Appendix. If the unit is operated in very dusty conditions, replace the return line filter more often. Also, replace the cartridge after new oil has circulated through the system for the first time.

Always replace the return line filter cartridge with a genuine Altec replacement part. Other filters may screw or fit into the filter housing, but may not have the same micron rating. Also, other filters may allow oil to bypass at a different rate.

Oil Specifications

Use high quality oil in the hydraulic system. The oil should contain rust, oxidation, and corrosion inhibitors. It should also contain antifoam and antiwear additives.

Hydraulic oil is commonly classified by viscosity. The viscosity of hydraulic oil changes with temperature. The higher the viscosity index of an oil, the less the viscosity will change as the temperature changes. A multiviscosity oil contains additives which increase the viscosity index. Multiviscosity oils should have high shear stability to maintain oil performance by avoiding excessive change in viscosity.

The ability of hydraulic oil to provide adequate fluid at low temperatures is measured by its pour point. If the pour point is not low enough, oil will not flow into the pump at a fast enough rate when the pump is operated at low temperatures. This will cause cavitation, which can quickly destroy the pump.

Notice

Only use hydraulic oil as recommended. Other fluids added to the hydraulic system can increase component wear and affect the lubricating characteristics of the oil.

Only use oils meeting the viscosity rating for military specification MIL-5606 in extremely cold climates. These oils have fewer antiwear characteristics and are not recommended for full time use.

Most companies can supply equivalent oils. The oil selected for the hydraulic system depends on the temperature during unit operation.

Oil Condition

An important part of hydraulic system preventive maintenance includes checking the condition of the hydraulic oil.

Periodic laboratory analysis is the most accurate method of determining the condition of hydraulic oil and determining when it should be changed. A visual inspection may also be useful to check oil condition.

A hydraulic oil supplier should be able to do testing or recommend a test laboratory. The laboratory should provide the following information.

- Particle count
- Trace element analysis (component wear, outside contaminants, and oil additive concentrations)
- Viscosity test
- Water content test

Before taking a sample of oil, operate the unit to circulate the oil. Warm it to operating temperature. Take the sample from the middle level of the reservoir using a clean hand pump, such as a disposable syringe and a piece of plastic tubing. If this is not available, drain the sample from the bottom of the reservoir. Allow several quarts of oil to flow out before collecting the sample to remove any dirt and water that has collected in the reservoir near the drain.

If a sample container has not been provided by the laboratory, use a wide mouth, screw top, clear glass container. Clean it with hot water and detergent. Rinse it thoroughly and let it air dry before putting oil into it.

Once the report is received, compare it to previous oil analysis reports for the same unit. This information will provide trends toward oil deterioration. It may give early warnings of a problem developing within hydraulic system components.

Notice

Change the oil if the sample has any of the characteristics listed in Figure 7.1.

If making a visual inspection, compare the sample of oil to a sample of new oil of the same type. Also, compare it to previous samples taken from the same unit. Look for the signs of oil deterioration listed in Figure 7.1.

There are fluid contamination detector kits available which allow for rapid, on-the-spot analysis of the hydraulic system's condition. Contact your Altec representative for further information.

Oxidation produces varnishes that bake onto hot surfaces. Oxidation products are acidic and tend to attack metal surfaces. This can damage pumps, motors, and valves. High operating temperatures will increase the rate of oxidation of the oil. The presence of water or air in hydraulic oil also causes oxidation.

The presence of water may cause rust and corrosion. If laboratory analysis or visual inspection indicate that the oil is deteriorating prematurely, determine the cause of the problem and correct it.

Changing Oil and Flushing the System

A properly maintained filtration system greatly extends the useful life of the hydraulic oil. However, the oil will eventually need to be replaced due to contaminants that form during normal operation of the unit.

It is impossible to recommend an exact time interval for oil changes due to varying conditions of unit use. Use the following guidelines to determine when the hydraulic oil should be changed.

- Change the oil as recommended by the checklists in the Appendix.
- If a hydraulic component fails and contaminates the system with metallic particles, change the component and the oil immediately.
- In climates with a wide variation in operating temperatures between summer and winter months, change to the appropriate weight oil each spring and fall.

Replace the return line filter cartridge and filler breather cap every time the hydraulic oil is changed. Also, clean or replace the suction filter.

A significant quantity of oil remains in the hydraulic system when the reservoir is drained. Flush the system when the oil is changed. This is especially important if the system is heavily contaminated with metal particles.

If the oil is contaminated with water, it may not be necessary to change the oil and flush the system. Follow the instructions under Water Removal in this section.

The following equipment and supplies are necessary to properly flush the hydraulic system.

- Approximately 13 gallons (49 l) of proper hydraulic oil
- Three return line filter cartridges
- Clean, lint-free rags
- Breather (if component has not been replaced within one year)

⚠ Caution

Spilled hydraulic oil creates slick surfaces and can cause personnel to slip and/or fall. Keep the unit and work areas clean.

Use the following procedure to flush the hydraulic system.

1. If the oil is being changed because of contamination due to hydraulic component failure, proceed to step 2. Otherwise, operate the unit to circulate the oil and warm it to operating temperature. This will allow many of the impurities to drain off in suspension.
2. Drain the oil reservoir completely.

Condition	Possible Cause
Dark color	Oxidation; contamination
Cloudiness or milky appearance	Presence of water or wax
Rancid or burned odor	Oxidation
Increase in viscosity	Oxidation; addition of improper fluids; presence of water
Decrease in viscosity	Addition of improper fluids; additive deterioration
Separation of water or other fluids from the oil	Presence of water; addition of improper fluids
Foreign particles or other visible contamination	Contamination; emulsion of water with oil additives

Figure 7.1 — Hydraulic Oil Conditions

3. Wipe off the top of the reservoir and the filler breather cap.

Warning

Death or serious injury can result from improper use of solvents. Follow the manufacturer's label for proper use and disposal.

4. Inspect the inside of the reservoir. If sludge or other contamination is found, thoroughly clean the inside of the tank using lint free wipes and a solvent which leaves no residue. Change the return line filter and clean or change the suction filter.

Notice

Only use hydraulic oil as recommended. Other fluids added to the hydraulic system can increase component wear and affect the lubricating characteristics of the oil.

5. Fill the reservoir with new hydraulic oil of the proper grade. The proper oil level is between 2" and 3" (5.08 and 7.62 cm) from the top of the tank. Do not fill tank completely full so as to leave room for fluid expansion. Filter the oil through a 10 micron filter as it is put into the reservoir.

6. Install the filler breather cap. If the filler breather cap has not been replaced in one year, or is damaged, replace it.

Notice

Oil change has been completed at step 6 for routine oil changes. If changing oil due to contamination, continue through step 11.

7. Cycle all cylinders, hydraulic motor and all valves to flush contaminated oil from the lines and components of the hydraulic system.

8. Change the return line filter cartridge and clean the suction filter element.

9. Drain the reservoir completely.

10. Fill the reservoir with new hydraulic oil of the proper grade. The proper oil level is between 2" and 3" (5.08 and 7.62 cm) from the top of the tank. Do not fill tank completely full so as to leave room for fluid expansion. Filter the oil through a 10 micron filter as it is put into the reservoir.

11. Change the return line filter cartridge after approximately 25 hours.

Water Removal

If the hydraulic system was contaminated with water, special water removal filtration may be necessary. An oil supplier or a qualified laboratory can determine if water has caused excessive oil oxidation or additive deterioration.

If analysis shows oil deterioration beyond an acceptable level, drain the reservoir and flush the system as described earlier in this section. Use a water removal filtration system during the flushing process to remove any residual water from the system.

If the condition of the oil is acceptable except for the water content, allow time for it to separate from the oil. Then drain the water off the bottom of the reservoir. Circulate the oil in the entire system through a separate water removal filter system.

Continue this process until the water content in the oil is reduced to an acceptable level. The preferred method of determining the water content in the oil is laboratory testing. Once the water content has been reduced to an acceptable level, replace the cartridge with a new return line cartridge.

Lubrication

Proper lubrication will extend the life of the equipment and reduce maintenance problems. The frequency of lubrication required will depend on the amount of use and the conditions the unit is operated in. Operation in extremely dusty, sandy, or rainy environments will require more frequent lubrication. Lubricate the unit as recommended by the Preventive Maintenance and Inspection Checklist in the Appendix.

The Lubrication Chart identifies each component, type of lubricant, and method of application. Any brand of lubricant that meets or exceeds the specifications of the products listed is acceptable. Select the appropriate interval and lubricate the components as identified in the chart.

Always wipe grease fittings clean before and after greasing to keep contaminants from entering the points of lubrication. To avoid bearing damage, use manually operated grease guns. Air-driven grease guns may have enough force to cause bearing damage.

If the unit is not used, or is stored for any length of time, apply fresh lubricant at all points indicated on the Lubrication Chart. This will help prevent corrosion during the idle period.

Lubrication Chart

Component	Lubricant	Applicator	10 Hours Daily	50 Hours Weekly	200 Hours Monthly	1,000 Hours Yearly
Cutter bearings	A	Grease gun	•			
Feed roll bearings	A	Grease gun	•			
Slide box	A	Grease gun		•		
Chute rotation	A	Grease gun		•		
Hinges, friction points	B, C	Spray		•		
Linkages	B, C	Spray		•		
Axle bearings	A	Grease gun		Refer to axle owners manual		
Jack	A	Grease gun			•	
Hydraulic oil	ISO 46		•			
PTO		As required		As required by PTO manufacturer		
Engine		As required		As required by engine oil manufacturer		

Letter	Lubricant
A	Use a premium grade, high temperature, lithium based grease. Some suggested greases include: Mobile Mobilith AW 2, Shell, Alvaina Grease 2, Texaco 1939 Premium RB, Amoco Ryko Premium Grease.
B	General purpose spray lubricant
C	Spray lubricant that penetrates and adheres with good water resistance, is unaffected by temperature extremes and has extreme pressure properties. Anti-seize compound with extreme pressure lubrication that prevents seizure, corrosion, rust, and galvanic pitting.

Bearings
Spherical roller bearings are used on the cutter head and feed roll assemblies. They require periodic lubrication with a chassis lubricant.

It is very important to grease this type of bearing regularly. If they are not greased properly, the usable life of the bearing will be greatly reduced.

Remove any exposed grease from the bearing. Grease each bearing daily with three or four pumps with a standard grease gun.

Slide Box
Clean exposed existing grease from the outside areas of the way surfaces. Pump grease in all four ways until new grease is observed.

Chute Rotation
Clean exposed existing grease from the outside areas of the chute rotation area. Pump grease in all four grease fittings until new grease is observed.

Hinge and Friction Points
Chipper operation and longevity can be improved by keeping all hinges and friction points lubricated. Remove all dirt, corrosion, or foreign matter. Lubricate with appropriate applicator.

Axle Bearings
Standard axles on Altec Environmental Products, LLC chippers have the UltruLube feature. This feature flushes and lubricates both the inner and outer wheel bearings. If your axle is equipped with the UltruLube 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.

Refer to the axle manufacturer's manual for more information.

Jack Stand
Depending on the model jack stand supplied with the chipper there may be a grease fitting. If so, lubricate with one or two pumps.

Engine 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 PTO owner's manual.

Engine
Due to varying engine models and engine specifications, check the engine owner's manual (EOM) for the specific lubrication requirements of your supplied engine.

Structures

The structural components of the unit are identified in the Component Identification in Section 2. The unit has been designed to meet or exceed the ANSI Specifications for Z133.1 Safety Requirements.

Regular inspection of the welds and structures is required to make sure that components maintain their strength. Periodic cleaning of the structures is also recommended. This will prevent damage that can result from dirt accumulation.

Caution

Injury can result from slipping and falling. Use care when cleaning the unit.

Periodic inspection of the structures is recommended to be certain there is no deformation, abnormal wear or abrasion, interference between moving parts, or cracking of the welds on structural members.

Inspect the structures and welds as recommended by the checklists in the Appendix.

Care of Exterior Surfaces

Altec units are manufactured out of structural steel, galvanized steel and/or aluminum components with differing resistance to corrosion. While Altec uses components, designs and coatings that maximize corrosion resistance, regular cleaning and maintenance is necessary to preserve the finish over the life of the equipment.

Frequent and regular washing will lengthen the life of the new equipment's painted finish and components. Wash the equipment frequently with warm or cold water to remove dirt and preserve the original luster of the paint. Never wash the equipment in direct sunlight or when the metal surfaces are hot to the touch as it may cause streaks on the finish. Caution must be used in selecting detergents and degreasers that may damage the finish. Use only commercially available automotive grade cleaners. High pressure washing systems should be used with caution, with the tip of the nozzle maintained at a distance of 12" (30.5 cm) or more from the surface.

It is particularly important to wash the unit during winter months as salt and other ice melting products are extremely corrosive and can damage the vehicle. Other corrosive environments that would necessitate additional washing may include coastal areas, farming communities where chemicals are sprayed, or mining operations.

Waxing of the exterior is typically not required, however waxing will provide additional protection and help restore the finish to the original luster. This may not only improve appearance, but will likely extend the service life of the equipment.

It is important to repair any chips or scratches that occur to prevent further corrosion. If the paint damage exposes primer, then a liquid touch up paint may be used. Damage that extends to unpainted metal must be primed prior to applying a top coat. Touch up paint for standard Altec colors may be ordered by calling 1-877-GO ALTEC. Your local auto body shop can assist you with matching a custom color.

Equipment that is used in harsh environments and off road use needs to have more routine washing and maintenance to the under body area. When the equipment is washed it should washed on the underside as well and routinely checked for any damage to the paint/undercoat. Any damage discovered should be touched up accordingly with a good rust preventative material and/or undercoat. This will help prevent corrosion that could spread from these areas that are not easily seen.

Accumulated dirt can damage the unit and cause it to malfunction. Dirt buildup also accelerates wear on the components.

Caution

Spilled hydraulic oil creates slick surfaces and can cause personnel to slip and/or fall. Keep the unit and work areas clean.

If a pressure washer or steam cleaner is used to clean the unit, be careful where the spray is directed. Do not direct the spray where the cleaning liquid might get into electrical components, such as electrical connections, switches or lights. Even though all electrical components on the unit are designed for all weather use, it is possible for water pressure from the nozzle to push a seal out of position. Do not direct the spray at the filler breather cap of the reservoir. The high pressure can force water and cleaning liquid into the reservoir and contaminate the hydraulic oil. Do not clean any of the hydraulic valve spool ends or near cylinder rod seals with direct pressure from a pressure washer. Limit the water pressure to 500 psi (34.47 bar) and keep the spray tip at least 18″ (45.72 cm) away from these components while washing. After washing and cleaning the unit, relubricate as necessary.

Welds

All welds on the unit are originally applied in conformance to AWS standards. Every weld on the unit is important and should be periodically inspected.

Warning

Death or serious injury can result from improper use of solvents. Follow the manufacturer's label for proper use and disposal.

If paint has lifted off the weld, or if rust is found, a closer inspection is required. Remove any loose paint or rust with a wire brush. Clean the area with a solvent such as acetone. Closely inspect the area for cracks in the welds. Dye penetration and magnetic particle testing are simple processes that may be used to verify or disprove a suspected problem.

Visual inspections can be very effective if conducted properly. Clean the area to be inspected. Look for visible cracks in the weld and at the weld-to-parent material joint. Use a bright light to provide adequate visibility of the inspection area.

Pay close attention to welds that are located where changes in cross section take place and near the attachment points of highly loaded components. If any cracks or unacceptable conditions are discovered, report them to your Altec representative.

Any welds added in the field should be done by qualified personnel and also conform to AWS standards.

After doing repair work on the unit, such as weld repair, some testing of the unit may be required.

Fasteners

A variety of fasteners are used on the unit. Different fasteners have different inspection and installation requirements depending on their use and design.

The standard grade of fastener used on the unit is a zinc plated, SAE Grade 8, steel cap screw. A variety of fasteners such as hex socket head, flat countersunk head, button head cap screws, eye bolts and carriage bolts are also used on the unit.

Check all fasteners for tightness as recommended by the checklists.

When inspecting fasteners, pay particular attention to the following fasteners.

- Blade fasteners
- Anvil fasteners
- Hitch and/or tongue fasteners
- Cutter bearing fasteners
- Control bar linkage fasteners
- Panic bar linkage fasteners

Refer to Torque Values in the Appendix as a guide to determine the proper cap screw torque value. The proper value is necessary to overcome the friction of the threads and develop the required clamping force.

A properly installed cap screw applies a clamping force equal to or greater than the load applied to it. A cap screw installed at less than the recommended torque value does not provide enough clamping force. The cap screw may fatigue, causing it to loosen or fail. If the cap screw is torqued beyond the recommended torque value, the elastic range of the cap screw may be exceeded. This may result in premature failure of the cap screw.

When checking fastener torque value, check at 90 percent of the original value. For example, if the torque value for a cap screw is 100 foot-pounds (136 N•m), check the cap screw for tightness at 90 foot-pounds (122 N•m).

Certain types of fasteners or fasteners used in special applications often require torque values that differ from common torque charts. Check the Fastener Specific Torque Application Chart in the Appendix.

System Operation

The chipper operates as an open center hydraulic system. There is limited pressure in the system until the actuators demand additional pressure. The system then responds with a maximum of 2,900 psi (200 bar). Standard flow rate is approximately 6.5 gpm (24.6 l/m). This may vary with engine selection and customer drive speed specifications.

The normal flow of hydraulic fluid is from the pump to the main control valve. The second spool from the right on the main control valve routes the fluid through into the two motors in either the forward or reverse direction. Fluid then flows through the return filter and returns to the tank.

The first spool in the main control valve is for the panic bar. This spool when activated routes all fluid directly back to the return filter bypassing the directional valve. It is used to stop feed roll motion in an emergency mode of operation.

Oil Reservoir

The reservoir will hold 12 gallons (45.4 l). A 100 micron suction filter is located at the outlet of the reservoir. A breather is located on the side of the fill on the reservoir. The breather contains a filter that cleans the air as it enters the reservoir. The return filter is located under the fill cap. When filling the reservoir remove the return filter cartridge.

Oil Pump

The standard hydraulic pump used on DRM 12 is a 0.5 cubic inch (8.2 cc) per revolution displacement gear pump. The pump is normally directly coupled to the engine auxiliary drive.

Hydraulic Motors

Two motors drive and control the brush feeding rate to the cutter. The motor tapered shafts are directly coupled to the feed rolls.

Valves

When describing hydraulic valves, “position” identifies the number of operating positions of the valve spool. A two-position blocking valve has two operating positions, open and closed.

The word “way” identifies the number of ports in a valve section. A four-way control valve has four ports. One port is for a pressure connection, one is for a return line connection, and the other two ports are the working ports.

Leakage

If components and connections are installed properly, leakage can be kept to a minimum. Small external leaks are usually easy to find because dust will collect on the hydraulic oil film.

External leakage is the escape of hydraulic oil outside the hydraulic system. Improperly tightened fittings are a primary cause of external leakage.

Warning

Death or serious injury can result from hydraulic oil being injected into the flesh. Do not use hands or other body parts to check hydraulic lines and fittings for leaks.

Seek immediate medical attention if injured by escaping hydraulic oil. Serious infection or reaction can result if medical treatment is not given immediately.

Spilled hydraulic oil creates slick surfaces and can cause personnel to slip and/or fall. Keep the unit and work areas clean.

If a connection is properly tightened but continues to leak, disassemble the connection. Seal the necessary parts and/or replace the defective part.

Worn or damaged parts such as scratched cylinder rods can cause leaks. A worn or scratched output shaft on a hydraulic motor can also cause a leak. Such conditions must be repaired or replaced. A new seal should also be installed.

Internal leaks allow pressurized hydraulic oil to escape to tank or another hydraulic circuit. Most hydraulic components have a small internal leak due to machining tolerances.

An internal leak can cause a variety of problems in a hydraulic system. An internal leak in a cylinder can cause drifting or malfunction of a cylinder.

After extended hours of operation, hydraulic motors will increase the internal leakage until a noticeable loss of power is apparent. At this time, you must replace the motor. To minimize motor wear it is essential to maintain clean filtered oil in the system.

Heat Generation

Heat is the result of pressurized fluid escaping to the reservoir. Most hydraulic components have a small internal leak due to machining tolerances. This type of leak generates a very small amount of heat that is taken into account when the component is designed.

Internal leaks in the system may be caused by internal housing cracks, bad relief valves, or leaking seals. This type of leak allows a large volume of pressurized oil to return to the reservoir, creating excessive heat in the hydraulic system. Continuous operation with excessive heat will damage the hydraulic oil, seals, and O-rings throughout the system.

The following conditions cause heat generation.

- Excessive pump speed
- Worn or defective pump
- Defective or improperly adjusted relief valve cartridges
- Low hydraulic oil level
- Improper hydraulic oil
- Internal component leakage

Hydraulic Lines

Hydraulic lines provide a passageway for fluid flow between components in the hydraulic system. Fluid is transmitted through the lines from the pump to the actuator to operate the unit. A variety of lines may be used on the unit depending on the specific application.

Most hoses have a lay line on them. The lay line contains the following information.

- Manufacturer's name
- Manufacturer's part number
- SAE rating
- Burst pressure (sometimes)
- "Nonconductive" appears on nonconductive hoses

When replacing a hose, use one the same size, length, and pressure rating. If hose size is doubled, four times the amount of oil will flow at the same pressure. If hose size is decreased, the flow in the circuit will decrease and back pressure will increase. The increase in back pressure will cause heat to build up and system malfunction.

Warning

Death or serious injury can result from hydraulic oil being injected into the flesh when loosening or disconnecting hydraulic components. Remove the pressure before loosening or disconnecting hydraulic components.

Seek immediate medical attention if injured by escaping hydraulic oil. Serious infection or reaction can result if medical treatment is not given immediately.

Spilled hydraulic oil creates slick surfaces and can cause personnel to slip and/or fall. Keep the unit and work areas clean.

Caution

Injury can result from airborne particles entering the eyes and lungs. Wear appropriate safety equipment.

Injury can result from being pinched or trapped between moving components. Keep hands clear.

Use caution when access covers have been removed to service the unit. Pinch points and shear points may exist between moving parts. Replace the access covers immediately after servicing.

Remove all fluid pressure from a hydraulic circuit before disconnecting lines or fittings.

Mark all hydraulic line fittings before disconnecting them to ease installation later. Place a container under the hoses to catch the hydraulic oil. Cap or plug all open ports, hoses, and fittings to prevent contamination.

Warranty will be denied on components returned to Altec if ports are not plugged and cylinder rods are not retracted.

After completing a procedure, check the oil level in the hydraulic oil reservoir and add oil if necessary.

Drive Belt/Pulleys

Caution

Injury can result from being pinched or trapped between moving components. Keep hands and body parts clear.

Never place any part of the body in a potential pinch point. This not only applies to the heads and chutes, but also drum and engine sheave/belt contacts.

Disengage clutch and the hydraulic feed system. Remove keys from the ignition switch and place in pocket. Lock out chipper.

Drum and drive system continue to move after the clutch has been disengaged and the engine has been cut off.

Make sure that the drum and drive system have come to a complete stop before attempting any maintenance in this area.

Inspect belt/pulley condition according to Figure 7.2. Replace as necessary.

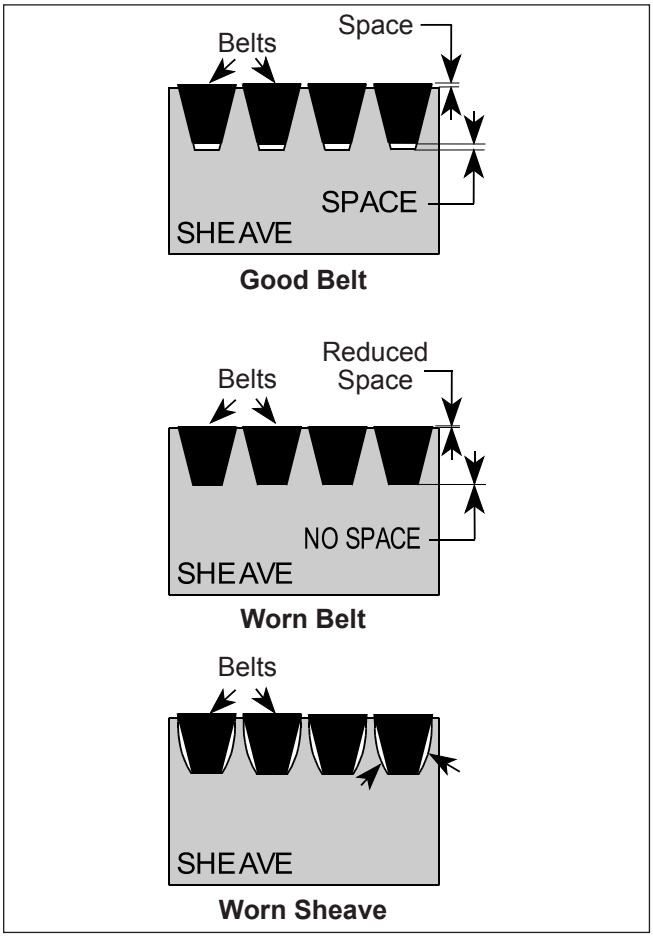


Figure 7.2 — Belt Wear

1. Remove belt guard.

2. Visually inspect drive belt for cracks or fraying. Visually inspect sheaves for signs of wear, cracks, or loose bushings.

3. Inspect belt tension. At the center point between the sheaves, the belt should deflect $^{3}/_{8}$" with 8 pounds of pull. Under-tensioning can cause unnecessary belt wear.

4. Overtensioning can cause premature PTO and/or bearing failure.

5. Check drum cutter head/engine alignment by placing a non-flexible straight edge against the outside surface of the drum cutter head sheave and the engine sheave. Alignment is correct when both inner and outer surfaces of both sheaves are in contact with the straight edge (refer to Figure 7.3).

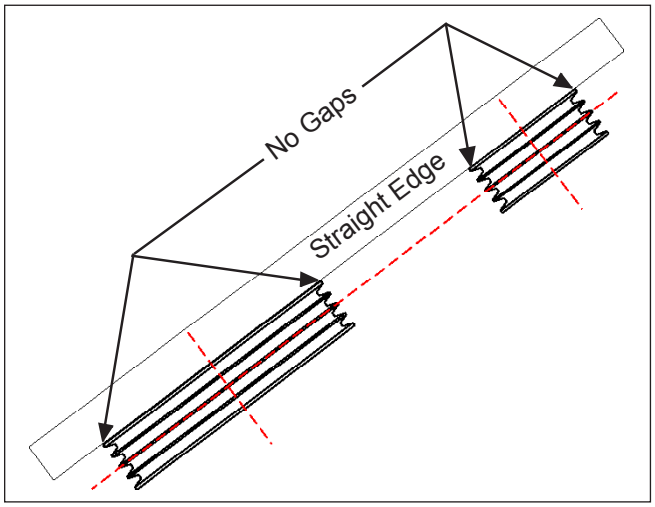


Figure 7.3 — Sheave Alignment

No gaps between straight edge and sheave on both sheaves.

Belt Adjustment

1. Back-off the engine mounting adjusting screws.

2. Loosen all of the engine mounting bolts.

3. Tighten or loosen the adjusting screws, as appropriate, while monitoring the sheave alignment and belt tension.

4. When the proper sheave alignment and belt tension have been achieved, retighten the engine mounting bolts.

5. Retighten the adjusting screw locking nuts.

6. Reinstall the belt guard and tighten all fasteners securely.

Warning

Death or serious injury may result if maintenance procedures are not completed.

Make sure that all tools and hardware are removed from the head and discharge chutes or any other area where maintenance, inspection or service was performed.

Make sure that all fasteners and adjustments are secured properly before starting the unit.

Do not operate the equipment unless all covers and guards are in place and properly secured.

Troubleshooting, Testing, and Adjustments

Synchronizing Tow Vehicle Brake Controller

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

Caution

Injury and property damage can result from failure to brake safely. Make sure the area is clear of vehicular and pedestrian traffic.

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. 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

Your 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.

Clean the backing plate, magnet arm, magnet and brake shoes. Make certain that all the parts removed are replaced in the same brake and drum assembly. Inspect for any loose or worn parts, stretched or deformed springs and replace as necessary. For ease of maintenance Altec parts department can supply complete backing plate assemblies. This includes new shoes, magnets, springs, and connecting hardware already assembled, ready to bolt in place.

Caution

Serious illness can result from breathing asbestos dust. Avoid breathing or creating dust when servicing the brakes.

Avoid machining, filling, or grinding the brake linings. Do not use compressed air or dry brushing for cleaning (dust can be removed with a damp brush).

Brake Adjustment

Adjust brakes at the following intervals. Refer to the axle owners manual.

- 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.

Mechanical

Blade/Anvil Replacement

Warning

Death, serious injury, and/or property damage can result from improper maintenance of the unit. Do not perform maintenance procedures on this unit without proper training.

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 cutter and drive train to ensure no movement of drive components.

Warning

Death, serious injury, or property damage can result when attempting to access moving components. Make sure components have come to a complete stop before performing inspection or maintenance.

Drum and drive system components 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.

Caution

Injury can result from being pinched or trapped between moving components. Keep hands clear.

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

Warning

Serious injury can result while performing blade maintenance. Wear appropriate safety equipment.

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.

Notice

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

Blade Installation and Adjustment

Warning

Death, serious injury, or property damage can result from operating the chipper with damaged or chipped blades. Replace damaged or chipped blades to prevent breaking and discharging of blades during operation.

Always use Altec supplied chipper blades. These blades are manufactured using special chipper blade steel and selectively hardened to reduce the possibility of blades shattering.

1. Complete LOTO procedures.

Danger

Death, serious injury, or property damage can result when attempting to access moving components. Make sure components have come to a complete stop before performing inspection or maintenance.

Caution

Injury can result from being pinched or trapped between moving components. Keep hands clear.

Never start the engine with the drum hood open. Never attempt to open or close the drum hood with the drum moving.

2. Remove the six 1/2" cap screws securing the top rotor access cover.

Figure 7.4 — Drum Locking Pin

3. Position the drum and install the drum 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 bolts, Do not use impact tool to remove or install bolts.

7. Make sure all mating surfaces between the cutter blades and drum are clean and free of debris and corrosion.

8. 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.

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

10. Using a straight edge against the blade mounting surface, check for any blade distortion by sliding the straight edge both perpendicular and parallel to the bolt holes. Any light seen between the blade and the straightedge indicates a distorted blade. Any distorted blade must be discarded.

11. Inspect bolts for damage or corrosion. Replace as necessary. Always replace blade bolts when using resharpened or new blades.

Operation with worn or dull blades will result in poor chip quality, stringy material output, possible discharge chute clogging, additional fuel consumption, unnecessary stress on structural components, engine overheating and excessive wear on drive components, i.e., drive belt, drive pulleys, bearings, drive clutch, and engine.

Equipment damage that results from the use of worn or damaged blades will not be considered for warranty. Operators and others are exposed to unnecessary risk by operating a unit in this negligent condition. Owners subject themselves to increased operating costs, significant downtime and premature equipment wear as a result of improper blade maintenance.

Warning

Death, serious injury, or property damage can result from overtorquing the blade bolts. Overtorquing may stress and break the blades.

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

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

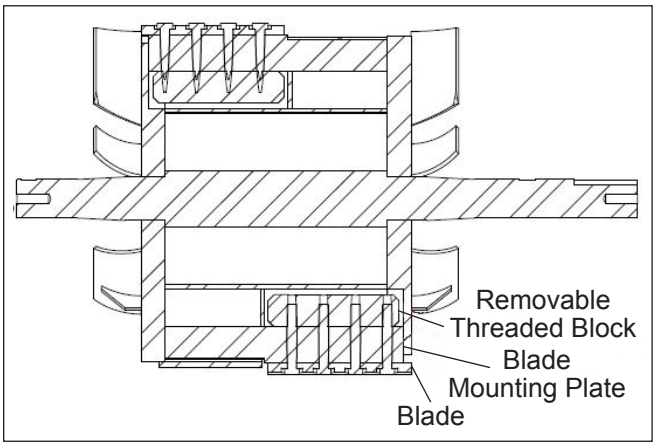


Figure 7.5 — Blade Cross Section

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

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

16. 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 center-line 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.

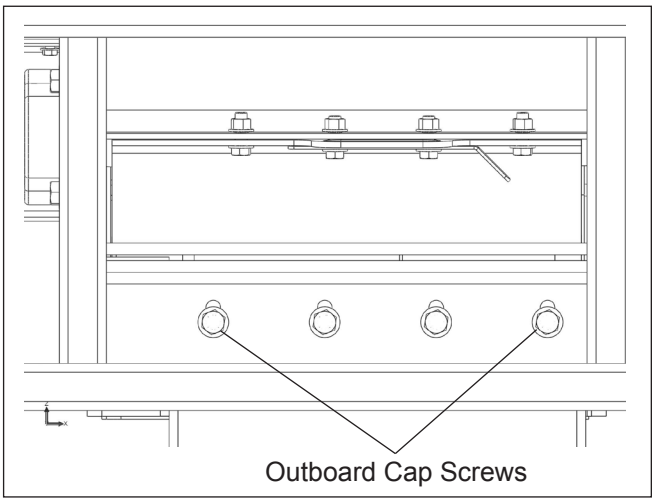


Figure 7.6 — Anvil

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.

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.

Engine/Clutch
Check engine/clutch operator's manuals for specific bearing lubrication, maintenance, and replacement procedures.

Bearing Replacement
Spherical Bearings
Spherical roller bearings are used on both sides of the cutter assembly and all feed roll bearings. Self-aligning bearings such as these are used in areas where perfect alignment is difficult to maintain. This type of bearing allows the component to follow the movements of the structure without applying a side load to the internal components of the cylinder. Daily lubrication of these bearing is required to prevent the inner rim that maintains the alignment from seizing to the outer rim of the bearing. Daily lubrication ensures contamination is flushed from the bearings inner components.

Cutter Bearing Replacement
1. Perform LOTO procedures.

2. Remove blades.

3. Remove top cutter housing, belt guard, and bearing cover.

Warning

Death or serious injury may occur when using improper lifting rigging. Use properly rated hoist, spreader bar and straps when hoisting drum assembly.

4. Support the cutter assembly using an overhead crane or hoist. Refer to unit specifications for weight of cutter assembly.

5. Remove any pulleys or auxiliary equipment from the out board sections of the cutter shaft.

6. Clean and de-bur the exposed sections of the shaft.

7. Remove the two set screws on each bearing assembly.

8. Remove the four bearing flange bolts and remove the bearing.

9. Install bearings. Apply Loctite #242 to all four bearing flange bolts. Torque the four bearing flange bolts to the torque values in the Appendix.

10. Center the cutter assembly in the cutter housing.

11. Make sure one set screw on each bearing is aligned with the flat on the cutter shaft. Apply Loctite #242 to all four set screws. Tighten all four set screws.

12. Reinstall blades and adjust the anvil/blade gap.

13. Reinstall pulleys or auxiliary equipment previously removed.

14. Reinstall all guards and covers.

Electrical

Electrohydraulic Control
The DRM 12 is equipped with both electronic and hydraulic controls. The system is comprised of the following parts.

- Hydraulic reservoir located on the street side of the drum housing.
- Hydraulic pump mounted on the engine inside the engine housing.
- Main control valve located on top of the infeed chute.
- Hydraulic cylinder anchored at the feed box and feed roller assembly.
- Holding valve located on the curb side of the feed box.
- EFC valve located on the infeed chute.
- Feed motor located on the curb side of the feed roller assembly.
- Magnetic speed sensor (magnetic pickup sensor) located on the street side of the drum shaft behind the bearing guard.
- Control module located underneath the control valve mounting bracket.

FeedSense® (EFC)
FeedSense® is a sub-system of the overall electrohydraulic operation of the chipper which manages the cutting drum speed. This system ensures that the drum is cutting at an optimal speed which yields best efficiency and maximum throughput. The specific components involved in the system are the control module, electrohydraulic EFC valve, and the magnetic speed sensor.

Using the magnetic pickup sensor, the control module monitors the drum rpm. The EFC valve remains in the neutral (blocked) state until the proper rpm have been reached. This prevents rotation of the motor in both forward and reverse directions. When the drum rpm is above 2,150 rpm, the EFC valve allows hydraulic flow to the motor. Now the operator can manipulate the feed control bar forward and reverse to feed the material in and out respectively. When feeding wood forward, the

material will cause the drum rpm to reduce. In the event that the rpm drop below 2,000 rpm, the control module will automatically send a signal to the EFC valve and reverse the rotation of the feed wheel. This will remove the fed material from the cutting drum and allow the system to regain speed. During this time, the EFC valve is in the neutral state. The system will not automatically resume forward feed until the drum rpm have recovered. This event occurs quickly and can last less than a second.

Advance System Recovery

Advance system recovery is a secondary security measure designed to ensure that the wood fed is controlled. In the event that the EFC cannot reverse the fed material due to the wood being too short, the advance system recovery prevents the wood from being pushed into the cutting mechanism as the feed wheel descends. It also monitors the drum rpm disabling the fed material from dropping the drum rpm to the point where the system would shut down the engine. This ensures longer component life and more effective performance. The specific components involved in the system are the control module, lift cylinder, holding valve, and the magnetic speed sensor.

Using the magnetic pickup, the control module monitors the drum rpm. When feeding wood forward, the material will cause the drum rpm to reduce. In the event that the fed material cannot be reversed because it is too short, the feed wheel will advance it forward as it descends about the pivot point. If the rpm drop below 1,300, the control module will automatically send a signal to the holding valve and block the flow of oil from the lift cylinder. This will prevent the cylinder from descending. The system will not automatically resume the descend until the drum rpm have recovered. This event occurs quickly and can last less than a second.

While the EFC valve will only allow flow to the motor in a specific rpm range, the lift cylinder can be used any time that the engine is running. The feed roller assembly can be lifted up allowing brush or logs to be tethered through, or lowered down putting pressure and compressing the fed material. It is important to note that in the descend of the feed wheel will have a timed delay in the range between 200 rpm and 1,300 rpm. The system will allow for upward motion, but will not allow downward motion until several seconds have passed.

Warning

Death, serious injury, or property damage can result when attempting to access moving components. Make sure components have come to a complete stop before performing inspection or maintenance.

During any point in operation, the panic bar can be pulled stopping all hydraulic flow to the system. This will divert all pump flow directly to tank rendering all successive functions (feed motor, lift cylinder, etc.) disabled. The panic bar solenoid must be reset in order to resume system operation.

Troubleshooting

Refer to Figure 7.7 for troubleshooting information.

Drum Speed (rpm)	Magnetic Pickup Frequency (Hz)
500	167
600	200
700	233
800	267
900	300
1,000	333
1,100	367
1,200	400
1,300	433
1,400	467
1,500	500
1,600	533
1,700	567
1,800	600
1,900	633
2,000	667
2,100	700
2,200	733
2,300	767

Figure 7.8 — Frequency to rpm Conversion

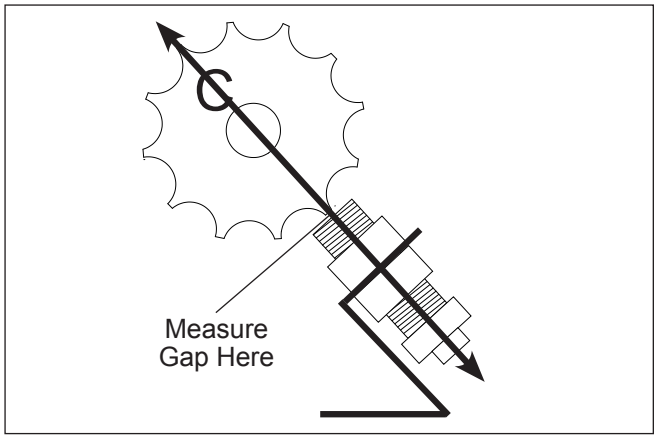


Figure 7.9 — Magnetic Sensor Pickup

Symptom	Possible Cause	Test Procedure/Corrective Action
Unit will not feed.	Panic bar tripped.	When tripped, the panic bar will mechanically deflect a cam attached to the first spool of the main control valve. This will in turn shift the valve to dump oil directly to tank. Reset panic bar by returning the red valve handle to the neutral state.
	Controller not receiving power.	Disconnect the harness from the controller. Using a test light, or multimeter, probe pin 13 (module ground) and pin 14 (module power) to ensure that power is delivered to the module. If no power is detected, confirm that the connection is adequate, and the harness is not damaged.
	Drum speed too low.	The controller receives a drum speed signal from a magnetic speed sensor. If the controller does not receive the signal, or the signal (rpm) read is too low (below 2,000 rpm), it will not allow forward/reverse motor functions.
		Engine throttle is not in the high position. The engine throttle needs to be in the high position running at about 2,600 rpm at Idle for the feed system to activate.
		Engine not increasing in speed when shifted from the low to high position. For proper throttle adjustment, refer to the engine manual.
		The drum may be jammed preventing it from rotating. Check the drum shaft for rotation. If no movement is visually detected, refer to the section labeled Clearing Feed System and Discharge Chute in the manual.
		Controller is not receiving a signal from the magnetic pickup. If the controller is not receiving a signal from the magnetic pickup or the signal is too low, the system will not allow the forward/reverse function of the feed wheel.
		Check the magnetic pickup output at full rpm for correct signal. At full drum rpm, the magnetic pickup should read 2.5 VAC. Refer to Figure 7.8 for the correct frequency to rpm conversion. This can be measured by disconnecting the magnetic pickup from the harness and measuring frequency (Hz) across the connector terminals.
		Verify all the wires intact and the connectors between the magnetic pickup and controller connected.
		Proper adjustment of magnetic pickup end should be approximately 0.030” to 0.050” from rpm sprocket on drum shaft. Refer to Figure 7.9 for clarity.
	EFC valve directing oil to the feed roller motor.	The valve is activated by a signal delivered from the controller. It shifts when the controller energizes one of two solenoids. The VF solenoid delivers flow in normal operation. The VR solenoid reverses flow during normal operation, and more specifically during the activation of the EFC function.
		When the control bar is in the forward feed position (pulled towards the rear of the unit), it shifts a spool on the main control valve through a series of linkages. The spool directs flow to the motor allowing it to feed forward or in reverse (depending on the control bar position).
		Disconnect the connector labeled VF/VR. Using a test light, or multimeter, probe the pins to ensure that power is delivered to the solenoid. You can also check the voltage from pin 1 to ground. It should be 12 V. If no voltage is read, check to make sure that the harness is not damaged.
	Oil pressure is too low.	For the feed roller to operate, the system has to produce both pressure and flow. If no material is in the infeed chute, the rollers will only require about 150 to 200 psi (10.3 to 13.8 bar) to turn. When feeding brush and logs, the system normally requires 1,000 to 1,500 psi (68.9 to 103.4 bar). The system relief is set to 2,500 psi (172.4 bar).
		If the feed roller does not move when the feed control bar is in the forward feed position, and all the previous checks show that the system is functioning properly, install a pressure gauge in the system. The main control valve has a quick connect port located by the panic bar spool which will allow for connection to a pressure gauge. If the feed wheel is in a bind, the pressure should read 2,500 psi (172.4 bar). Another option to confirm hydraulic flow to the feed wheel is to install a pressure gauge in the hose going to the P (or A) port of the EFC valve. With the control bar and valve in the forward feed position, this should read approximately 2,500 psi (172.4 bar).

Figure 7.7 — FeedSense® Controller Troubleshooting

Symptom	Possible Cause	Test Procedure/Corrective Action
Unit will not feed (cont.)		If the feed roller does not move when the feed control bar is in the reverse feed position, and all the previous checks show that the system is functioning properly, install a pressure gauge in the system. The main control valve has a quick connect port located by the panic bar spool which will allow for connection to a pressure gauge. If the feed wheel is in a bind, the pressure should read 2,500 psi (172.4 bar). Another option to confirm hydraulic flow to the feed wheel is to install a pressure gauge in the hose going to the T (or B) port of the EFC valve. With the control bar and valve in the reverse feed position, this should read approximately 2,500 psi (172.4 bar).
	Feed roller is jammed.	Material can build up around the feed roller, or wedge between the feed roller assembly and feed box causing a jam.
		With the unit running, cycle the feed control bar from forward to reverse several times. This may sometimes "back flush" jammed material or debris and allow the unit to continue operating normally.
		With the unit locked out and tagged out according to instructions previously mentioned in the manual, try moving the feed roller slightly back and forth. If the system is jammed, refer to the Clearing Feed System and Discharge Chute section of the manual.
	Material will not move forward.	At times, all systems may check out fine, but material may not move forward. The feed roller may climb the limbs and pull them slightly but will stall or spin on the material.
		The feed opening is 12" high by 17" wide (30.5 cm high by 43.2 cm wide). Anything wider than this will not advance forward. Remove the material from the chipper, and proceed to cut the material to a dimension which will fit in the opening.
		Some materials like cedar and cypress can be very resilient or slippery preventing the feed wheel from gripping and pulling it through. Use the lift cylinder for down pressure to gain better traction in order to advance the material forward.
		If the system is jammed, refer to the Clearing Feed System and Discharge Chute section of the manual.
Lift cylinder malfunction.	Lift cylinder does not operate up/ down.	The lift cylinder can be used to hydraulically lift the feed roller assembly open, or it can be used to apply down pressure to large piles of debris for traction.
		When the panic bar is tripped, it will mechanically deflect a cam attached to the first spool of the main control valve. This will in turn shift the valve to dump oil directly to tank. Reset panic bar by returning the red valve handle to neutral state.
		The cylinder needs both pressure and flow to actuate in/out. Install a gauge on the quick connection on the main control valve, and measure the pressure while toggling the cylinder rise/ lower lever. At full rise, and at full lower, the pressure should read around 1,160 psi (80 bar).
		Material blocking the feed roller assembly from traveling up and down. If the system is jammed, refer to the Clearing Feed System and Discharge Chute section of the manual.
	Lift cylinder is stuck (at any point in the range of stroke).	The lift cylinder can be hydraulically actuated up or down. By releasing the lift cylinder lever, a spool in the main control valve will shift to neutral. The cylinder will lose pressure allowing the feed roller assembly to descend to rest.
		Check linkages to ensure the cylinder lift lever returns to neutral.
		Electrical problem if the cylinder stays up when the machine is off. Check the connector going to the holding valve (labeled H). Using a test light, or multimeter, probe the pins to ensure that power is not delivered to the solenoid. If the ground signal wire is loose and touching metal, it can cause false trips. This valve is an integral part of the advance system recovery and will only energize for a short period of time (no more than five seconds at a time).
		A jam could cause the cylinder to stay up even in machine off state? If the system is jammed, refer to the Clearing Feed System and Discharge Chute section of the manual.

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	DRM 12
Blade/Anvil		
Anvil cap screws	Hex head	*
Blade cap screws	Hex head, Bowmalloy	210 (285)
Bearings		
Cutter bearing cap screws	Ferry cap or hex head	160 (217)
Feed roller bearing cap screws	Hex head, Bowmalloy	127 (172)
Structural		
Pintle ring cap screws	Hex head $^{5}/_{8}$-11	120 (163)
Drum draw ring cap screws	Hex head	64 (87)
Axle		
Axle mounting cap screws	Hex head	120 (163)
Axle spindle nut	Hex nut	Refer to axle owners manual
Wheel lug nuts	Wheel lug	Refer to axle owners manual
Specific Component		
Hydraulic motor shaft nut	Hex nut	265 (359)

* Refer to General Fastener Torque

Daily Preoperational Checklist

VIN No. _____ Location _____ Date _____

Model Number _____ Date of Manufacture _____

Hours Meter _____ Inspector _____

Symbols

✓/O = Okay or completed
C = Corrected by inspector
R = Repair or replacement required
U = Unsafe to operate
N/A = Not applicable

	Chip curtain is properly fastened and in good repair		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
	Rotation indicator is clear of debris and fully visible		
	Disc/drum cover padlock is in place and key is in responsible party’s possession		Lubricate cutter and feed roll bearings
			Inspect and operate panic bar
	Disc/drum hood switch is working properly		Inspect for hydraulic leaks
	Inspect safety tow chains for wear or damage		Check cutting blades to make sure all attachment cap screws are tight and blades are in good condition
	Check engine fuel, coolant, and oil levels (refer to EOM)		
	Check the engine air filter (refer to EOM)		Inspect discharge chute to determine if it is clear, properly positioned, and secure
	Check clutch handle free play		
	Check radiator fins and ensure free passage of air through the radiator		Check feed roller for debris
			Check the transition area for debris that could lock the drum or disc during start up
	All cap screws and nuts are tight and secure		
	Inspect anvil to make sure all attachment and adjustment cap screws are secure and anvil edge is in good condition		Make sure the safety devices are properly installed and functioning properly
			Make sure the feed table is in place and secure for both operation and travel
	Check all controls for free and proper operation		
	Inspect the chipper frame and structure for any bent, broken, cracked, missing, or loose parts		No loose tools or materials on the chipper or on the infeed chute
	Check all guards to make sure they are undamaged, in place, and properly secured		Wheels and tires are secure and properly inflated
			Make sure a complete AEP Operator’s Manual is available for all operators to review
	All decals must be in place and legible prior to operating the chipper		

Comments _____

_____

Preventive Maintenance and Inspection Checklist

VIN No. _____ Location _____ Date _____

Model Number _____ Date of Manufacture _____

Hours Meter _____ Inspector _____

Intervals

❑ Weekly ❑ Monthly ❑ Yearly

Symbols

✓/O = Okay or completed
C = Corrected by inspector
R = Repair or replacement required
U = Unsafe to operate
N/A = Not applicable

Weekly			
	Complete daily preoperational checklist		Inspect hitch for wear or damaged components
	Test breakaway switch system		Lubricate all hydraulic valve connecting linkages
	Check general condition of tires and tire pressure		Lubricate slide box
	Lubricate clutch bearings (refer to clutch operator's manual)		Lubricate chute rotation
			Lubricate hinges and friction points
Monthly			
	Complete weekly checklist		Lubricate clutch lever and linkage (refer to clutch operator's manual)
	Where applicable check battery water level		
	Check drive belt tension and alignment		Lubricate drive roller bearings
	Where applicable check pump belt and alignment		Lubricate all pivot points and pins
			Lubricate jack
Yearly			
	Complete monthly checklist		Flush and replace engine coolant (refer to engine operator's manual)
	Change hydraulic oil filter		
	Lubricate trailer wheel bearings (refer to axle manual)		Flush and replace hydraulic fluid
	Replace fuel filter (refer to engine operating manual)		

Comments _____

_____

Troubleshooting Chart

This chart is general to all Altec chippers. Some information may be excluded or unimportant to certain models. For specific information pertaining to one model, refer to the Maintenance Section of this manual.

Symptom	Possible Cause	Text Procedure/Corrective Action
Starter will not crank engine.	Weak battery.	Charge battery.
	Battery terminals corroded or poor ground connection.	Clean and tighten connections.
	Defective ignition switch or starter solenoid.	Replace defective components.
	Malfunctioning starter.	Replace starter.
	Hood safety switch not engaged or damaged.	Verify cutter hood and switch activator plate properly secured.
Engine will not start.	Fuel tank empty.	Refuel.
	Hood safety switch not engaged or damaged.	Verify cutter hood and switch activator plate properly secured.
	Choke inoperative (gasoline engines only).	Refer to engine owner's manual.
	Engine flooded.	Refer to engine owner's manual.
	Battery partially discharged.	Charge battery.
	Faulty engine carburetion or ignition.	Refer to engine owner's manual.
	Air in fuel line (diesel only).	Refer to engine owner's manual.
	Preheater not working (diesel only).	Refer to engine owner's manual.
Engine runs but cutting implement does not turn.	Material wedged against cutting implement.	Refer to Section 5: Clearing Feed System and Discharge Chute.
	Slipping or broken drive belt.	Refer to Maintenance section.
	Defective clutch.	Refer to Care of the Unit.
Feed rollers do not turn.	Panic bar activated.	Reset panic bar and return feed control bar to neutral position.
	Ensure proper control bar position.	Place in forward or reverse position.
	Debris jammed in roller area.	Refer to Section 5 — Clearing Feed System and Discharge Chute.
	Improper hydraulic fluid level.	Fill hydraulic tank.
	Engine not operating at full throttle.[1]	Increase engine speed to maximum setting.[1]
	Cutting implement not turning at correct rpm.[1]	Refer to Section 5 — Clearing Feed System and Discharge Chute.
Feed roller only turns in reverse.	Engine not operating at full throttle.[1]	Increase engine speed to maximum setting.[1]
	Cutting implement not turning at correct rpm.[1]	
	Material blockage.	Refer to Section 5 — Clearing Feed System and Discharge Chute.
	Belt slippage.	Refer to Maintenance section.
	Clutch slippage.	Refer to Care of the Unit.

Symptom	Possible Cause	Text Procedure/Corrective Action
Engine overheats.	Radiator fins clogged.	Clean radiator fins of debris (let engine cool first).
	Improper coolant level or mixture.	Fill radiator and coolant reservoir (let engine cool first).
	Damaged fan or fan belt.	Refer to engine owner's manual.
	Engine fins not clean.[2]	Clean engine cooling fins (let engine cool first).[2]
Chute clogging.	Cutting implement not turning at correct rpm.	Increase engine speed to maximum setting.
	Dull blades.	Refer to Maintenance section.
	Improper blade/anvil gap.	Refer to Maintenance section.
	Feeding wet or sappy material.	Mix heavier stock in with lighter/wet materials.
	Material too large for chipper.	Cut large material into smaller sizes.
	Feed system not operating properly.	Refer to Maintenance section.
	Cutter housing vents covered.	Clear cutter housing vents of any blockage.
Chipper will not self-feed properly or rejects material.[3]	Dull blades.	Refer to Maintenance section.
	Improper blade setting.	Refer to Maintenance section.
	Improper setting of bed blade or feed plate.	Refer to Maintenance section.
	Material is too large for chipper.	Cut large material into smaller sizes.

[1] FeedSense equipped
[2] DC 610 only
[3] WC 126A/166A only

Parts Manual

This manual contains the illustrations and diagrams to identify components and their part numbers.

Parts Ordering

When ordering parts or requesting service for an Altec unit, supply the model number and the serial number to your Altec representative. This information assures that the correct parts will be supplied.

There is a serial number placard on the unit. It contains the model and serial number along with other important information.

There may be more than one supplier for some components. For a component with a given Altec part number, parts from different suppliers will be interchangeable as a complete unit. However, the parts may look slightly different. The parts may also have different internal construction and/or require different seal kits. Such components are shown in the Parts Manual by alternate construction illustrations. These drawings have different parts lists. The drawings and parts lists are under the same figure number. To determine the part to order, compare the parts of the unit being serviced to the illustrations.

Repair and Rebuild Services

Repair and rebuild services are available at the factory for many items. Altec also has facilities across the country for service of Altec equipment. Each facility has factory trained personnel to meet your service requirements.

When requesting service for an Altec unit, supply both the model and serial number. Use only Altec parts to maintain and repair this unit.

Altec Locations

Altec service centers are located across the nation and around the world. Each center is strategically located to provide fast and efficient service.

Nationally, field service personnel live and work in each territory to respond quickly to customer needs. Altec service personnel are trained in the latest technology at our training centers by Altec specialists. Factory rebuild and repair services are available for a variety of components.

Call 1-877-GO-ALTEC to contact your Altec service center.

Altec Service Group

CALL
1-877-GO-ALTEC
(877-462-5832)
For all Parts and service needs

- Prompt 1 Parts/Tools & Accessories
  - Order parts
  - Order tools and accessories
  - Determine shipping status
  - Technical support to order parts
- Prompt 2 Shop Service
  - Arrange for service at the nearest Altec Service Center
  - Obtain a service quotation
- Prompt 3 Mobile Service
  - Arrange for a mobile service technician to visit your location for on-site repair
- Prompt 4 Technical Support
  - Answer technical questions to assist in repairs

Order Parts Online at www.altecconnect.com

ALTEC SERVICE CENTERS

Alabama
1730 Vanderbilt Road
Birmingham, AL 35234
(205) 458-3839 fax

Arizona
2505 West Durango Street
Phoenix, AZ 85009
(602) 252-8843 fax

Northern California
325 Industrial Way
Dixon, CA 95620
(707) 678-1038 fax

Southern California
2882 Pomona Boulevard
Pomona, CA 91766
(909)444-0448 fax

Colorado
641 Telluride Street
Aurora, CO 80011
(303)364-9523 fax

Florida
2570 Old Okeechobee Road
West Palm Beach, FL 33409
(561) 686-6972 fax

Georgia
287 First Street
Forest Park, GA 30050
(404) 363-2180 fax

Indiana
5201 West 84th Street
Indianapolis, IN 46268
(317) 876-3620 fax

Maryland
1434 Hughes Ford Road
Frederick, MD 21701
(301) 694-9644 fax

Massachusetts
28 Wales Street
Millbury, MA 01527
(508) 752-4791 fax

West Missouri
2106 South Riverside Road
St. Joseph, MO 64507
(816) 236-1356 fax

East Missouri
1125 South Callahan Road
Wentzville, MO 63385
(636) 639-2261

North Carolina
800 Highway 152 East
China Grove, NC 28023
(704) 856-2044 fax

Ohio
1236 Township Road 1175
Ashland, OH 44805
(419) 289-7444 fax

Oregon
13817 NE Sandy Boulevard
Portland, OR 97230
(503) 253-1191 fax

Pennsylvania
250 Laird Street
Plains, PA 18705
(570) 822-7062 fax

North Texas
1001 Solon Road
Waxahachie, TX 75165
(972) 937-8253 fax

South Texas
6902 E. Orem Drive
Houston, TX 77075
(713) 336-6249 fax

Crossroads Chevrolet
(Independent Service Provider)
420 S. Roth Street
Reed City, MI 49677
(231) 832-4362

Utility Equipment Specialists
(Independent Service Provider)
1111 S. 3200 W.
Salt Lake City, UT 84104
(801) 972-6168

Utility Truck Services
(Independent Service Provider)
14601 Ramsey Blvd.
Ramsey, MN 55303
(763) 323-4236

Altec Worldwide LLC
2106 South Riverside Road
St. Joseph, MO 64507
(816) 236-1279
(816) 236-1361 fax

Altec Limited - Milton
831 Nipissing Road
Milton, Ontario L9T 4Z4
(905) 875-2000
(905) 875-2009 fax

Altec Limited - Surrey
12352 84th Avenue
Surrey, British Columbia V3W 0J5
(604) 597-0355
(604) 597-0357 fax

Altec Limited - Winnipeg
570 Durand Road
Winnipeg, Manitoba R2J 3T1
(204) 663-8362
(204) 663-4798 fax

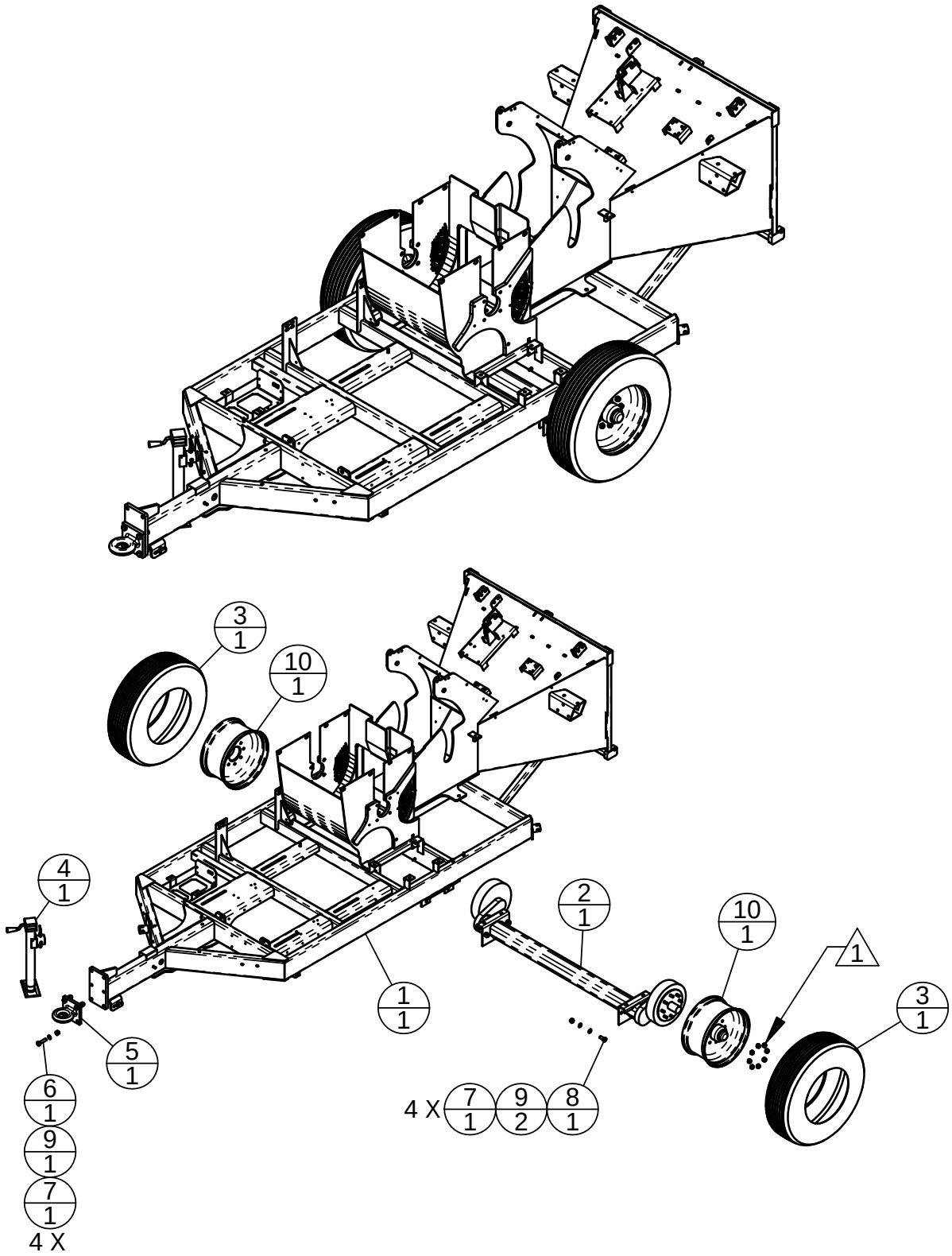
General Body & Equipment Ltd. - Calgary
3773 19th Street NE
Calgary, Alberta, Canada T2E 6S8
(403) 250-2115
(403) 250-1925 fax

General Body & Equipment Ltd. Edmonton
8124 Davies Road
Edmonton, Alberta, Canada T6E 4N2
(780) 468-5331
(780) 468-5301 fax

Altec Parts
2106 South Riverside Road
St Joseph, MO 64507
(816) 236-1356 fax
www.altecconnect.com

Call **1-877-GO ALTEC** (1-877-462-5832)
to reach your local parts, shop, or mobile service representative.

ASSEMBLY, ROLLING HEAD AND FRAME, DRM 12

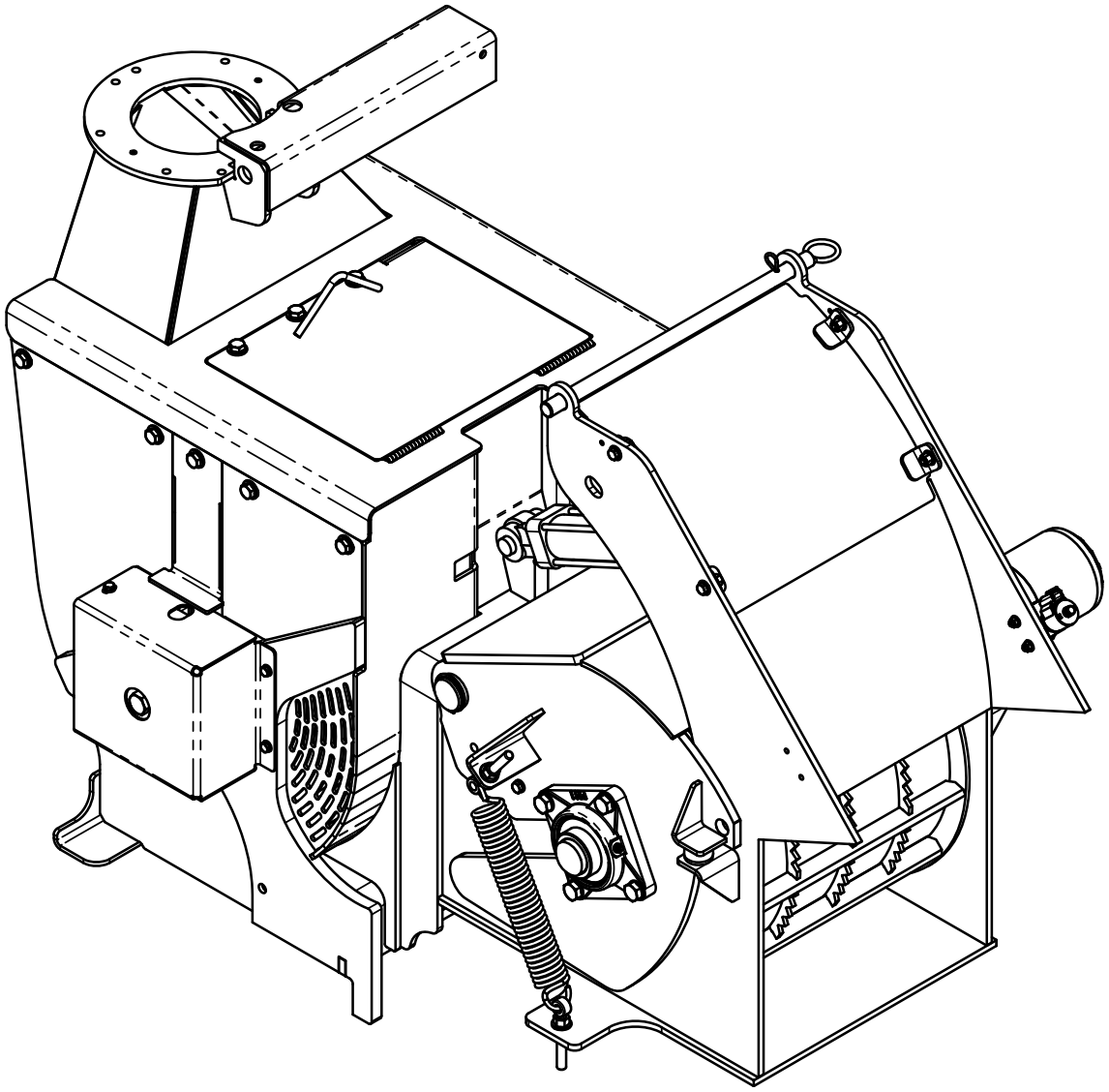


NOTE:
1. LUG NUTS (P/N 970130501) ARE DISPLAYED FOR REFERENCE ONLY. THEY ARE LOCATED ON THE AXLE BILL OF MATERIAL.

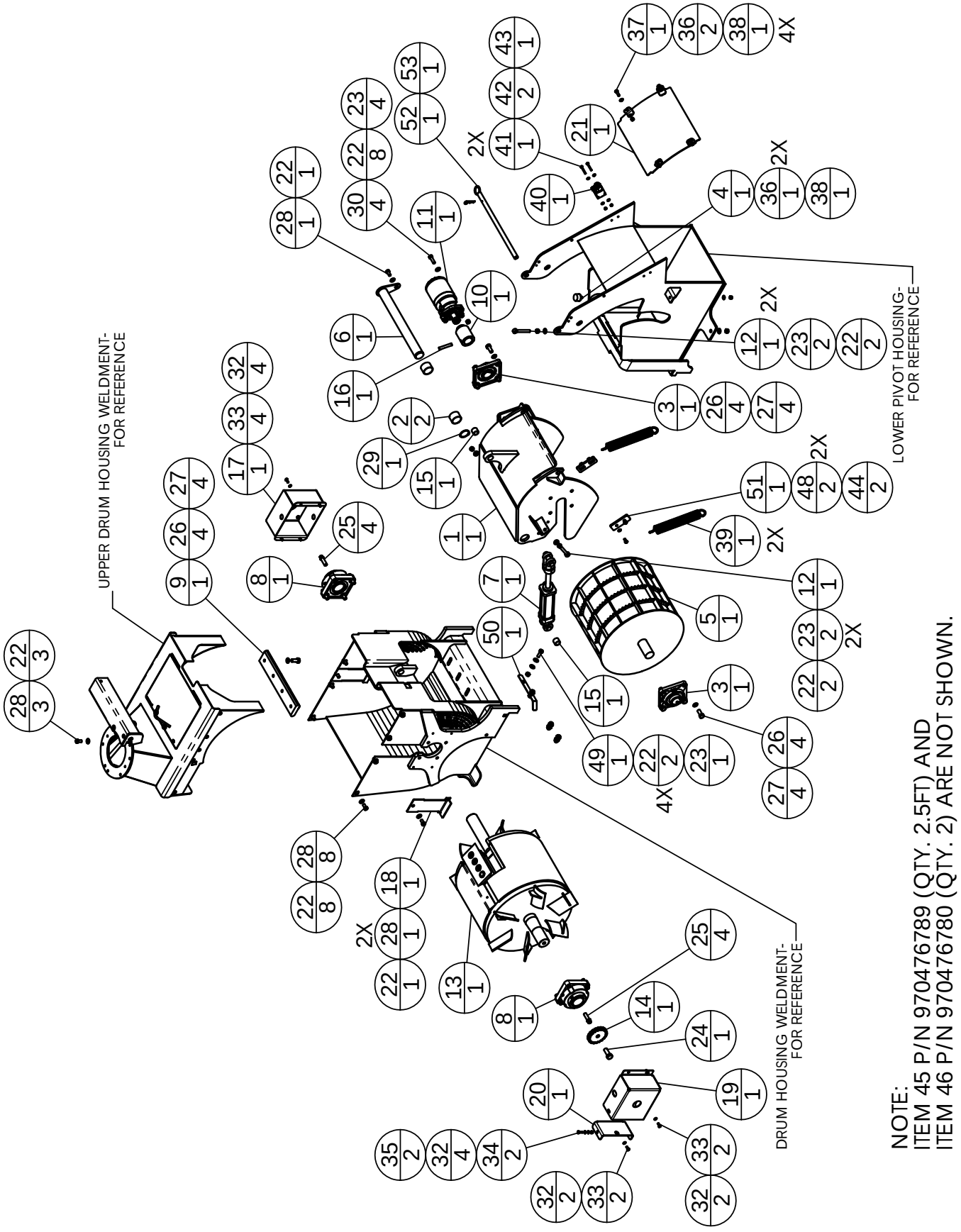
ASSEMBLY, ROLLING HEAD AND FRAME, DRM 12

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970398796	ASSEMBLY, HEAD FRAME, 50 IN W X 30 IN H FEED HORN, DRM 12
	2	970413441	KIT, LUG NUT, ONE WHEEL, REF 970130501, 8-LUB WHEEL
0	2	970413441	KIT, LUG NUT, ONE WHEEL, REF 970130501, 8-LUG WHEEL,
1	1	970398731	HEAD AND FRAME, WELDMENT, DRM-12,
2	1	970234727	TORSION AXLE, SIDE MOUNT, 7000 LBS, 55.00 IN OB, 70.00 HF, .50 -20 UNF
3	2	970127225	TIRE, 245/75R16, LOAD RATING E
4	1	970116490	JACKSTAND SIDEWIND, TAIL HITCH, 5000 LB CAPACITY, 15 IN TRAVEL
5	1	970122563	DRAWBAR, 4-BOLT MOUNT, 42, 000 LBS MGTW, 7, 000 LBS VERT LOAD, FORGED
6	4	020041612	CAPSCREW, STEEL, HEX HEAD, .63-11 UNC, 2.50 IN L, GR 8
7	8	020391609	NUT, STEEL, TOP LOCK, .63-11 UNC, GR C, PLATED 18,
8	4	970116588	CAPSCREW, S/R/B 980114139, STEEL, HEX HEAD, .63-11 UNC, 1.50 IN L, GR 8, PLATED,
9	12	020401706	WASHER, STEEL, FLAT, .63 IN DIA, ASTM F436, PLATED,
10	2	970122596	RIM, 16X6K, 8 LUG ON 6.50 IN DIA, .50-20 STUD 60 DEG TAPER, .50 IN OFFSET "IN", BLACK

ASSEMBLY, FEED SYSTEM, HYDRAULIC LIFT, DRM 12



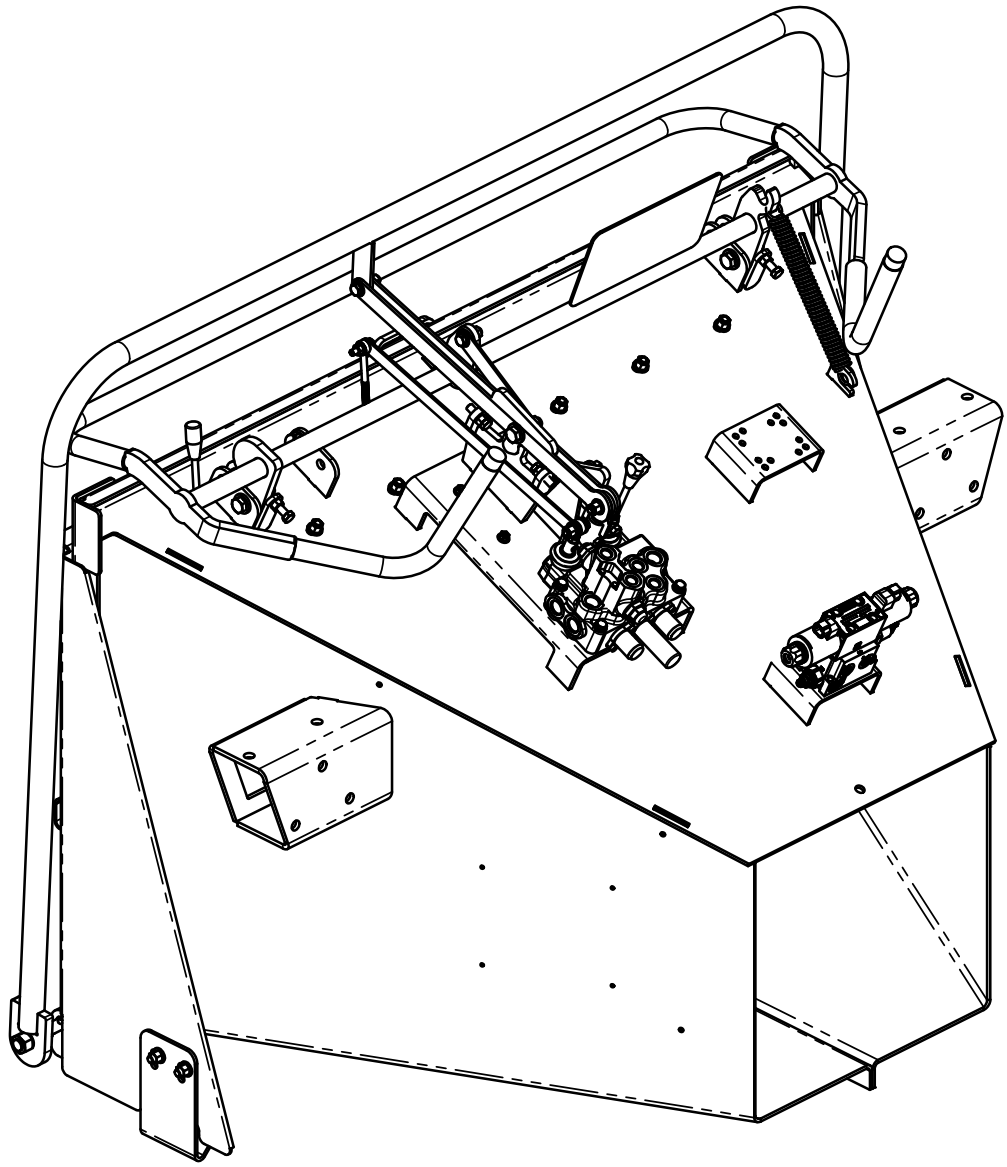
ASSEMBLY, FEED SYSTEM, HYDRAULIC LIFT, DRM 12



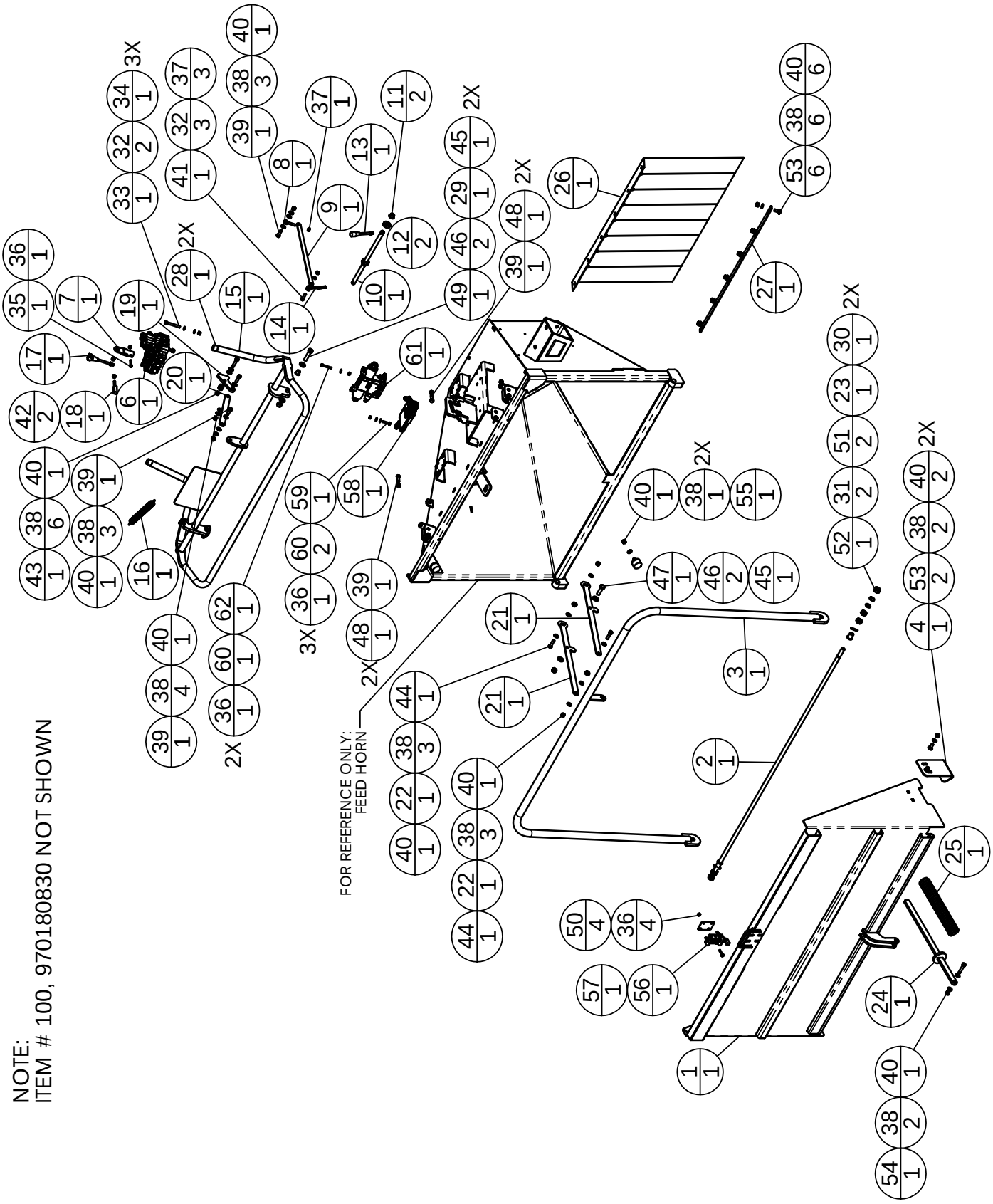
ASSEMBLY, FEED SYSTEM, HYDRAULIC LIFT, DRM 12

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970398738	ASSEMBLY, FEED ROLLER & ROTOR, HYDRAULIC FEED ROLLER LIFT, DRM 12
1	1	970398707	UPPER PIVOT HOUSING, WELDMENT, UNIVERSAL FEED SYSTEM,
2	2	044115014	BEARING, CYLINDRICAL, BACKED, 2.00 IN BORE, 2.25 IN OD, 1.50 IN L,
3	2	970113602	BEARING, ROLLER, STEEL, 2.000 IN BORE, 2.23 IN L, 5.118 BOLT PATTERN,
4	2	970260503	BUMPER, RUBBER, 1.50 IN DIA X 1.00 IN L, .38-16 UNC X .75 IN L STUD,
5	1	970398720	FEED WHEEL, WELDMENT, 20 IN OD, UNIVERSAL FEED SYSTEM,
6	1	970398739	PIN, PIVOT, SNAP RING, 20.00 IN L, 19.69 IN USABLE LENGTH, 2.00 IN OD,
7	1	970398721	HYDRAULIC CYLINDER, LIFT CYLINDER, 2.00 IN BORE, 1.125 IN ROD, 16.25, 6.00 IN
8	2	970116846	BEARING, ROLLER, STEEL, 2.4375 IN BORE, 3.500 IN L, 4.77 BOLT PATTERN,
9	1	970108997	ANVIL, BAR, CFD 1217
10	1	970398741	FEED WHEEL SHAFT, COUPLER, 2.00 IN ID, 2.975 IN OD, UNIVERSAL FEED SYSTEM,
11	1	970398742	HYDRAULIC MOTOR, GEROLLER, 32.3 CU IN, 4 BOLT MOUNT, TAPERED SHAFT
12	4	970273285	ROD END, STEEL, THREADED, .50-13, 4.00 IN L, .50, 5, PLATED,
13	1	970181850	DRUM CONTROL FED, DUAL FIN, 20 IN, ASSEMBLY
14	1	970202502	SPROCKET, EFC/SPACER, 4.50 IN DIA, 20 TOOTH, DC-1317, CFD-1217, DC-912A
15	2	044112003	BEARING, CYLINDRICAL, FRP, 1.00 IN BORE, 1.25 IN OD, 1.00 IN L,
16	1	970398744	COUPLER PIN, DOWEL, CHAMFERED ENDS, 0.50 IN OD, 3.00 IN L,
17	1	970200546	GUARD, BREARING, DRIVE SIDE, BACKING PLATE MOUNT, CFD-1217,
18	2	970398757	WELDMENT, DRUM HOUSING VENT COVER, SIDE MOUNT, CFD1217A,
19	1	970368630	COVER, COMPONENT, BEARING AND EFC, STREET SIDE, CFD-1217
20	1	970368635	MOUNT, WELDMENT, EFC SENSOR, STREET SIDE, CFD-1217
21	1	970398752	PIVOT BOX OPENING COVER, WELDMENT, UNIVERSAL FEED SYSTEM,
22	38	020401404	WASHER, STEEL, FLAT TYPE A NARROW, .50 IN DIA, PLATED 18,
23	16	020391404	NUT, HEX, SELF-LOCKING, STEEL, OVALATED, .50-13 UNC, GR C, PLATED,
24	1	879060184	CAPSCREW, STEEL, HEX HEAD, .75-10 UNC, 2.00 IN L, GR 8, PLATED,
25	8	970179927	CAPSCREW, STEEL, FERRY CAP, 2.00 IN L, .63 IN DIA, .63-11 UNC, GR 8, PLATED,
26	12	970032732	CAPSCREW, STEEL, HEX HEAD, .63-11 UNC, 1.50 IN L, GR 8, W/LOCKING PATCH PLATED,
27	12	020401706	WASHER, STEEL, FLAT, .63 IN DIA, ASTM F436, PLATED,
28	14	020031406	CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 1.00 IN L, GR 5, PLATED,
29	1	023017001	RETAINING RING, EXTERNAL, 2.00 IN ID, BASIC
30	4	020031409	CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 1.75 IN L, GR 5, PLATED,
32	12	020401102	WASHER, STEEL, FLAT TYPE A NARROW, .31 IN DIA, PLATED 18
33	8	020031104	CAPSCREW, STEEL, HEX HEAD, .31-18 UNC, .75 IN L, GR 5, PLATED,
34	2	020031106	CAPSCREW, STEEL, HEX HEAD, .31-18 UNC, 1.00 IN L, GR 5, PLATED, YELLOW ZINC
35	2	020391102	NUT, STEEL, NYLON INSERT, .31-18 UNC, PLATED 18,
36	10	020401202	WASHER, STEEL, SAE FLAT TYPE A NARROW, .38 IN DIA, PLATED 18,
37	4	020031207	CAPSCREW, STEEL, HEX HEAD, .38-16 UNC, 1.25 IN L, GR 5, PLATED,
38	6	020391205	NUT, STEEL, CENTER LOCK, .38-24 UNF, GR A,
39	2	970398725	SPRING, EXTENSION, MUSIC WIRE, 11.106 IN L, .242 WIRE DIA, 1.900 COIL OD, 30.769 LBF/IN,
40	1	970413426	SOLENOID VALVE, ELECTRO HYDRAULIC, 2 WAY POPPET, 3000 PSI, 8 GPM
41	2	020031010	CAPSCREW, STEEL, HEX HEAD, .25-20 UNC, 2.00 IN L, GR 5, PLATED,
42	4	020401004	WASHER, STEEL, FLAT TYPE A NARROW, .25 IN DIA, PLATED
43	2	020391022	NUT, TOP LOCK, 1/4-20 UNC, 18-8 STNL STL
44	4	020031204	CAPSCREW, STEEL, HEX HEAD, .38-16 UNC, .75 IN L, GR 5, PLATED,
45	2.5	970476789	WIRE ROPE, WIRE COIL, .0625 IN DIA, 250 FT L, 480 LBS, VINYL COAT, 1.00 IN DIA ID COIL
46	2	970476780	SLEEVE, .0625 IN DIA, .375 IN L, FERRULE
48	4	020411201	WASHER, STEEL, LOCK SPLIT TYPE, .375 IN DIA, PLATED,
49	4	020041408	CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 1.50 IN L, GR 8, PLAIN FINISH
50	1	970115949	SPECIAL TOOL, BLADE/ANVIL GAP SET, 1.00 IN W, 12.00 IN L, .125 IN T
51	2	970413430	BEARING, SLIDE PAD, UHMW POLYETHELENE, 4.50 X 2.00, .31 T
52	1	970466917	PIN, DRM-12 ROTATION LOCK, .875 IN DIA, 1.75 IN GRIP, W/ RING HANDLE
53	1	970121057	PIN, STEEL, HAIRPIN, 2.63 IN L, .13 IN DIA, PLATED 18,

ASSEMBLY, FEED CONTROL, HYDRAULIC LIFT, DRM 12



ASSEMBLY, FEED CONTROL, HYDRAULIC LIFT, DRM 12



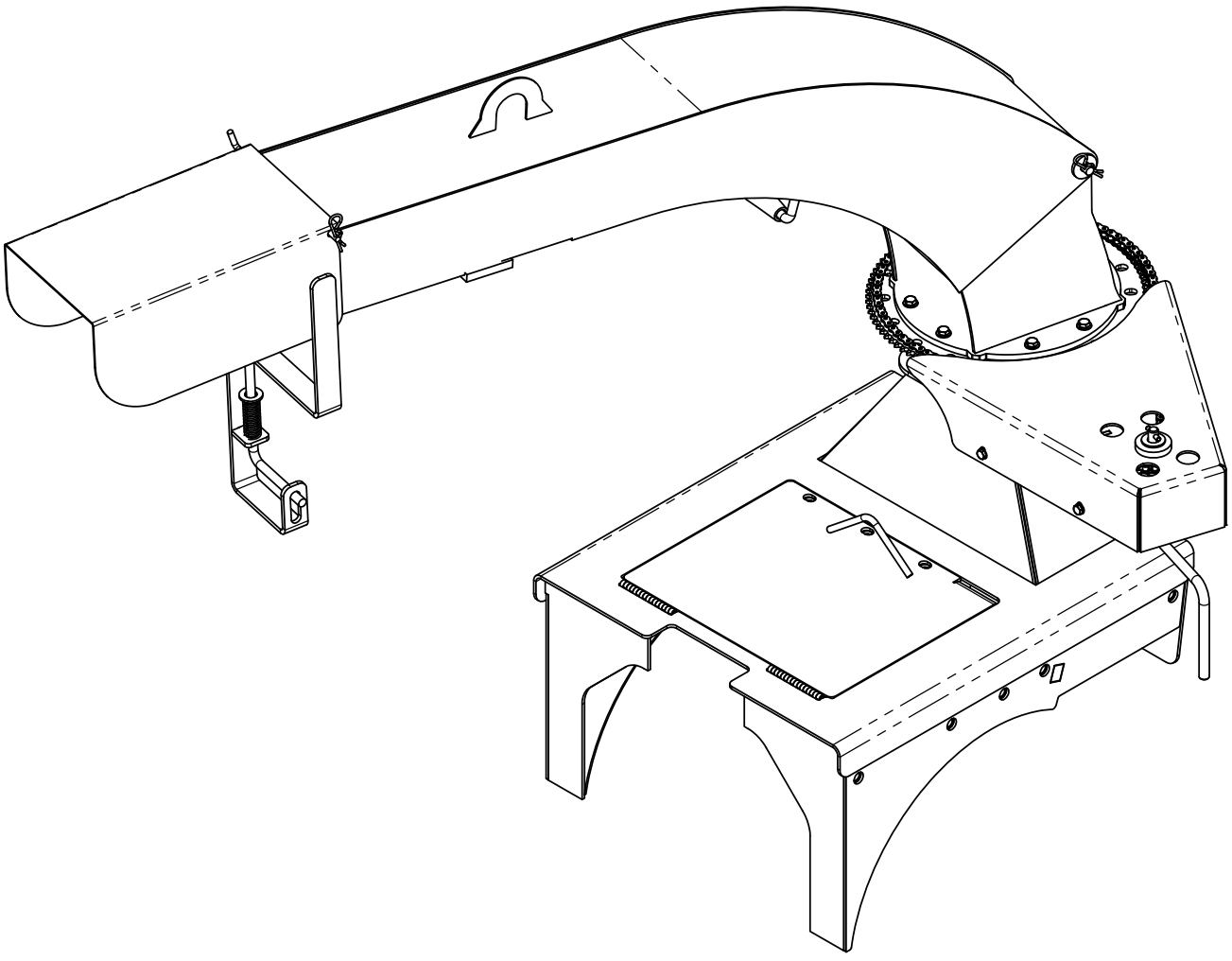
ASSEMBLY, FEED CONTROL, HYDRAULIC LIFT, DRM 12

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970382785	ASSEMBLY, FEED CONTROL, 50 IN W X 30 IN H FEED HORN, HYDDRAULIC FEED ROLLER LIFT
1	1	970382777	INFEED TABLE, WELDMENT, REMOVABLE, 50 IN, COMMON
2	1	970163226	HINGE ROD, 50 IN INFEED TABLE, .625 IN DIA,
3	1	970185856	HANDLE, FEED CONTROL, 50 IN INFEED CHUTE, FEED CONTROL LINKAGE 21.83 IN,
4	2	970184860	CATCH, FEED TABLE, POSITIVE, FORMED,
6	1	970151945	HYDRAULIC VALVE, MANUAL, 3 SPOOLS, 3000 PSI, SERIES VALVE,
7	1	970111145	HANDLE, FEED CONTROL, VALVE, WALVOIL
8	1	970171421	ROD END, STEEL, SWIVEL BALL JOINT, M8X1.25, 42 MM L,
9	1	970185918	LINKAGE, HYDRAULIC LIFT, 42 IN & 50 IN FEEDHORNS,
10	1	970184513	SHAFT LINKAGE, 42, 50, & 65 IN INFEED CHUTE, SINGLE LIFT, HYDRAULIC CYLINDER
11	2	970156828	BEARING, FLANGED, .63 IN BORE, .75 IN OD, .50 IN L, IGLIDE R-PLAIN
12	2	970171383	LOCKING COLLAR, STEEL, CLAMP, .44 IN L, .63 IN DIA SHAFT,
13	1	035200209	HYDRAULIC VALVE HANDLE KIT, 4.75 IN LG, M8 X 1.25 THREAD,
14	1	970173820	ROD END, STEEL, SOLID ROD, .31-18 UNC, 4.00 IN L, GR 5,
15	1	970185850	PANIC BAR, 50 IN INFEED CHUTE, PANIC MOUNT LINKAGE 3.96 IN,
16	1	970122395	SPRING-EXTENSION, STEEL, 7.00 IN, 0.125 DIA, 1.00 IN OD, 18 LBS/IN, PANIC BAR
17	1	035200294	HYDRAULIC VALVE HANDLE KIT, RED KNOB
18	1	970114999	CAM HANDLE, PIVOT, WALVOIL VALVE, PANIC BAR EN-GAUGE
19	1	970116518	PANIC BAR, VALVE CAM PIVOT, LOWER MOUNT,
20	1	970177732	LINKAGE, PANIC BAR, 1.00 IN W, 7.50 IN CD, 36.00 IN W FEEDHORN,
21	2	970114898	BRACKET, CONTROL LINK, WAVOIL, .250 X 1.75 X 19.87,
22	2	970111152	BUSHING, RUBBER, FLANGED, .38 IN ID .66 IN OD, .88 IN FLANGE,
23	2	970214464	PIN, STEEL, COILED, 1.25 IN L, .250 IN DIA, STANDARD DUTY PLAIN OILED,
24	1	970145785	SPRING ASSIST ARM, FEEDTABLE,
25	1	970157645	SPRING-COMPRESSION, STEEL, NO FINISH, 13.00 IN L, .283 IN DIA, 2.00 IN DIA, 78 LBF/IN
26	1	970128276	BRUSH CURTAIN, .141 IN T X 32 IN W X 25 IN L, 166, 126, 912, 1217, 1317
27	1	970121714	ROD, REAR CURTAIN, FEED TABLE, 32.00 IN L X 1.00 IN W,
28	2	970157227	CAP, RUBBER, .875 IN ID, 1.00 IN H, BLACK, TURN-UP PANIC BAR
29	2	970114853	BEARING, FLANGED, FRP, .50 IN BORE, .63 IN OD, .63 IN L,
30	2	970152303	BEARING, FLANGED BEARING, PLASTIC, .625 IN BORE, .750 IN OD, 1.00 IN L, .062 IN T,
31	4	970156323	WASHER, STEEL, BELLEVILLE, .625 IN DIA, PLATED, BLACK-PHOSHATE STEEL
32	9	020401102	WASHER, STEEL, FLAT TYPE A NARROW, .31 IN DIA, PLATED 18
33	3	201432600	CAPSCREW, STEEL, HEX HEAD, .31-18 UNC, 2.75 IN L, GR 8, PLATED,
34	3	020391105	NUT, STEEL, TOP LOCK, .31-18 UNC, GR C, PLATED 18,
35	1	020031008	CAPSCREW, STEEL, HEX HEAD, .25-20 UNC, 1.50 IN L, GR 5, PLATED,
36	10	020391006	NUT, STEEL, HEX OVALATED, .25-20 UNC, GR C YZ8, PLATED 18,
37	2	020391106	NUT, STAINLESS STEEL, FLAT, .31-18 UNC, .31 IN DIA, GR 316,
38	36	020401207	WASHER, STEEL, FLAT, .38 IN DIA, SAE THRU-HARD HIGH STRENGTH, PLATED 18,
39	7	020041207	CAPSCREW, STEEL, HEX HEAD, .38-16 UNC, 1.25 IN L, GR 8, PLATED 18,
40	19	020391225	NUT, STEEL, TOP LOCK, .38-16 UNC, GR C, PLATED,
41	1	879160108	CAPSCREW, STEEL, HEX HEAD, .31-24UNF, 1.25, GR 5, PLATED / PLATED,
42	2	020394003	NUT, STEEL, HEX, M8 x 1.25, PLATED 18,
43	1	970116572	CAPSCREW, STEEL, HEX HEAD, .38-16 UNC, 1.75 IN L, GR 8, PLATED 18,
44	2	020041208	CAPSCREW, STEEL, HEX HEAD, .38-16 UNC, 1.50 IN L, GR 8, PLATED 18,
45	3	020391404	NUT, HEX, SELF-LOCKING, STEEL, OVALATED, .50-13 UNC, GR C, PLATED,
46	6	020401405	WASHER, STEEL, FLAT, .50 IN DIA, THRU HARD HIGH STRENGTH, PLATED
47	1	020041409	CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 1.75 IN L, GR 8, PLATED
48	4	020301201	NUT, STEEL, HEX, .38-16 UNC, GR 5, PLATED 18
49	2	879060138	CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 2.25 IN L, GR 5, PLATED / PLATED,
50	4	020031004	CAPSCREW, STEEL, HEX HEAD, .25-20 UNC, .75 IN L, GR 5, PLATED,
51	4	020311601	NUT, STEEL, HEX JAM, .63-11 UNC, PLATED 18,
52	2	020391609	NUT, STEEL, TOP LOCK, .63-11 UNC, GR C, PLATED 18,
53	10	970116553	CARRIAGE BOLT, STEEL, .38-16 UNC, 1.00 IN L, .38 IN DIA, GR A, PLATED 18, ASTM A307
54	1	020041210	CAPSCREW, STEEL, HEX HEAD, .38-16 UNC, 2.00 IN L, GR 8,
55	2	970260503	BUMPER, RUBBER, 1.50 IN DIA X 1.00 IN L, .38-16 UNC X .75 IN L STUD,
56	1	970162003	LATCH, SLAM, 0.50 IN X 0.35 BAR, DRAWER LATCH, WITH COVER, FINGER PULL

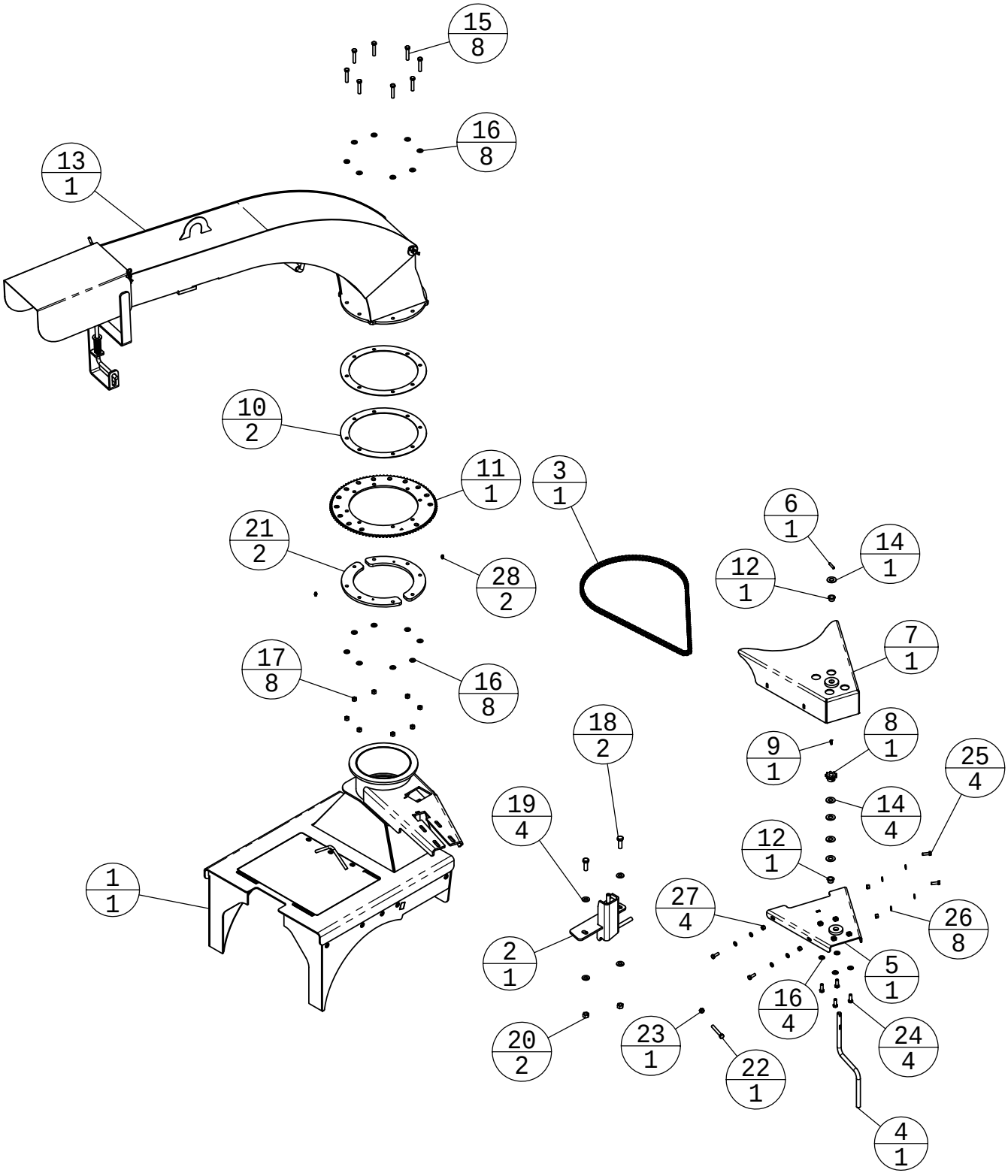
ASSEMBLY, FEED CONTROL, HYDRAULIC LIFT, DRM 12

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
57	1	970458004	SPACER, SLAM LATCH SPACER, 10 GA, 2 IN X 2.875 IN, PAINTED, 4 HOLES
58	1	970266671	CONTROL MODULE, CHIPPER FEED CONTROL, DC610 SOFTWARE, SECM0804 MODULE
59	3	020031007	CAPSCREW, STEEL, HEX HEAD, .25-20 UNC, 1.25 IN L, GR 5, PLATED,
60	8	970137805	WASHER, STEEL, FLAT, .25 IN DIA, THRU-HARD HIGH STRENGTH, PLATED,
61	1	970256923	HYDRAULIC VALVE, ELECTRO HYDRAULIC, MANIFOLD, 3000 PSI, WITH SYSTEM RELIEF
62	2	020101009	CAPSCREW, STEEL, SOCKET HEAD, .25-20 UNC, 1.75 IN L, GR 8,
100	1	970180830	PLACARD, ENGLISH, INFORMATIVE, FEED ROLLER, HYDRAULIC LIFT CYL CONTROL,

ASSEMBLY, HAND CRANK CHUTE ROTATION, DRUM CHIPPER



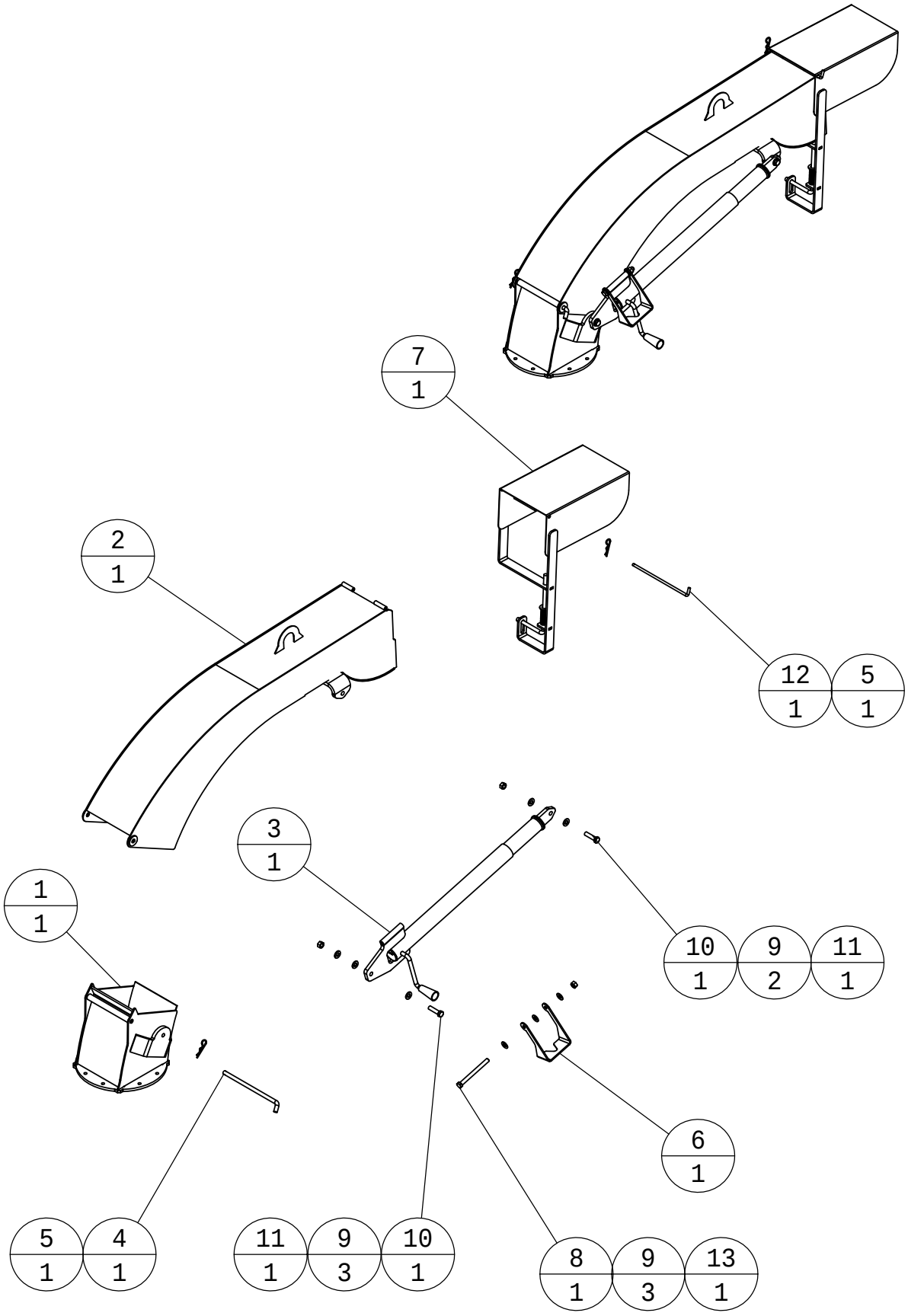
ASSEMBLY, HAND CRANK CHUTE ROTATION, DRUM CHIPPER



ASSEMBLY, HAND CRANK CHUTE ROTATION, DRUM CHIPPER

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970403928	ASSEMBLY, HAND CRANK CHUTE ROTATION, DRUM CHIPPER
1	1	970468547	UPPER DRUM HOUSING, WELDMENT, UNIVERSAL FEED, CHUTE ROTATION, DRUM CHIPPER
2	1	970468972	WELDMENT, CHUTE ROTATION LOCK, DRUM CHIPPER
3	1	970227270	CHAIN ASSEMBLY, 5.29 FT, WITH CONNECTOR LINK, HAND CRANK CHUTE ROTATION
4	1	970156427	HAND CRANK, ROD, FORMED, NO 606 WOODRUFF KEY
5	1	970403933	WELDMENT, CHAIN TENSIONER, CHUTE ROTATION, DRUM CHIPPER
6	1	970214464	PIN, STEEL, COILED, 1.25 IN L, .250 IN DIA, STANDARD DUTY PLAIN OILED,
7	1	970472314	COVER, WELDMENT, CHUTE ROTATION, CHAIN GUARD
8	1	970156368	SPROCKET, ROLLER CHAIN, .50 IN PITCH, NO 40, 9 TEETH, .63 BORE WITH KEYWAY
9	1	970156419	WOODRUFF KEY #606
10	2	970403646	SPACER, CHUTE ROTATION, 12.5 IN OD 10.04 ID, DRUM CHIPPER
11	1	970403645	SPROCKET, ROLLER CHAIN, .50 IN PITCH, NO 40, 96 TEETH, DRUM CHIPPER
12	2	970156828	BEARING, FLANGED, .63 IN BORE, .75 IN OD, .50 IN L, IGLIDE R-PLAIN
13	1	970403929	CHAIN DRIVE CHUTE, ASSEMBLY, HEIGHT ADJUSTABLE, DRUM CHIPPER
14	5	020401606	WASHER, STEEL, FLAT TYPE A NARROW, .63 IN DIA, PLATED PER ALTEC PLATED & 19,
15	8	020031210	CAPSCREW, STEEL, HEX HEAD, .38-16 UNC, 2.00 IN L, GR 5, PLATED,
16	20	020401202	WASHER, STEEL, SAE FLAT TYPE A NARROW, .38 IN DIA, PLATED 18,
17	8	020391211	NUT, STEEL, HEX, OVALATED, .38-16 UNC, GR 8,
18	2	020041408	CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 1.50 IN L, GR 8, PLAIN FINISH, O/R/B 879060135 C
19	4	020401404	WASHER, STEEL, FLAT TYPE A NARROW, .50 IN DIA, PLATED 18,
20	2	020391404	NUT, HEX, SELF-LOCKING, STEEL, OVALATED, .50-13 UNC, GR C, PLATED,
21	2	970403647	KIDNEY PLATE, CHUTE ROTATION, DRUM CHIPPER
22	1	020031213	CAPSCREW, STEEL, HEX HEAD, .38-16 UNC, 2.75 IN L, GR 5, PLATED,
23	1	020301201	NUT, STEEL, HEX, .38-16 UNC, GR 5, PLATED 18
24	4	020031206	CAPSCREW, STEEL, HEX HEAD, .38-16 UNC, 1.00 IN L, GR 5, PLATED,
25	4	020031106	CAPSCREW, STEEL, HEX HEAD, .31-18 UNC, 1.00 IN L, GR 5, PLATED, YELLOW ZINC
26	8	020401102	WASHER, STEEL, FLAT TYPE A NARROW, .31 IN DIA, PLATED 18
27	4	020391105	NUT, STEEL, TOP LOCK, .31-18 UNC, GR C, PLATED 18,
28	2	040050021	GREASE FITTING, STRAIGHT ZERK, .25-28 SELF TAPPING,

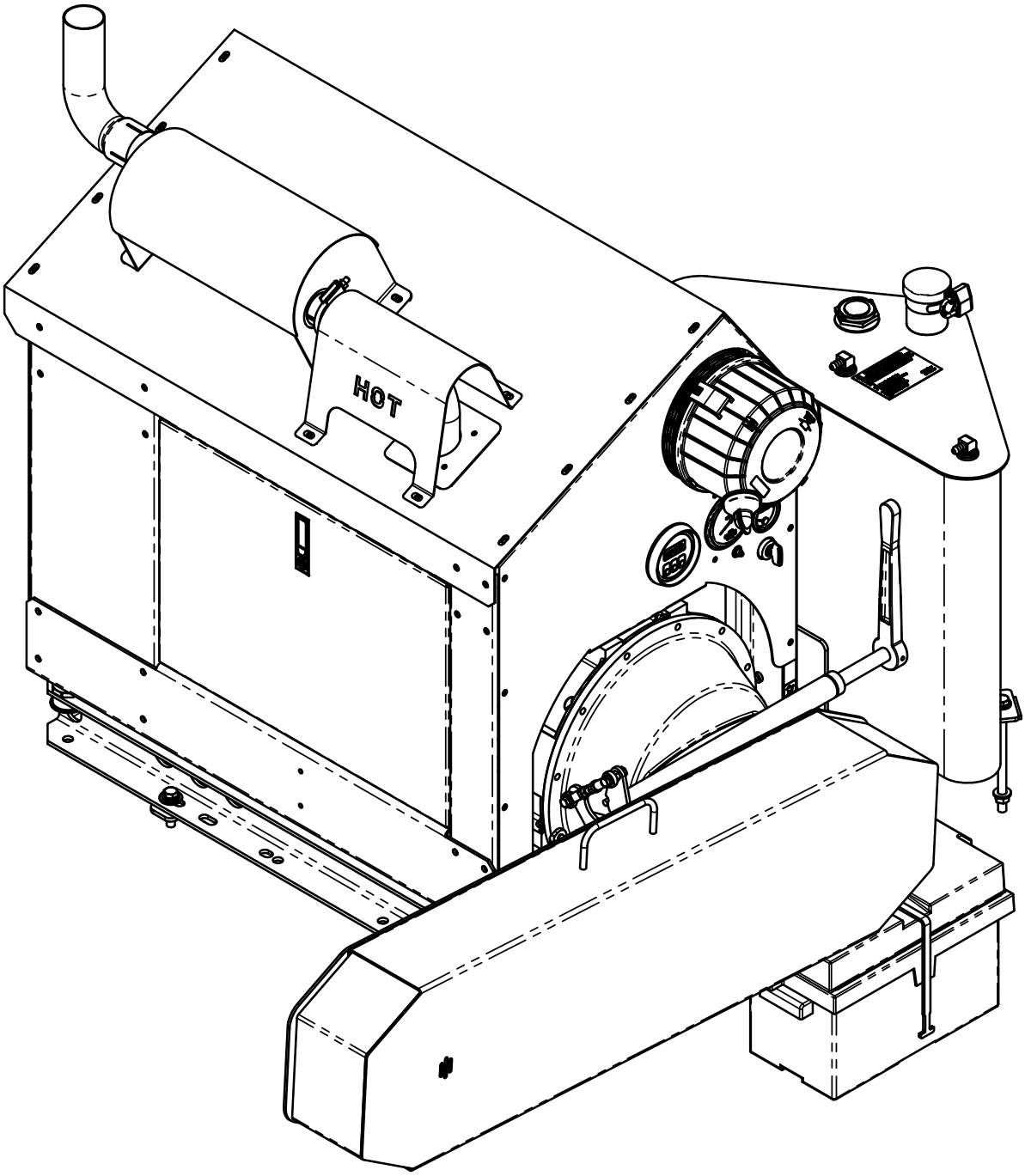
CHAIN DRIVE CHUTE ASSEMBLY, HEIGHT ADJUSTABLE, DRUM CHIPPER



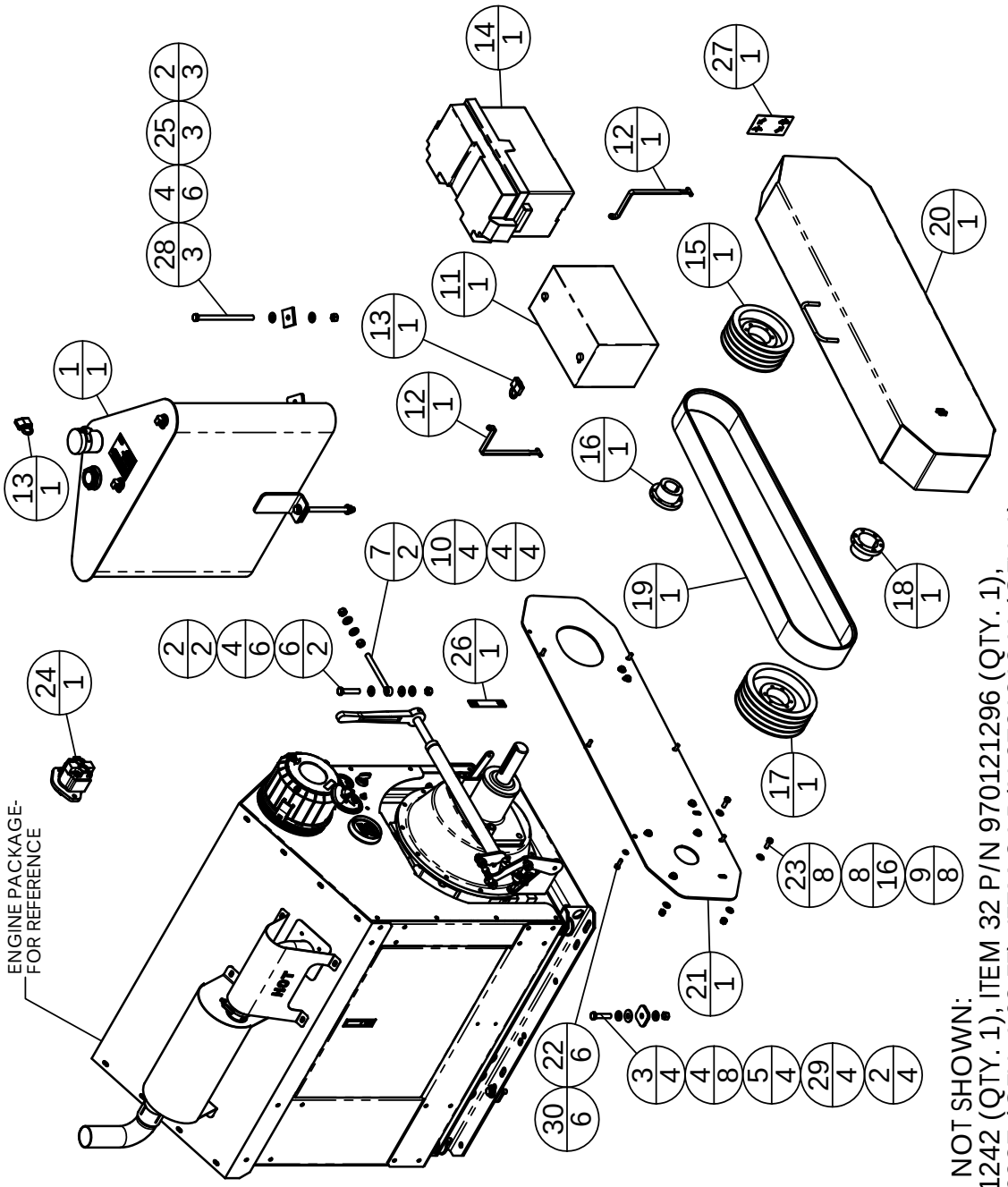
CHAIN DRIVE CHUTE ASSEMBLY, HEIGHT ADJUSTABLE, DRUM CHIPPER

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970403929	CHAIN DRIVE CHUTE ASSEMBLY, HEIGHT ADJUSTABLE, DRUM CHIPPER
1	1	970403930	WELDMENT, CHUTE BASE, CHUTE ROTATION, DRUM CHIPPER
2	1	970176213	ASSEMBLY, HT ADJ CHUTE, UPPER SECTION, ROTATIONAL CHUTE,
3	1	970130134	WELDMENT, JACK, HEIGHT ADJUSTABLE CHUTE, 33.00 IN MIN PIN TO PIN, 15.00 IN STROKE
4	1	970176180	PIN, HT ADJ CHUTE, 10.00 IN L, CROSS DRILLED,
5	2	970121057	PIN, STEEL, HAIRPIN, 2.63 IN L, .13 IN DIA, PLATED 18,
6	1	970111369	LOCKDOWN LATCH, CHUTE ROTATION, DISCHARGE SPOUT
7	1	970177631	CHUTE DEFLECTOR, BARE METAL, S/A 970336459, 970336460, 970336461 OR 970336462, 9.00
8	1	879060150	CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 5.5, GR 5, PLATED / PLATED,
9	8	020401404	WASHER, STEEL, FLAT TYPE A NARROW, .50 IN DIA, PLATED 18,
10	2	970355863	CAPSCREW, STEEL, HEX HEAD, .50-20 UNF, 2.00 IN L, GR 8, PLATED, ALL THREAD
11	2	020301403	NUT, STEEL, HEX, .50-13 UNC, GR 8,
12	1	970121064	PIN, DEFLECTOR PIVOT, .31 IN DIA, 10.00 IN GRIP, CROSS DRILLED
13	1	020391404	NUT, HEX, SELF-LOCKING, STEEL, OVALATED, .50-13 UNC, GR C, PLATED,

ASSEMBLY, POWER SYSTEM, KUBOTA 67 HP/74 HP/99 HP, DIESEL, DRM 12



ASSEMBLY, POWER SYSTEM, KUBOTA 67 HP/74 HP/99 HP, DIESEL, DRM 12

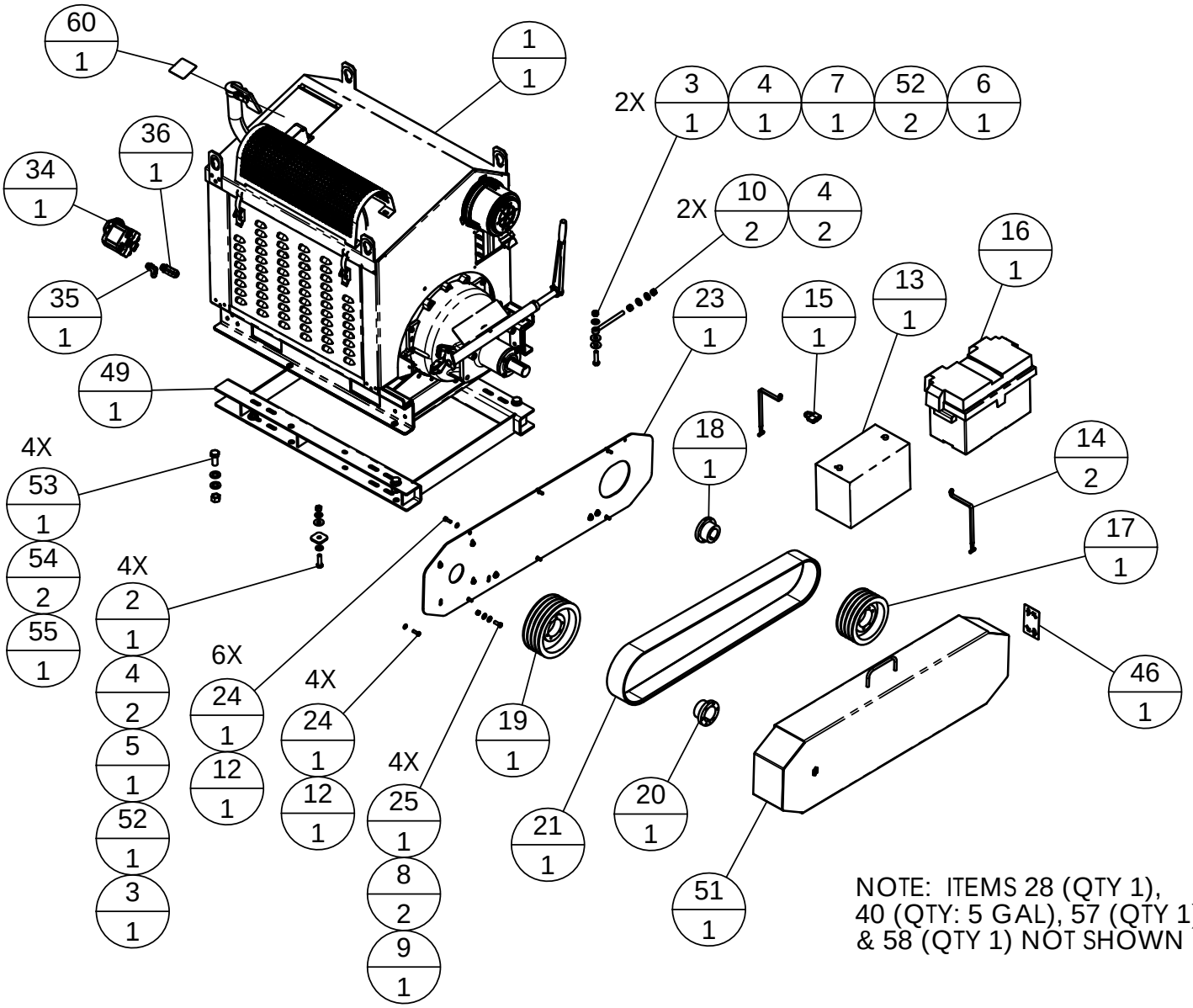


NOTE:
FOLLOWING ITEMS NOT SHOWN:
ITEM 31 P/N 970121242 (QTY. 1), ITEM 32 P/N 970121296 (QTY. 1),
ITEM 33 P/N 970376937 (QTY. 4.63 FT), ITEM 34 P/N 970121244 (QTY. 1),
ITEM 35 P/N 970149311 (QTY. 6.67 FT), ITEM 36 P/N 027400060 (QTY. 1),
ITEM 37 P/N 27420065 (QTY. 1), ITEM 38 P/N 878010370 (QTY. 5 GAL),
ITEM 39 P/N 970175472 (QTY 7.5 FT), ITEM 40 P/N 970179959 (QTY. 4),
ITEM 42 P/N 970124380 (QTY. 8.3 FT), ITEM 43 P/N 020411101 (QTY. 1),
ITEM 44 P/N 020411201 (QTY. 1), ITEM 45 P/N 02041202 (QTY. 1),
ITEM 46 P/N 970412025 (QTY. 1), ITEM 47 P/N 970412012 (QTY. 1).

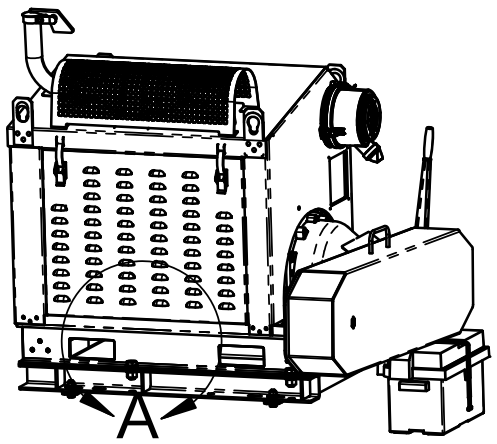
ASSEMBLY, POWER SYSTEM, KUBOTA 67 HP/74 HP/99 HP, DIESEL, DRM 12

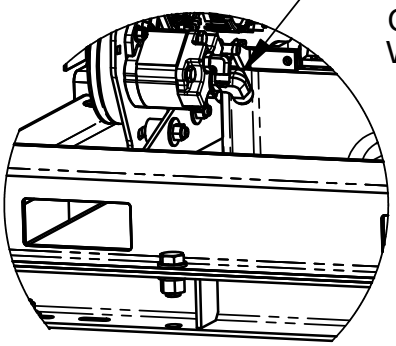
ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970413408	KIT, POWER SYSTEM, KUBOTA, 67 HP/74 HP/99 HP, DIESEL, DRM 12
1	1	970159564	TANK, DIESEL, CFD-1217, S/A 970384418 P-TICKET USE, ASSEMBLED,
2	9	020391404	NUT, HEX, SELF-LOCKING, STEEL, OVALATED, .50-13 UNC, GR C, PLATED,
3	4	020041411	CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 2.25 IN L, GR 8,
4	24	020401405	WASHER, STEEL, FLAT, .50 IN DIA, THRU HARD HIGH STRENGTH, PLATED
5	4	970116595	PLATE, ENGINE SUPPORT, 2.00 IN W, 2.00 IN H, 7 GA, .563 HOLE IN CENTER
6	2	970116563	CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 2.50 IN L, GR 8, PLATED 18,
7	2	970116493	ROD END EYE BOLT, STEEL, FULLY THREADED, .50-13 UNC, 6.00 IN L, PLATED 18
8	16	020401207	WASHER, STEEL, FLAT, .38 IN DIA, SAE THRU-HARD HIGH STRENGTH, PLATED 18,
9	8	020391225	NUT, STEEL, TOP LOCK, .38-16 UNC, GR C, PLATED,
10	4	020301401	NUT, STEEL, HEX, .50-13 UNC,
11	1	970116580	BATTERY, 12 VDC, BCI GROUP 31, 1030 CCA, DIESEL, TOP POST
12	2	970116627	BAR, FORMED, BATTERY BOX, LOCK
13	2	970116628	PADLOCK, KEYED, .25 IN DIA SHACKLE, 1.50 IN W, .81 IN X .81 IN CLEARANCE, KEY 5401
14	1	970113585	BOX, BATTERY BOX, PLASTIC, 9.00 IN H, 9.50 IN W, 17.00 IN L, PLASTIC, DIESEL,
15	1	970116508	SHEAVE, B, SK, 4 GROOVE, 7.40, 4B74SK
16	1	970116509	BUSHING, QD, SK, 1.75 IN DIA, .38 IN X .19 IN KEYWAY,
17	1	970116511	SHEAVE, B, SK, 4 GROOVE, 8.60, 4B86SK
18	1	970159505	BUSHING, QD, SK, 2.44 IN DIA, SHALLOW KEYWAY,
19	1	970168249	BELT, B, KEVLAR, 4 GROOVE, 93 IN, 4/B93
20	1	970389581	WELDMENT, BELT DRIVE GUARD, CFD 1217
21	1	970161179	BACKING PLATE, DRIVE GUARD, CFD-1217,
22	6	020041106	CAPSCREW, STEEL, HEX HEAD, .31-18 UNC, 1.00 IN L, GR 8, PLATED,
23	8	020049206	CAPSCREW, STEEL, HEX HEAD, .38-16 UNC, 1.00 IN L, GR 8, PLATED 18,
24	1	970398753	PARKER, GEAR PUMP, 0.27 CUBIC IN/REV, COUNTER CLOCKWISE (LEFT HAND),
25	3	970122462	RUBBER, .250 IN T, 2.00 IN W, 2.00 IN L, RUBBER SHOCK ISO TANKS, 60 DUROMETER
26	1	970220770	PLACARD, ENGLISH, INSTRUCTION, THROTTLE CONTROL, 1.00 IN W X 5.00 IN H,
27	1	970220771	PLACARD, ENGLISH, INSTRUCTION, CLUTCH ENGAGEMENT, 3.00 IN W X 5.00 IN H,
28	3	020031426	CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 8.00 IN L, GR 5, PLATED,
29	4	020401401	WASHER, STEEL, USS FLAT, .562 IN ID / 1.375 IN OD, PLATED 18, YELLOW ZINC
30	6	020401102	WASHER, STEEL, FLAT TYPE A NARROW, .31 IN DIA, PLATED 18
31	1	970121242	TERMINAL, 2/0 CABLE, POSITIVE, BATTERY END,
32	1	970121296	CAP, PLASTIC, RED, POSITIVE TERMINAL,
33	4.63	970376937	CABLE, 1 COND, STRANDED, 2/0, BULK, RED, SGTM, CLASS K
34	1	970121244	LUG, .38 IN DIA, HEAVY WALL, 2/0 WIRE, POSITIVE,
35	6.67	970149311	LOOM, 3/4 IN DIA, WIRE LOOM, PLASTIC,
36	1	027400060	ADAPTER, STRAIGHT, -8 SAE, -8 JIC
37	1	027420065	ADAPTER, 90 DEG ELBOW, -12 SAE, -12 JIC
38	5	878010370	DIESEL FUEL,
39	7.5	970175472	HOSE, FUEL, 0.562 OD, 0.3125 ID, CUT TO LENGTH,
40	4	970179959	CLAMP, HOSE, WORM GEAR, .31 MAX ID, .13 MIN ID, .31 IN WIDE, STAINLESS STEEL,
42	8.3	970124380	EDGING, SEAL, RUBBER,
43	1	020411101	WASHER, STEEL, LOCK SPLIT TYPE, .31 IN DIA, PLATED,
44	1	020411201	WASHER, STEEL, LOCK SPLIT TYPE, .375 IN DIA, PLATED,
45	1	020041202	CAPSCREW, STEEL, HEX HEAD, .38-16 UNC, .75 IN L, GR 8, PLATED,
46	1	970412025	CABLE ASSEMBLY, 1 COND, STRANDED, 2 GA, 25 IN L, GROUND, BATTERY TO FRAME
47	1	970412012	CABLE ASSEMBLY, 1 COND, STRANDED, 2/0 GA, 41 IN L, NEG., BATTERY TO ENGINE

ASSEMBLY, POWER SYSTEM, GM, 89HP, GASOLINE, DRM12 & CFD1217



NOTE: ITEMS 28 (QTY 1), 40 (QTY: 5 GAL), 57 (QTY 1), & 58 (QTY 1) NOT SHOWN





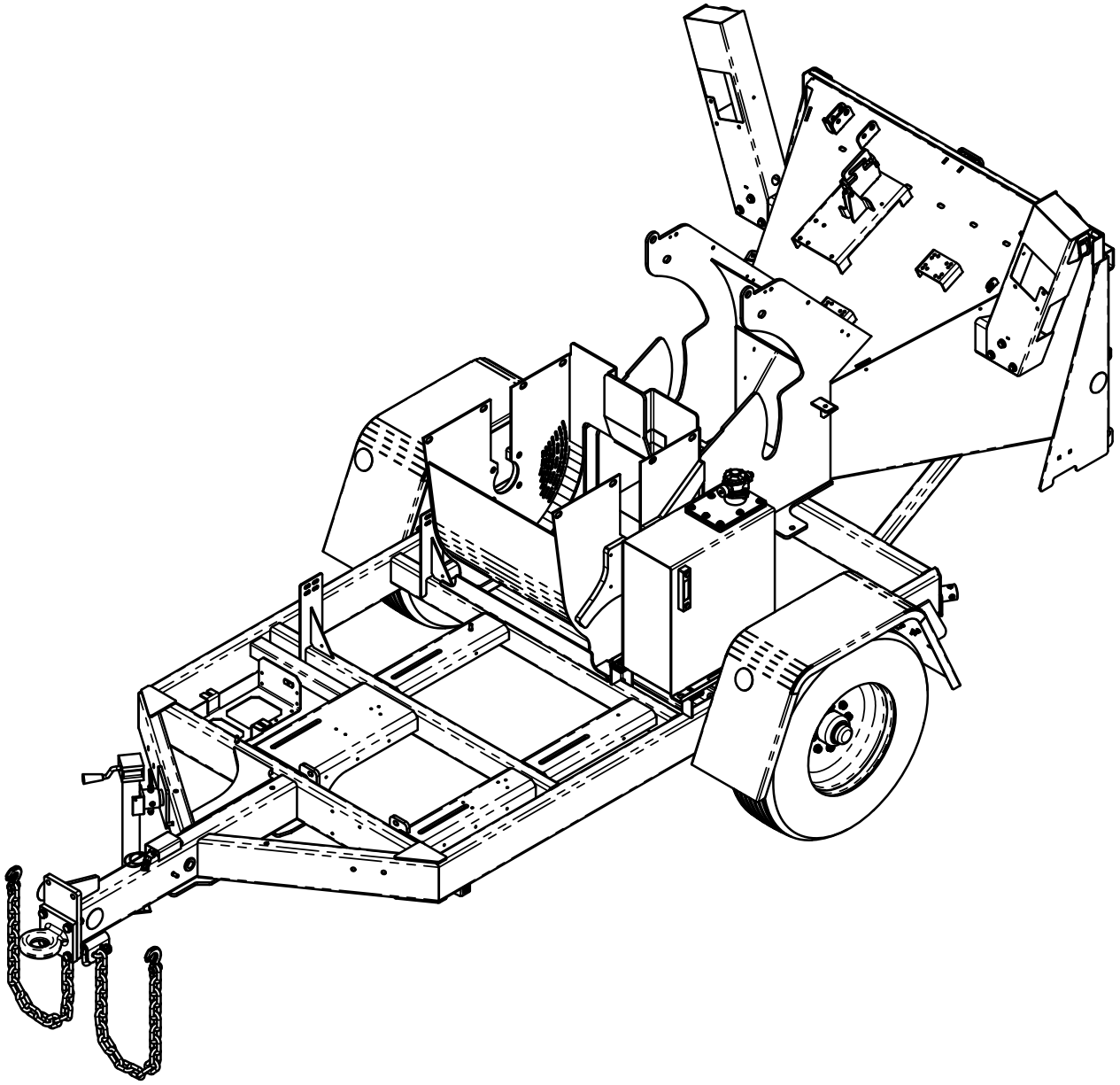
ORIENT PUMP FITTINGS TO MAXIMIZE HOSE BEND RADII AND AVOID CONTACT OF HOSES WITH SHARP EDGES.

DETAIL A
SCALE 1 : 10

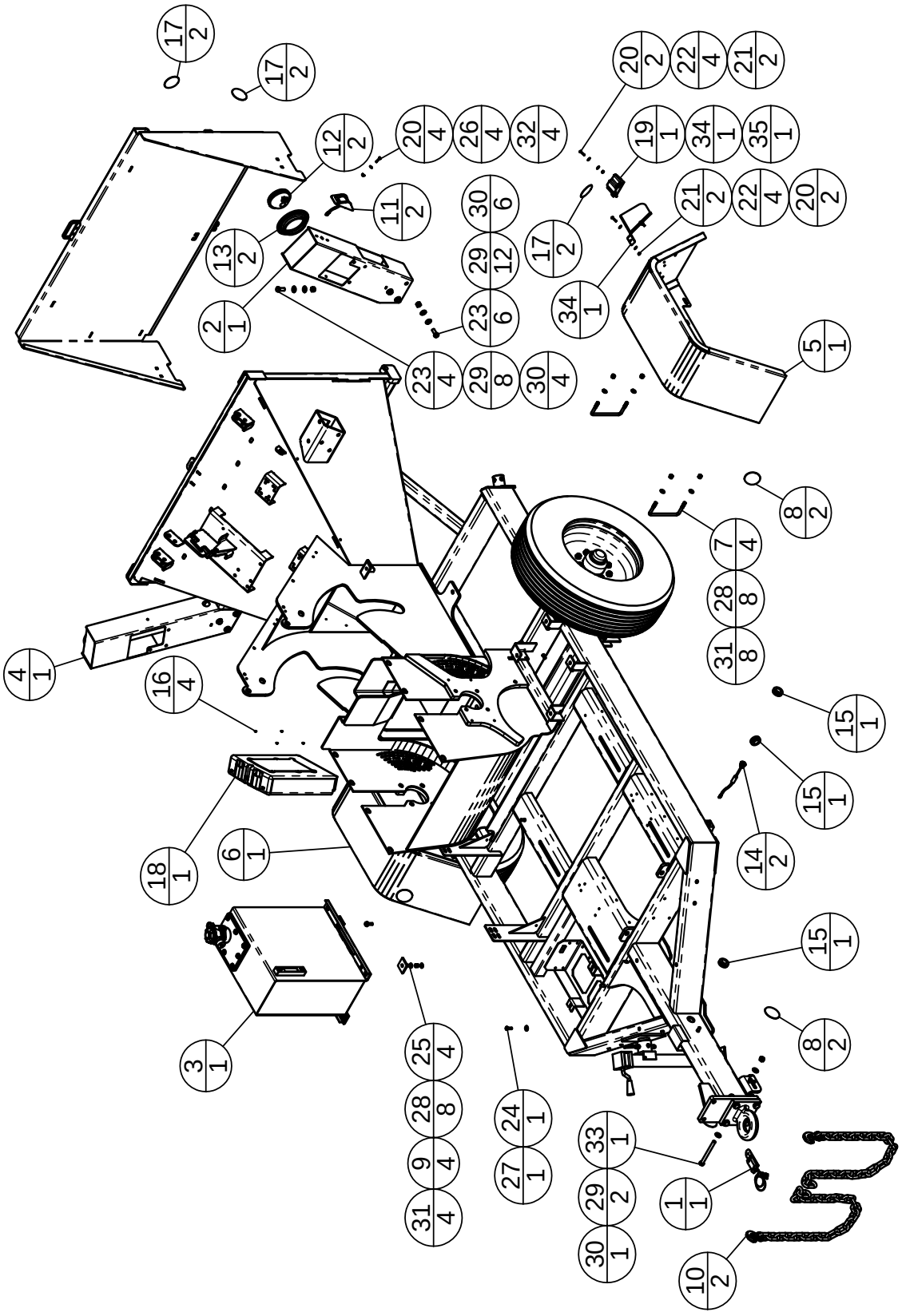
ASSEMBLY, POWER SYSTEM, GM, 89HP, GASOLINE, DRM12 & CFD1217

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970389253	ASSEMBLY, POWER SYSTEM, GM, 89 HP, GASOLINE, CFD1217 **(CFD)**
		970463202	ASSEMBLY, POWER SYSTEM, GM, 89 HP, GASOLINE, DRM12 **(DRM)**
1	1	970387567	KIT, AUXILIARY BELT DRIVE, HYDRAULIC PUMP, 3.0L GM GASOLINE ENGINE, DC1317,
2	4	020041409	**(CFD)** CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 1.75 IN L, GR 8, PLATED
	4	020041427	**(DRM)** CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 2.00 IN L, GR 8, PLATED 18,
3	6	020391404	NUT, HEX, SELF-LOCKING, STEEL, OVALATED, .50-13 UNC, GR C, PLATED,
4	14	020401405	WASHER, STEEL, FLAT, .50 IN DIA, THRU HARD HIGH STRENGTH, PLATED
5	4	970116595	PLATE, ENGINE SUPPORT, 2.00 IN W, 2.00 IN H, 7 GA, .563 HOLE IN CENTER
6	2	020041427	CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 2.00 IN L, GR 8, PLATED 18,
7	2	970116493	ROD END EYE BOLT, STEEL, FULLY THREADED, .50-13 UNC, 6.00 IN L, PLATED 18, .50 IN
8	8	020401207	WASHER, STEEL, FLAT, .38 IN DIA, SAE THRU-HARD HIGH STRENGTH, PLATED 18,
9	4	020391225	NUT, STEEL, TOP LOCK, .38-16 UNC, GR C, PLATED,
10	4	020301401	NUT, STEEL, HEX, .50-13 UNC,
12	10	020401102	WASHER, STEEL, FLAT TYPE A NARROW, .31 IN DIA, PLATED 18
13	1	970116580	BATTERY, 12 VDC, BCI GROUP 31, 1030 CCA, DIESEL, TOP POST
14	2	970116627	BAR, FORMED, BATTERY BOX, LOCK
15	1	970116628	PADLOCK, KEYED, .25 IN DIA SHACKLE, 1.50 IN W, .81 IN X .81 IN CLEARANCE, KEY 5401,
16	1	970113585	BOX, BATTERY BOX, PLASTIC, 9.00 IN H, 9.50 IN W, 17.00 IN L, PLASTIC, DIESEL,
17	1	970116508	SHEAVE, B, SK, 4 GROOVE, 7.40, 4B74SK
18	1	970116509	BUSHING, OD, SK, 1.75 IN DIA, .38 IN X .19 IN KEYWAY,
19	1	970116511	SHEAVE, B, SK, 4 GROOVE, 8.60, 4B86SK
20	1	970159505	BUSHING, OD, SK, 2.44 IN DIA, SHALLOW KEYWAY,
21	1	970168249	BELT, B, KEVLAR, 4 GROOVE, 93 IN, 4/B93
23	1	970161179	BACKING PLATE, DRIVE GUARD, CFD-1217,
24	10	020041106	CAPSCREW, STEEL, HEX HEAD, .31-18 UNC, 1.00 IN L, GR 8, PLATED,
25	4	020049206	CAPSCREW, STEEL, HEX HEAD, .38-16 UNC, 1.00 IN L, GR 8, PLATED 18,
28	1	970419800	CABLE ASSEMBLY, BATTERY, POSITIVE, CHIPPER, DC1317/HP, DC912A, CFD1217, 1 COND,
34	1	970403629	**(CFD)** HYDRAULIC PUMP, GEAR TYPE, .49 CU IN, CW, REAR PORTS, .75 IN DIA, 4.8 KEY
	1	970435410	**(DRM)** HYDRAULIC PUMP, GEAR TYPE, .28 CU IN, CW, REAR PORTS, .75 IN DIA, 4.8 KEY
35	1	027420058	ADAPTER, 90 DEG ELBOW, -8 SAE, -8 JIC
36	1	027420062	ADAPTER, 90 DEG ELBOW, -10 SAE, -12 JIC,
40	5	970166049	UNLEADED GASOLINE, FUEL,
46	1	970220771	PLACARD, ENGLISH, INSTRUCTION, CLUTCH ENGAGEMENT, 3.00 IN W X 5.00 IN H,
49	1	970386123	WELDMENT, SUBFRAME, 3.0L GM ENGINE,
51	1	970389581	WELDMENT, BELT DRIVE GUARD, CFD 1217
52	8	020401401	WASHER, STEEL, USS FLAT, .562 IN ID / 1.375 IN OD, PLATED 18, YELLOW ZINC
53	4	020041739	CAPSCREW, STEEL, HEX HEAD, .75-10 UNC, 1.75 IN L, GR 8, PLATED,
54	8	020401702	WASHER, STEEL, FLAT, .75 DIA, ASTM F436, PLATED 18,
55	4	020391702	NUT, STEEL, HEX, .75-10 UNC, OVALATED, PLATED
57	1	970412025	CABLE ASSEMBLY, 1 COND, STRANDED, 2 GA, 25 IN L, GROUND, BATTERY TO FRAME,
58	1	970412012	CABLE ASSEMBLY, 1 COND, STRANDED, 2/0 GA, 41 IN L, NEG., BATTERY TO ENGINE,
60	1	970441951	PLACARD, ENGLISH, NOTICE, ENGINE, EQUIPMENT DAMAGE HAZARD, DEXCOOL

FINAL ASSEMBLY, DRM 12

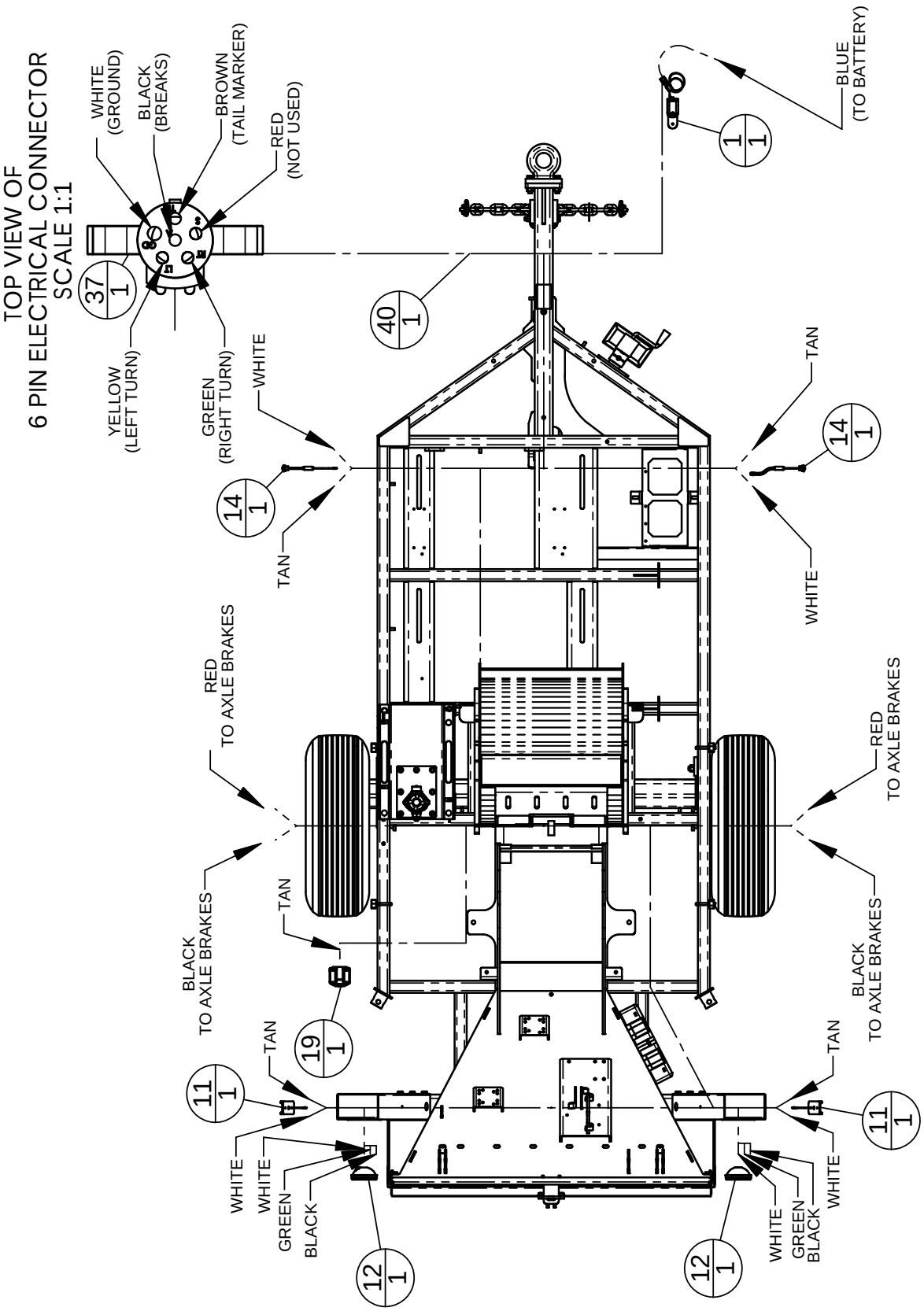


FINAL ASSEMBLY, DRM 12



NOTE:
ITEM 36 P/N 970345498, 38 P/N 90020028
AND ITEM 39 P/N 970363950 ARE NOT VISUALLY SHOWN.

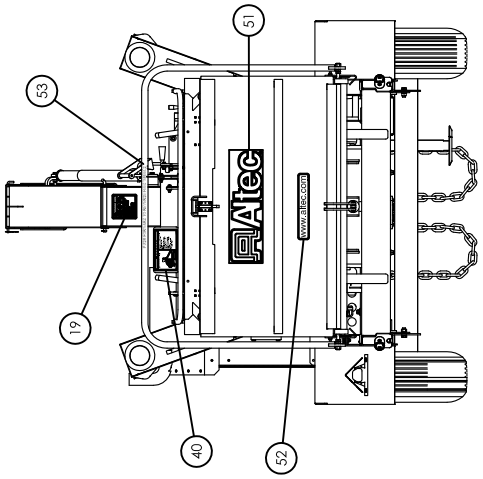
FINAL ASSEMBLY, DRM 12

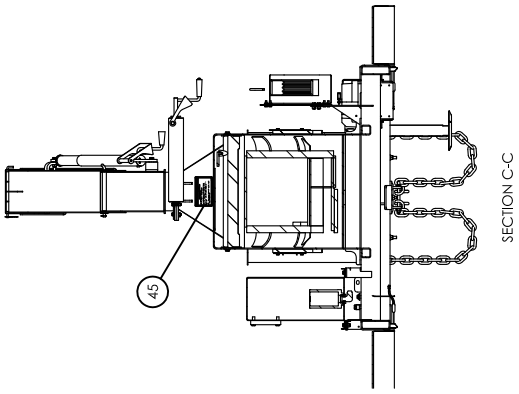


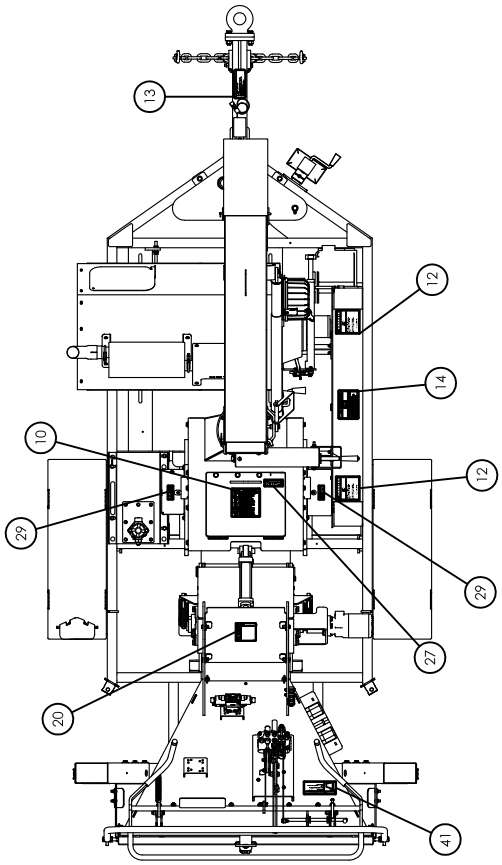
FINAL ASSEMBLY, DRM 12

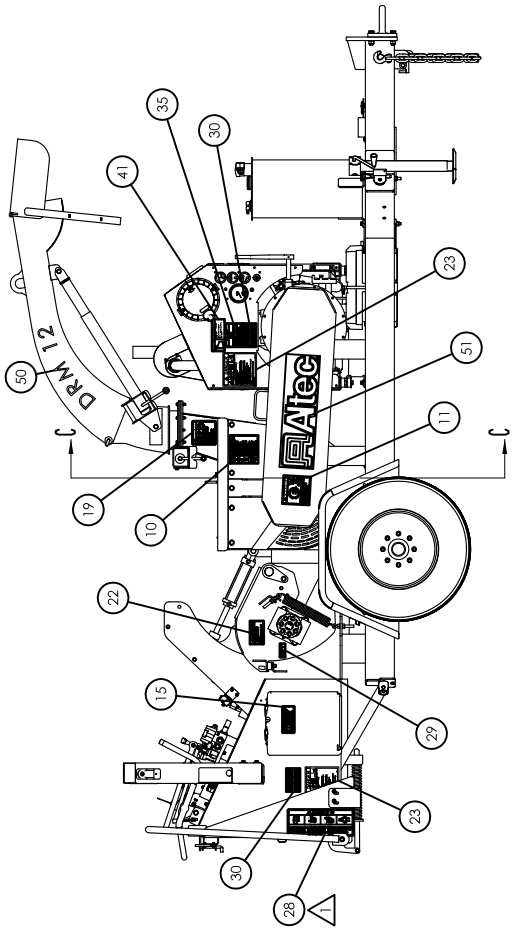
ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970413431	FINAL ASSEMBLY, DRM 12
1	1	970158259	SWITCH, BREAK AWAY, WITH CONNECTOR, MATE BAGGED,
2	1	970306927	LIGHT BRACKET, WELDMENT, BOLT ON, STREET SIDE,
3	1	970162760	RESERVOIR, HYDRAULIC, STEEL, 12 GAL, INTERNAL, INTERNAL, TUBE, 5.00 IN, 18.96 IN L
4	1	970306918	LIGHT BRACKET, WELDMENT, BOLT ON, CURB SIDE,
5	1	970333989	WELDMENT, FENDER, STREET SIDE,
6	1	970333988	WELDMENT, FENDER, CURB SIDE,
7	4	970162554	U BOLT, STEEL, SQUARE BEND, 2.88 IN L, .38-16, 6.09 IN W, 1.25 IN THREAD LENGTH
8	4	068490016	REFLECTOR, ROUND, 2.88 IN DIA, AMBER, SPITFIRE
9	4	970122462	RUBBER, .250 IN T, 2.00 IN W, 2.00 IN L, RUBBER SHOCK ISO TANKS, 60 DUROMETER
10	2	970116608	CHAIN, .38 IN DIA, 42 IN L, GRADE 43, CLEVIS SLIP HOOK WITH LATCH,
11	2	970116622	LIGHT, MARKER, 1.25 IN H, 5.50 IN L 2.00 IN T, 12 VDC, RED, LED,
12	2	970192098	LIGHT, STOP TURN TAIL, 4.31 IN DIA, 12 VDC, RED, LED, ROUND,
13	2	068440018	GROMMET, STOP/TURN/TAIL, 5.50 IN DIA, BLACK, FLUSH MOUNT, GROMMET
14	2	970190075	LIGHT, INDICATOR, 1.80 IN H, .75 IN DIA, 12.8 VDC, AMBER, LED, WITH GROMMET,
15	3	970116626	GROMMET, RUBBER, 1.25 IN ID, 1.375 IN GROOVE OD, .625 IN T, BLACK, .245 IN T GROOVE,
16	4	980039825	RIVET, ALUMINUM, AB6-4A, .13-.25 IN GRIP RANGE, .19 IN DIA,
17	6	068490017	REFLECTOR, ROUND, 2.88 IN DIA, RED, SPITFIRE
18	1	970377482	HOLDER, MANUAL, INSTRUCTION, PLASTIC, 15.75 IN L, 13.38 IN W, 3.56 IN H,
19	1	970201725	LIGHT, LICENSE LIGHT BRACKET, BLACK, USE WITH LP-91CB OR LPL-91CP,
20	8	020120813	MACHINE SCREW, STEEL, PAN HEAD SLOTTED, #10-24 UNC, 1.00 IN L, PLATED 18,
21	4	020390904	NUT, STEEL, TOP LOCK, #10-24 UNC, GR A, PLATED 18
22	8	020400801	WASHER, STEEL, FLAT MEDIUM, #10, PLATED 18,
23	10	020031407	CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 1.25 IN L, GR 5, PLATED,
24	1	020041106	CAPSCREW, STEEL, HEX HEAD, .31-18 UNC, 1.00 IN L, GR 8, PLATED,
25	4	020041207	CAPSCREW, STEEL, HEX HEAD, .38-16 UNC, 1.25 IN L, GR 8, PLATED 18,
26	4	020400808	WASHER, STEEL, FLAT, #10, GR8, PLATED,
27	1	020401101	WASHER, STEEL, FLAT, .31 IN DIA, PLATED
28	16	020401207	WASHER, STEEL, FLAT, .38 IN DIA, SAE THRU-HARD HIGH STRENGTH, PLATED 18,
29	22	020401404	WASHER, STEEL, FLAT TYPE A NARROW, .50 IN DIA, PLATED 18,
30	11	020391404	NUT, HEX, SELF-LOCKING, STEEL, OVALATED, .50-13 UNC, GR C, PLATED,
31	12	020391225	NUT, STEEL, TOP LOCK, .38-16 UNC, GR C, PLATED,
32	4	020390804	NUT, STEEL, KEP, #10-24 UNC, PLATED,
33	1	879060150	CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 5.5, GR 5, PLATED / PLATED,
34	1	970201724	LIGHT, LICENSE, 12 VDC, CLEAR, REQUIRES BRACKET LP-25SB,
35	1	068472010	HARNESS, PLUG, PIGTAIL
36	1	970345498	PLACARD, STAMPED, METAL, ENGLISH, INFORMATION, S/N DECAL, ANODIZED ALUMINUM
37	1	970116579	CONNECTOR, 6-WAY, TRAILER SIDE, PLUG, TECTRAN,
38	2	900200028	KEYCHAIN, PROMOTIONAL, PULL-APART
39	1	970363950	PHANTOM ASSEMBLY, COMMON PARTS, ALL CHIPPERS,
40	1	970157257	ELECTRICAL HARNESS, 6 COND, 14 GA, (4) TAIL LIGHTS, DC-1317/CFD-1217
41	1	970466113	PLATE, GUARD, TAG LIGHT,

ASSEMBLY, PLACARD ORIENTATION, DRM 12

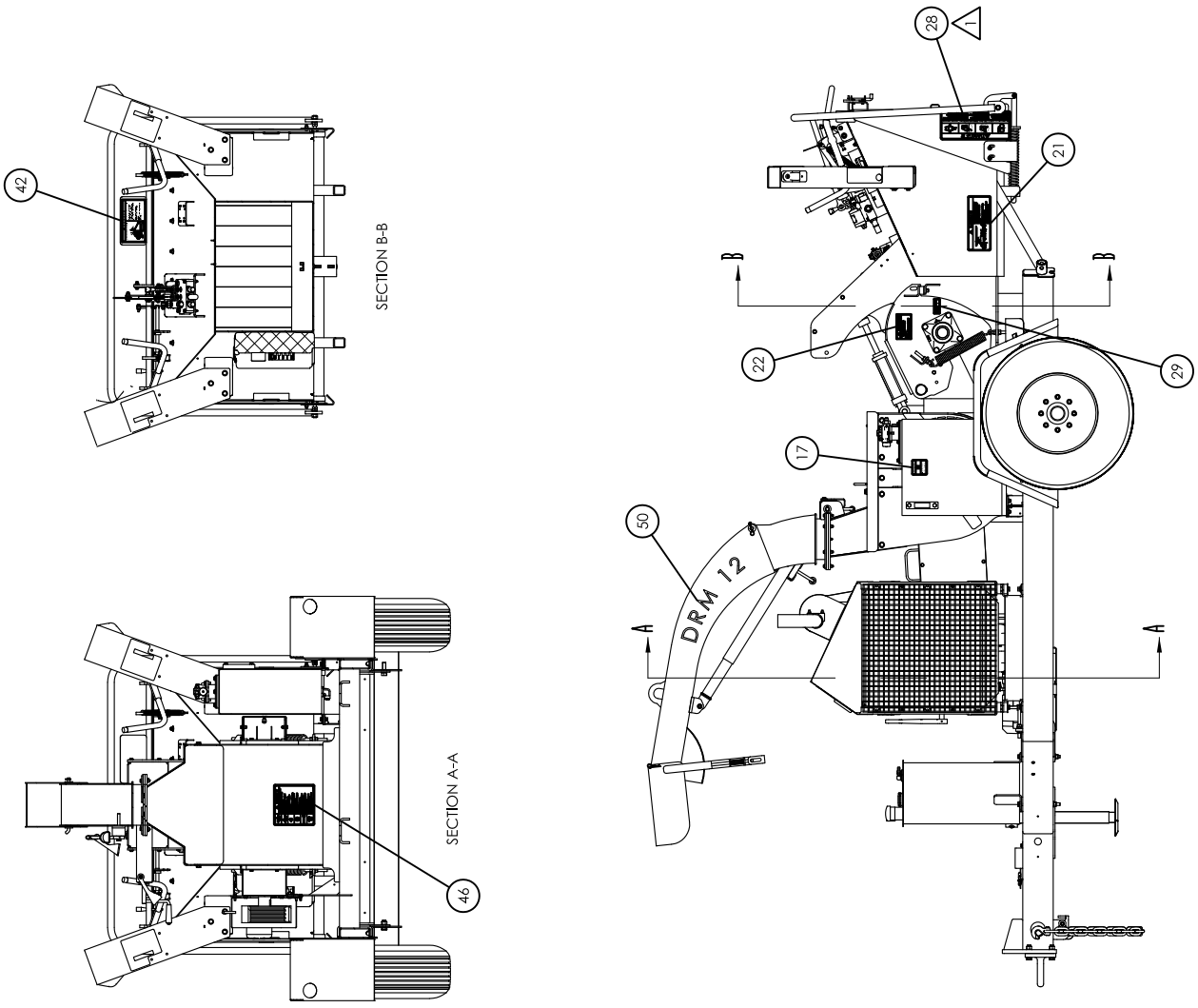




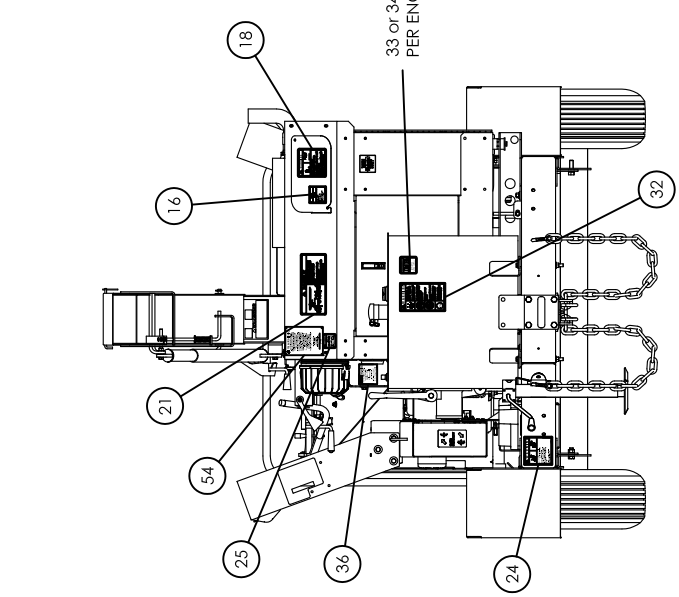


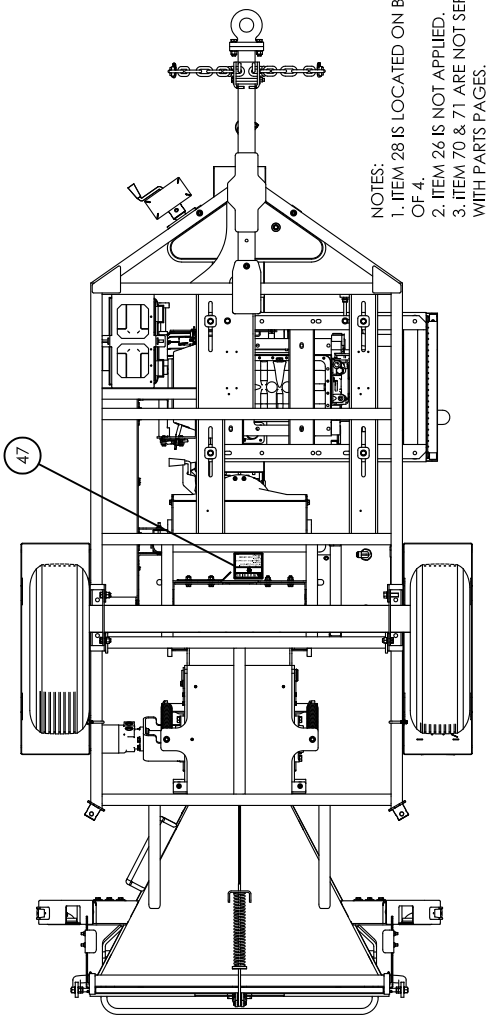


ASSEMBLY, PLACARD ORIENTATION, DRM 12

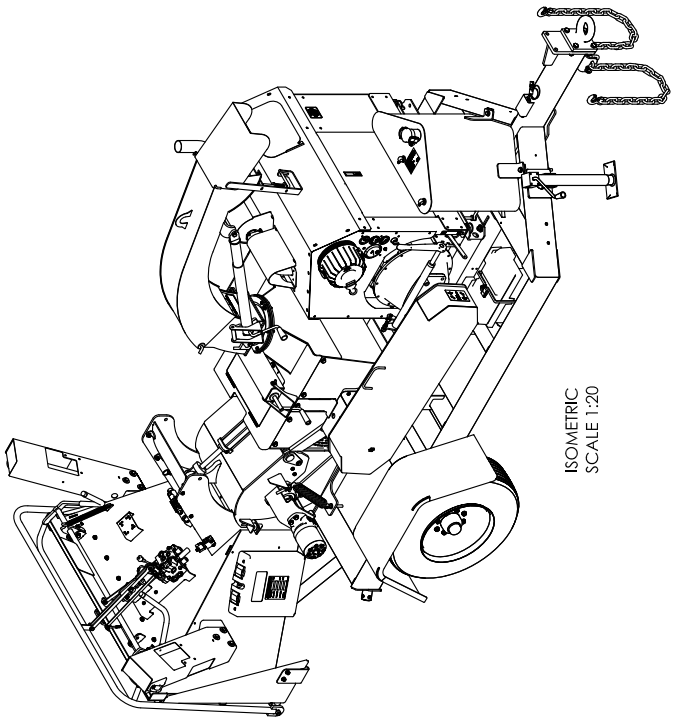


ASSEMBLY, PLACARD ORIENTATION, DRM 12





NOTES:
1. ITEM 28 IS LOCATED ON BOTH SIDES OF FEED TABLE SIDE FLANGE TOTALING TO A QUANTITY OF 4.
2. ITEM 26 IS NOT APPLIED.
3. ITEM 70 & 71 ARE NOT SERVICE PARTS AND ARE NOT SHOWN TO MAINTAIN CONSISTENCY WITH PARTS PAGES.



ISOMETRIC
SCALE 1:20

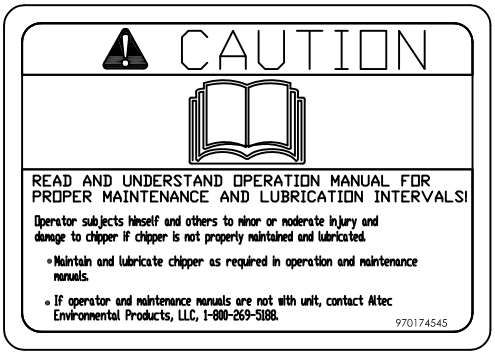
ASSEMBLY, PLACARD ORIENTATION, DRM 12

ITEM #10

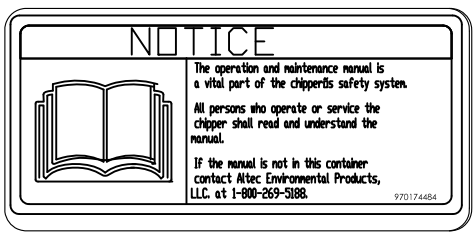
ITEM #11

ITEM #12

ITEM #13



ITEM #14

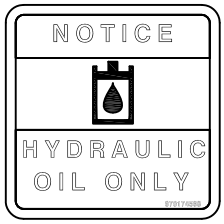


ITEM #15

NOTE: ONLY HAZARD WARNING PLACARDS SHOWN

ASSEMBLY, PLACARD ORIENTATION, DRM 12

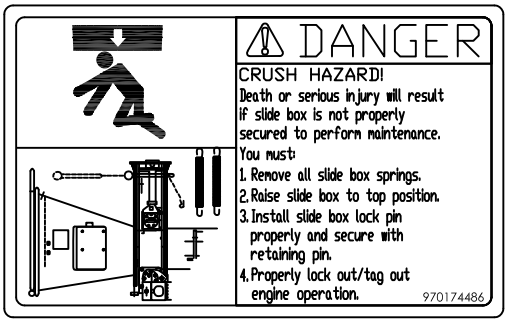
ITEM #16



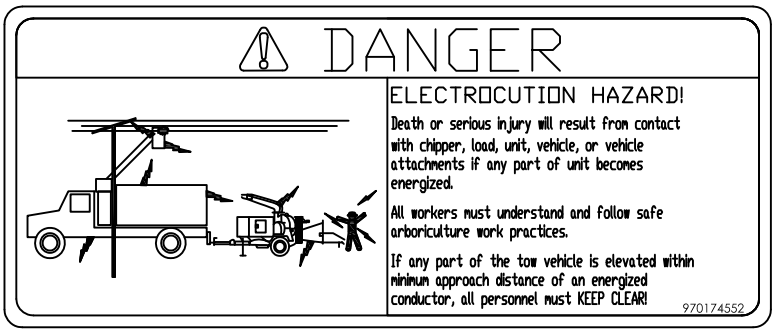
ITEM #17

ITEM #18

ITEM #19



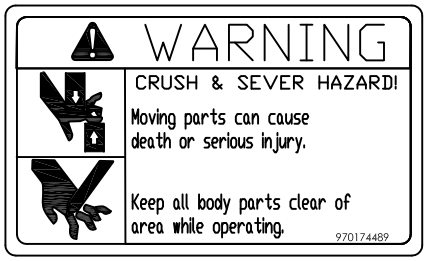
ITEM #20



ITEM #21

NOTE: ONLY HAZARD WARNING PLACARDS SHOWN

ASSEMBLY, PLACARD ORIENTATION, DRM 12



ITEM #22

ITEM #23

ITEM #24

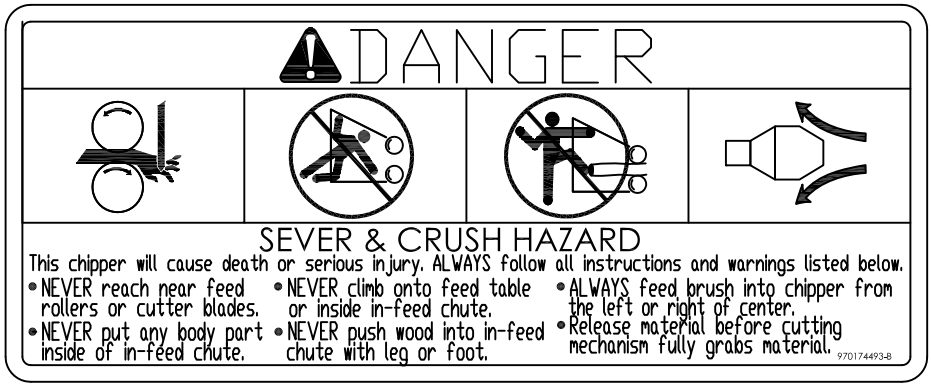
ITEM #25

ITEM #26

ITEM #27

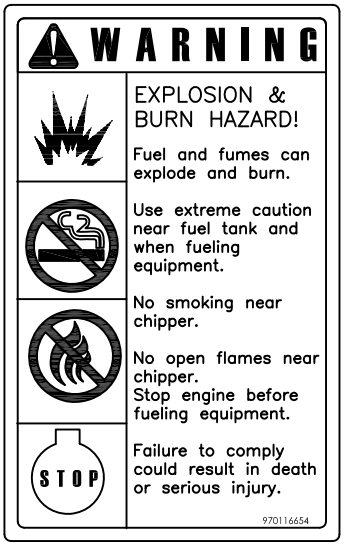
NOTE: ONLY HAZARD WARNING PLACARDS SHOWN

ASSEMBLY, PLACARD ORIENTATION, DRM 12

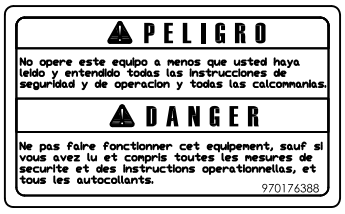


ITEM #28

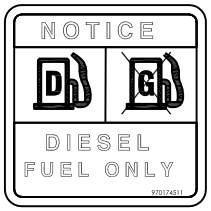
ITEM #29



ITEM #32



ITEM #30

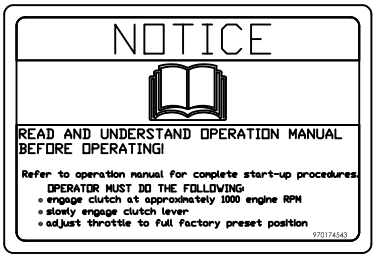


ITEM #33

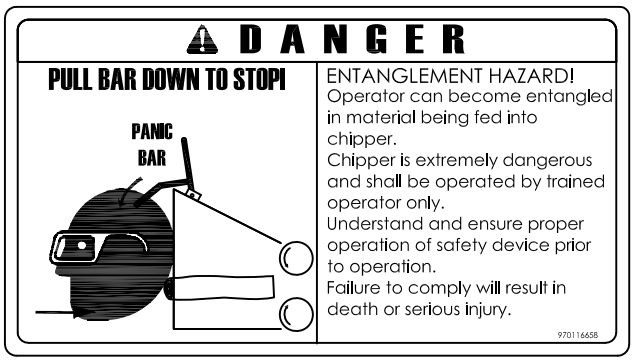
ITEM #34

NOTE: ONLY HAZARD WARNING PLACARDS SHOWN

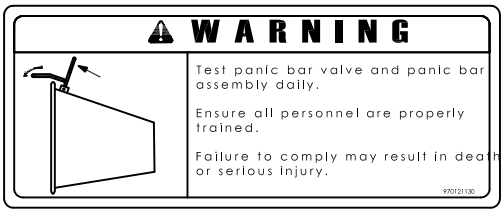
ASSEMBLY, PLACARD ORIENTATION, DRM 12



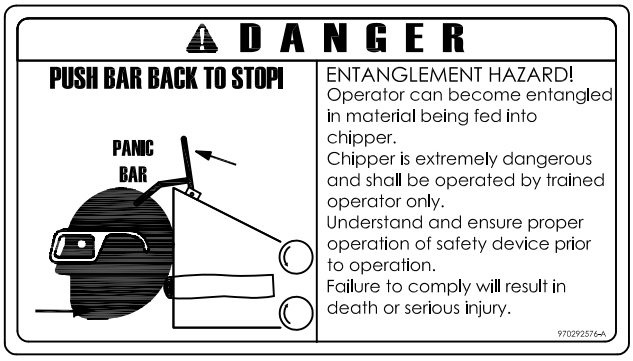
ITEM #35



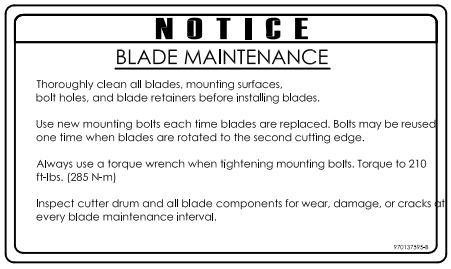
ITEM #40



ITEM #41



ITEM #42

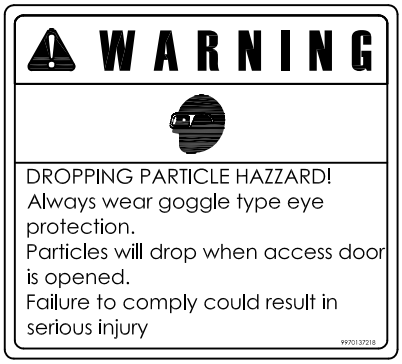


ITEM #45

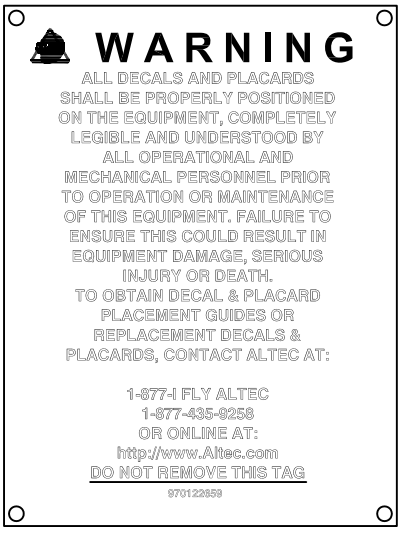
NOTE: ONLY HAZARD WARNING PLACARDS SHOWN

ASSEMBLY, PLACARD ORIENTATION, DRM 12

ITEM #46



ITEM #47



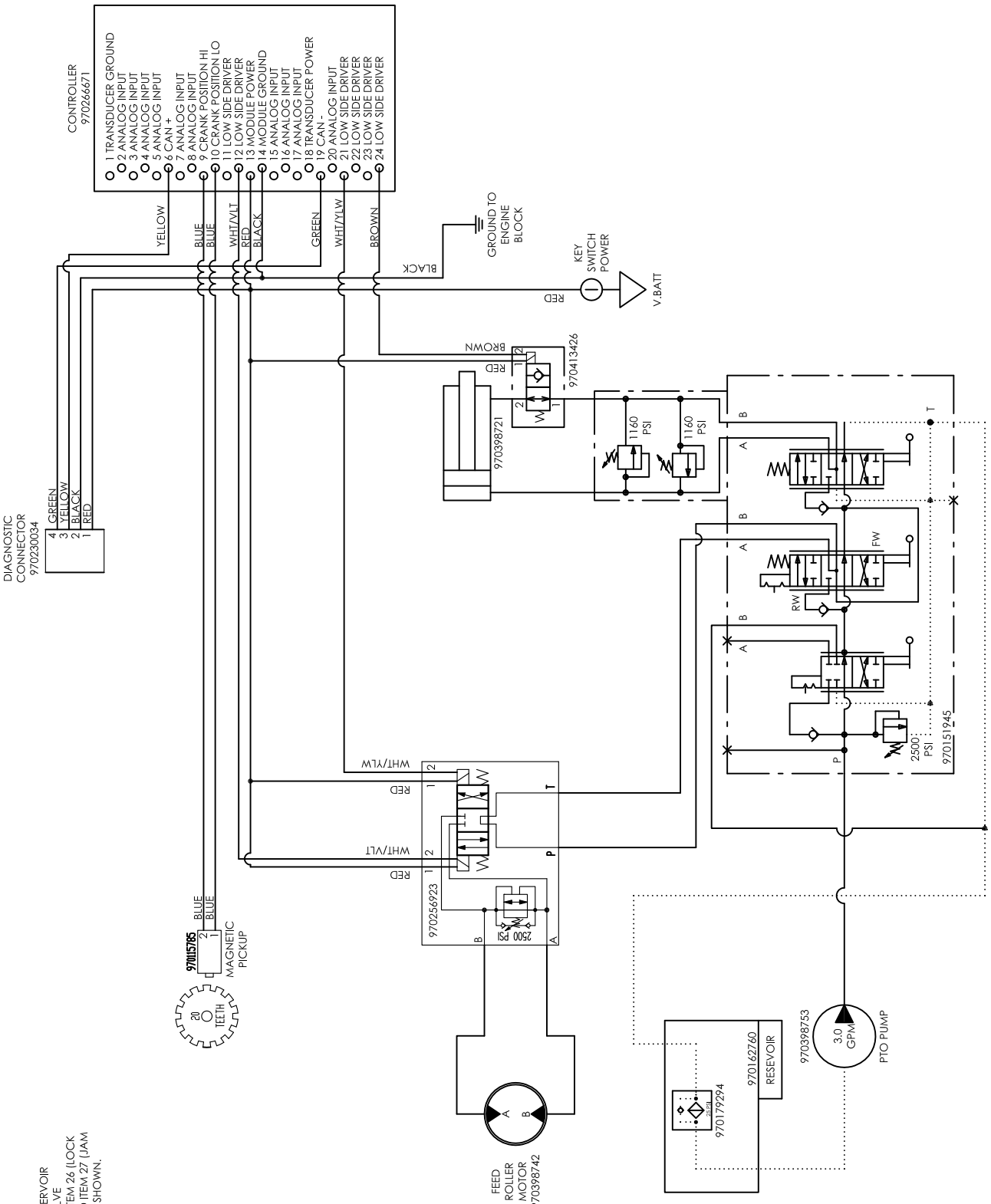
ITEM #54

NOTE: ONLY HAZARD WARNING PLACARDS SHOWN

ASSEMBLY, PLACARD ORIENTATION, DRM 12

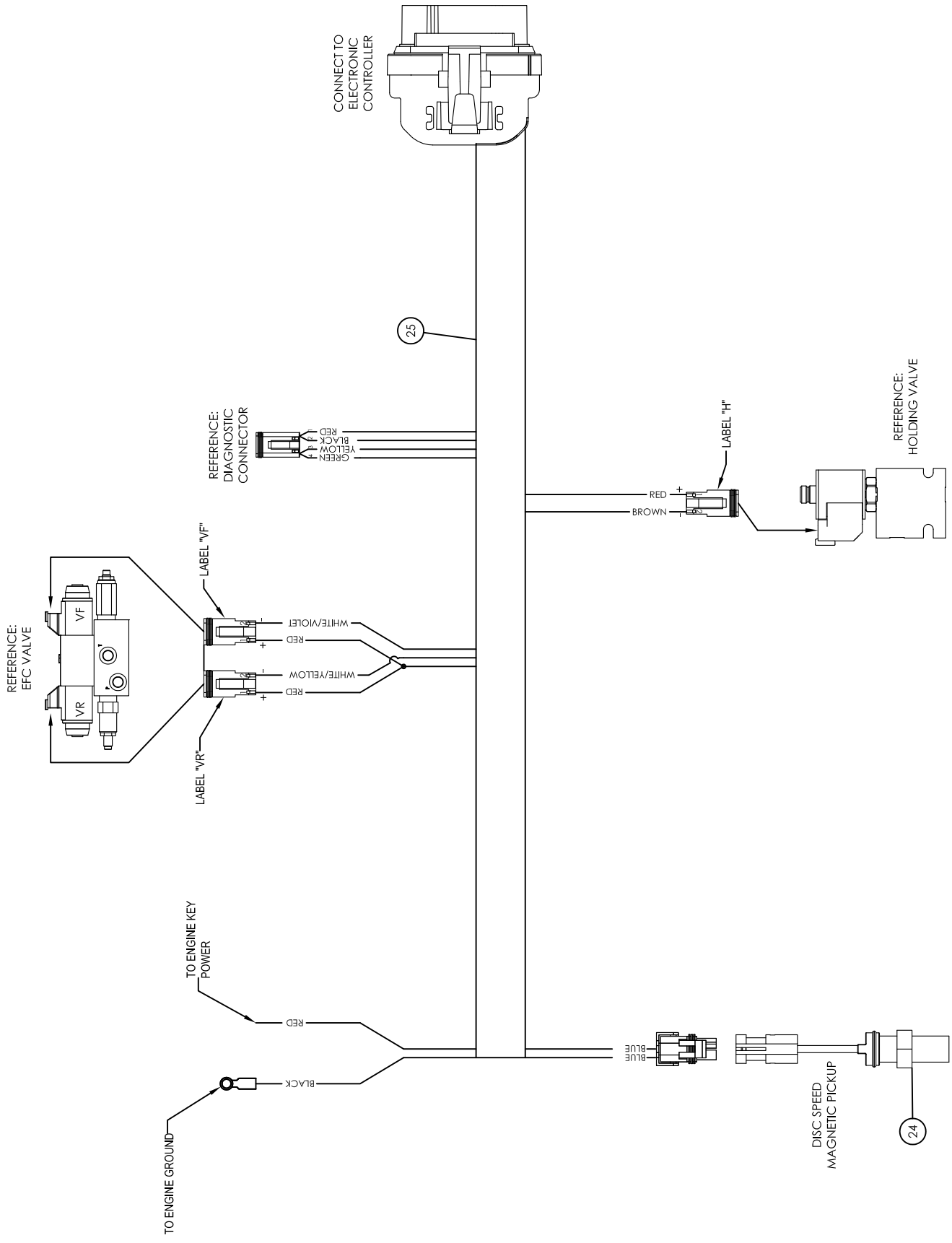
ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970413432	ASSEMBLY, PLACARD ORIENTATION, DRM12
	1	970176549	PLACARD KIT, ENGLISH, DRUM AND DISC CHIPPERS,
	1	970176550	PLACARD KIT, ENGLISH, PANIC BAR,
	1	970182410	PLACARD, ENGLISH, WARNING, BLADE ACCESS, CFD-1217
10	2	970174494	PLACARD, ENGLISH, DANGER, SEVER AND ENTANGLEMENT, HAZARD,
11	1	970174727	PLACARD, ENGLISH, WARNING, ROTATING SHAFT,
12	2	970176501	PLACARD, ENGLISH, WARNING, ENTANGLEMENT HAZARD, DRIVE BELTS,
13	1	970174780	PLACARD, ENGLISH, WARNING, TOWING HAZARDS,
14	1	970174545	DECAL, ENGLISH, CAUTION, READ AND UNDERSTAND, OPERATION MANUAL
15	1	970174484	PLACARD, ENGLISH, NOTICE, OPERATION AND MAINTENANCE, 6.25IN L X 2.75 IN W,
16	1	970116651	PLACARD, ENGLISH, NOTICE, ENGINE, EQUIPMENT DAMAGE HAZARD,
17	1	970174568	PLACARD, ENGLISH, NOTICE SMALL DECAL, HYDRAULIC OIL ONLY,
18	1	970116652	PLACARD, ENGLISH, WARNING, ENGINE, BURN HAZARD,
19	2	970174499	PLACARD, ENGLISH, WARNING, FLYING OBJECT HAZARD,
20	1	970174486	PLACARD, ENGLISH, DANGER, CRUSH HAZZARD, SLIDEBOX,
21	2	970174552	PLACARD, ENGLISH, DANGER, ELECTROCUTION HAZARD,
22	2	970174489	PLACARD, ENGLISH, WARNING, SLIDEBOX CRUSH AND SEVER,
23	2	970174538	PLACARD, ENGLISH, DANGER, OPERATION BY QUALIFIED PERSON,
24	1	970116649	PLACARD, ENGLISH, WARNING, EXPLOSION HAZARD, BATTERY,
25	1	970116653	PLACARD, ENGLISH, WARNING, ENGINE, CALIFORNIA PROPOSITION G5,
26	1	970116640	PLACARD, ENGLISH, WARNING, DISC HOUSING, SEVER HAZARD,
27	1	970137559	PLACARD, ENGLISH, WARNING, ROTOR LOCK OUT,
28	4	970174493	PLACARD, ENGLISH, DANGER, SEVER AND CRUSH HAZARD, INFEED CHUTE,
29	4	970116642	PLACARD, ENGLISH, NOTICE, BEARINGS, LUBRICATE DAILY,
30	2	970176388	PLACARD, SPANISH/FRENCH, DANGER, OPERATION, READ AND UNDERSTAND,
32	1	970116654	PLACARD, ENGLISH, WARNING, FUEL TANK, EXPLOSION & BURN HAZARD,
33	1	970174511	PLACARD, ENGLISH, NOTICE, DIESEL FUEL ONLY,
34	1	970176387	PLACARD, ENGLISH, NOTICE, GASOLINE ONLY,
35	1	970174543	DECAL, ENGLISH, NOTICE, READ AND UNDERSTAND, OPERATION MANUAL
36	1	970193930	DECAL, ENGLISH, CALL CENTER PHONE NUMBER, LAMINATED DECAL
40	1	970116658	PLACARD, DANGER, PANIC BAR, ENTANGLEMENT HAZARD,
41	2	970121130	PLACARD, ENGLISH, WARNING, PANIC BAR TEST,
42	1	970292576	PLACARD, ENGLISH, DANGER, ENTANGLEMENT HAZARD, PANIC BAR PUSH TO STOP,
45	1	970137595	PLACARD, ENGLISH, BLADE MAINTENANCE, INSTRUCTIONS,
46	1	970174494	PLACARD, ENGLISH, DANGER, SEVER AND ENTANGLEMENT, HAZARD,
47	1	970137218	PLACARD, ENGLISH, WARNING, FEED ROLLER BOTTOM COVER
50	2	970413439	PLACARD, ENGLISH, DISCHARGE CHUTE, DRM 12,
51	2	067000454	PLACARD, N/A, INFORMATION, ALTEC LARGE KISS CUT, VINYL, REPLACED 670-00356
52	1	970116666	PLACARD, ENGLISH, WEBSITE, FEED TABLE,
53	1	970116644	PLACARD, ENGLISH, OPERATION, FEED CONTROL HANDLE
54	1	970122659	PLACARD, ENGLISH, WARNING, ENGINE, DO NOT REMOVE THIS TAG, ALTEC LABLE,
70	1	970345498	PLACARD, STAMPED;METAL, ENGLISH, INFORMATION, S/N DECAL, ANODIZED ALUMINUM
71	4	970121395	RIVET, ALUMINUM, AB8-4A RIVET, .06-.25 IN L, .25 IN DIA

ASSEMBLY, ELECTRO-HYDRAULIC CONTROLS, DRM 12

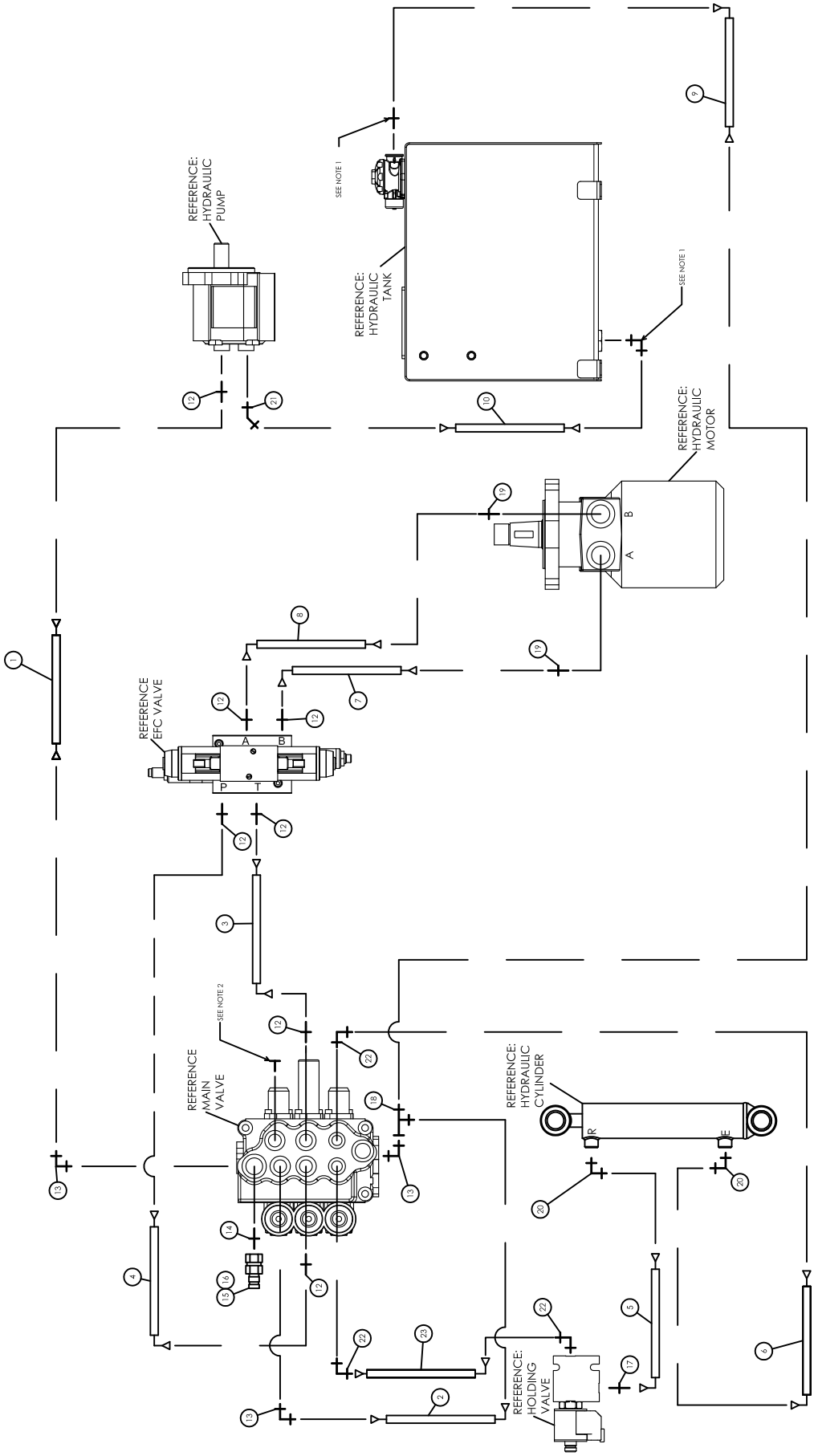


NOTES:
1. FITTINGS SUPPLIED WITH RESERVOIR
2. FITTINGS SUPPLIED WITH VALVE
3. ITEM 11 (HYDRAULIC OIL), ITEM 26 (LOCK WASHER) P/N 970377342 AND ITEM 27 (JAM NUT) P/N 970116593 ARE NOT SHOWN.

ASSEMBLY, ELECTRO-HYDRAULIC CONTROLS, DRM 12



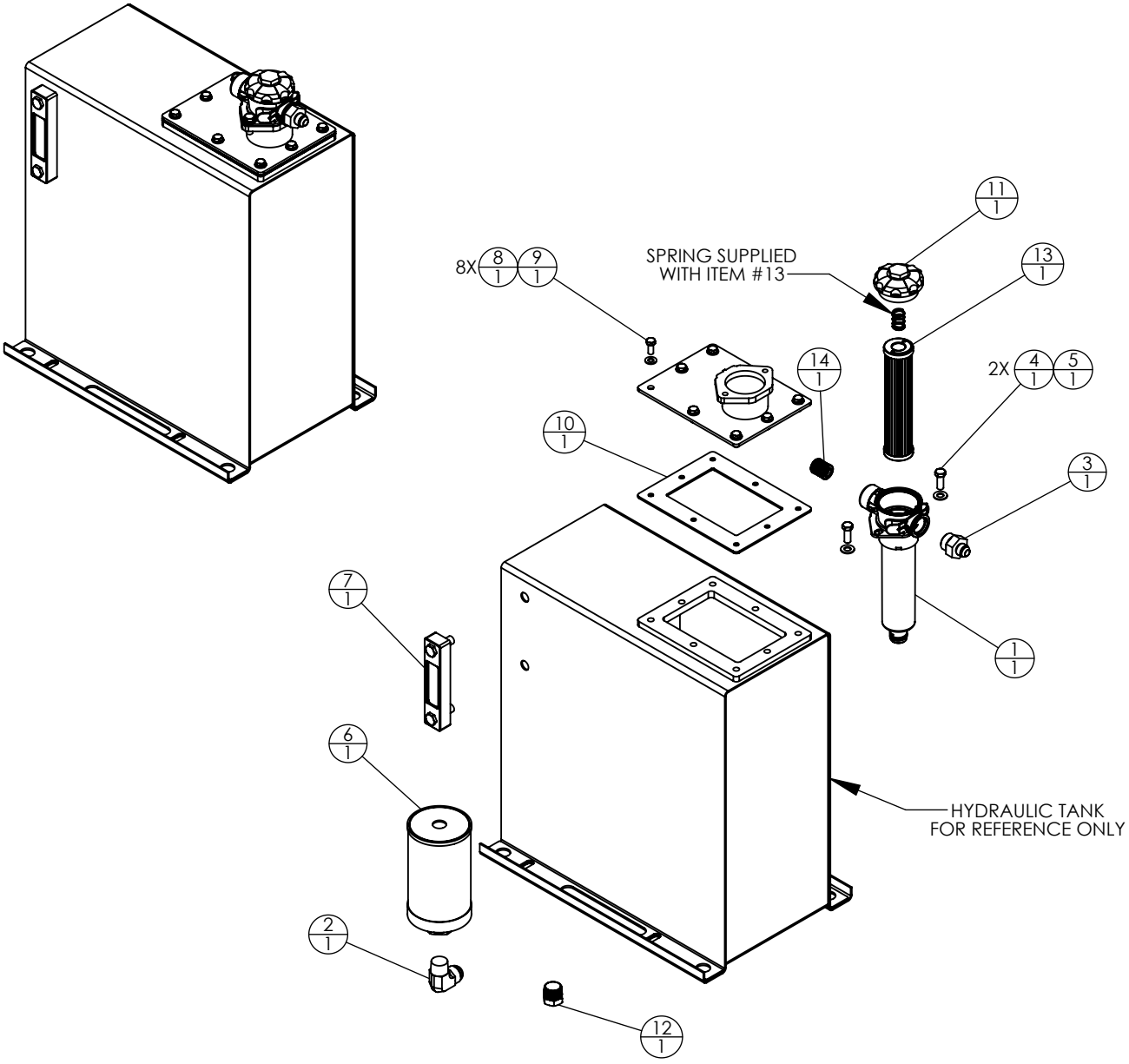
ASSEMBLY, ELECTRO-HYDRAULIC CONTROLS, DRM 12



ASSEMBLY, ELECTRO-HYDRAULIC CONTROLS DRM 12

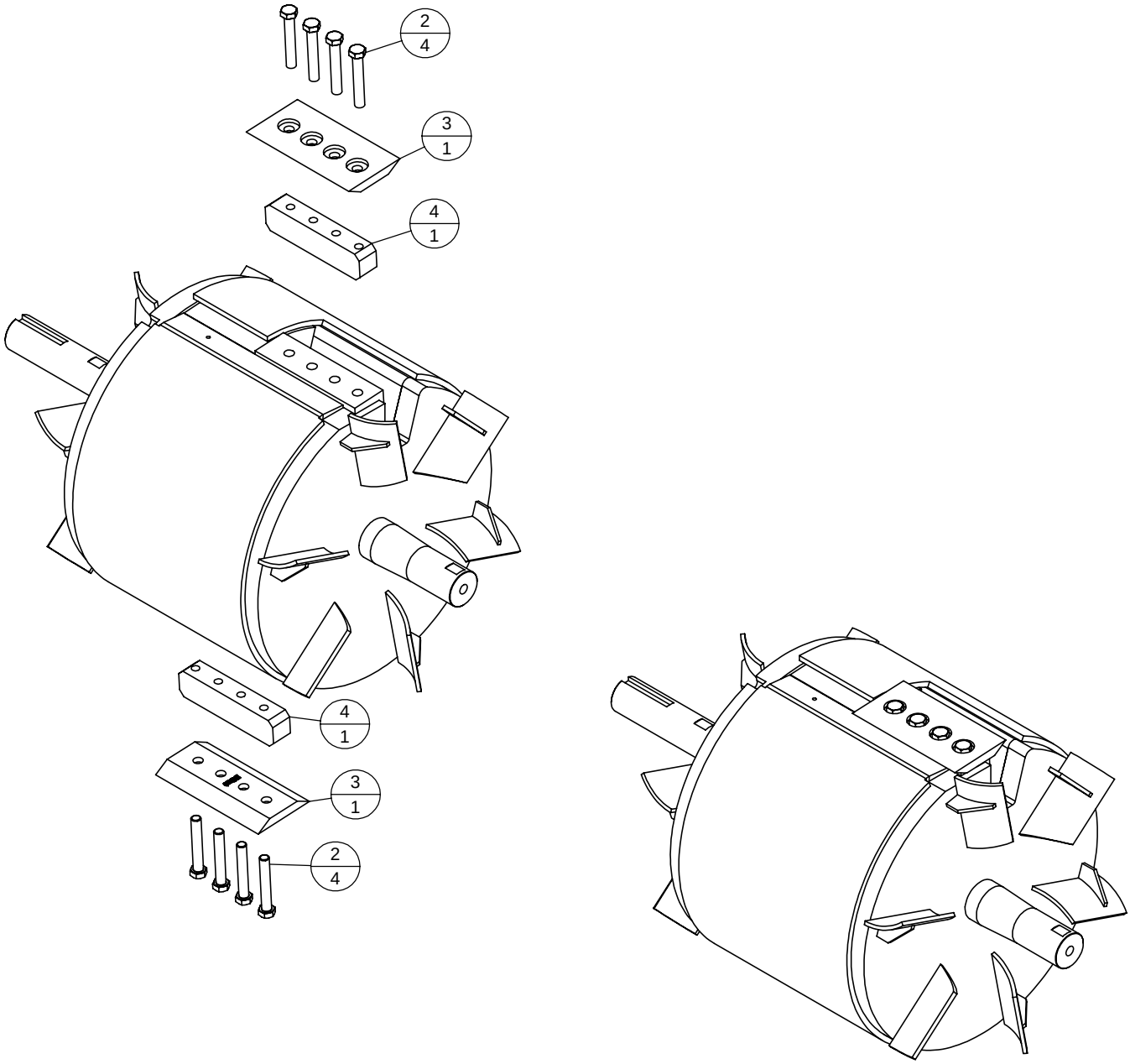
ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970413410	ASSEMBLY, ELECTRO-HYDRAULIC CONTROLS, HYDRAULIC FEED ROLLER LIFT, DRM 12
1	1	970413411	HOSE ASSEMBLY, .50 IN ID, 135.00 IN L, 100R17, 1-8, 1-8, 132.26 CL,
2	1	970413412	HOSE ASSEMBLY, .38 IN ID, 12.00 IN L, 100R17, 1-8, 4-8, 9.05 CL,
3	1	970413413	HOSE ASSEMBLY, .38 IN ID, 19.00 IN L, 100R17, 1-8, 4-8, 16.05 CL,
4	1	970413414	HOSE ASSEMBLY, .38 IN ID, 21.57 IN L, 100R17, 1-8, 4-8, 19.05 CL,
5	1	970413415	HOSE ASSEMBLY, .38 IN ID, 50.02 IN L, 100R17, 1-8, 4-8, 47.50 CL,
6	1	970413416	HOSE ASSEMBLY, .38 IN ID, 56.00 IN L, 100R17, 1-8, 4-8, 53.48 CL,
7	1	970413417	HOSE ASSEMBLY, .38 IN ID, 47.00 IN L, 100R17, 1-8, 4-8, 44.05 CL,
8	1	970413418	HOSE ASSEMBLY, .38 IN ID, 44.5 IN L, 100R17, 1-8, 4-8, 42.00 IN CL,
9	1	970413419	HOSE ASSEMBLY, .50 IN ID, 95.00 IN L, 100R17, 1-4, 4-8, 92.27 IN CL,
10	1	970188877	HOSE ASSEMBLY, .75 IN ID, 62.06 IN L, 100R4, 1-12, 1-12, 59.00 IN L,
11	12 GAL	970149432	HYDRAULIC OIL, AW ISO 46,
12	7	027400060	ADAPTER, STRAIGHT, -8 SAE, -8 JIC
13	3	027420058	ADAPTER, 90 DEG ELBOW, -8 SAE, -8 JIC
14	1	027400059	ADAPTER, STRAIGHT, -8 SAE, -6 JIC
15	1	035620155	QUICK DISCONNECT, NIPPLE, 0.13 MALE BODY, -6 JIC FEMALE, DIAGNOSTIC
16	1	035620102	DUST CAP, DIAGNOSTIC QUICK DISCONNECT, FITS .13 IN DIA MALE BODY,
17	1	027400056	ADAPTER, STRAIGHT, -6 SAE, -8 JIC
18	1	027434203	ADAPTER, TEE, -8 JIC, -8 JIC FEMALE SWIVEL, -8 JIC
19	2	027400064	ADAPTER, STRAIGHT, -10 SAE, -8 JIC
20	2	879020010	ADAPTER, 90 DEG, ELBOW, -8 JIC, -6 NPTF
21	1	027410057	ADAPTER, 45 DEG ELBOW, -12 JIC, -12 SAE
22	3	027400065	ADAPTER, STRAIGHT, -10 SAE, -10 JIC
23	1	970413442	HOSE ASSEMBLY, .38 IN ID, 26.52 IN L, 100R17, 1-8, 4-8, 24.00 IN CL,
24	1	970115785	SENSOR, MAGNETIC PICKUP, .75-16 UNF, 1.79 IN LONG THREADS,
25	1	970413428	ELECTRICAL HARNESS, ELECTRONIC FEED CONTROL, DRM 12, DELPHI 100W 24 PIN, 18 GA,
26	1	970377342	WASHER, STEEL, BELLEVILLE, .78" ID, 1.19" OD, SERRATED LOCK, BLACK-FINISH
27	1	970116593	NUT, STEEL, HEX JAM, .75-16 UNF,

HYDRAULIC TANK ASSEMBLY



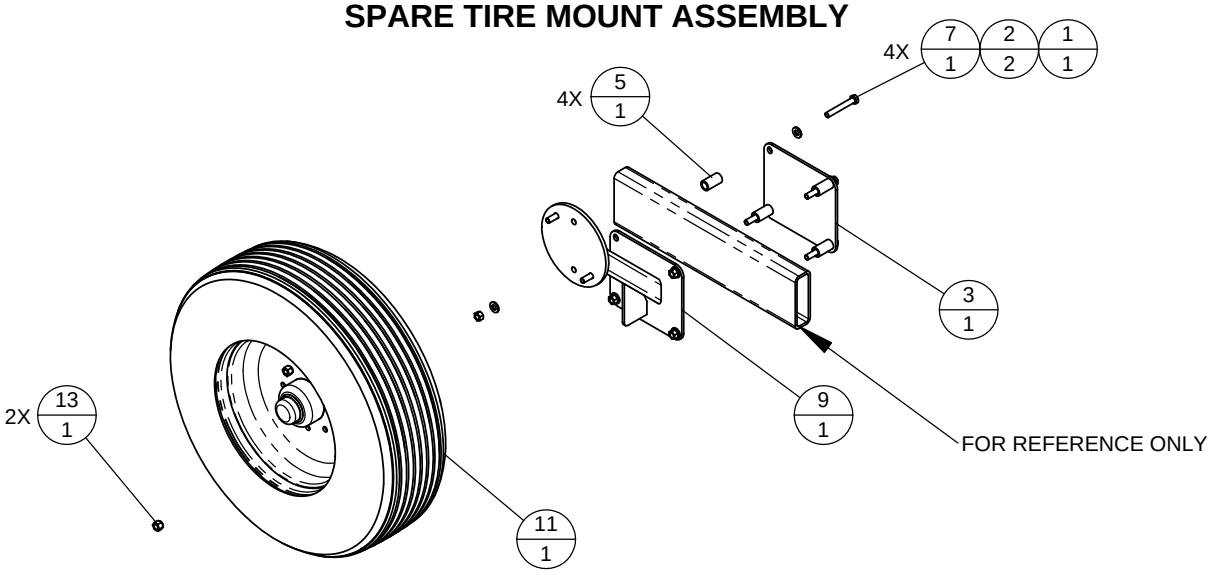
ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970162760	RESERVOIR, HYDRAULIC, STEEL, 12 GAL, DC1317, HP, CFD1217
		970156811	RESERVOIR, HYDRAULIC, STEEL, 8 GAL, DC912A
1	1	970151738	HYDRAULIC RETURN FILTER, HOUSING, TANK MOUNTED
2	1	027423070	ADAPTER, 90, .75 NPT MALE, -12 JIC MALE
3	1	027400068	ADAPTER, STRAIGHT, -12 SAE, -8 JIC
4	2	020041206	CAPSCREW, STEEL, HEX HEAD, .38-16 UNC, 1.00 IN L, GR 8, PLATED/PLATED,
5	2	020401207	WASHER, STEEL, FLAT, .375 IN DIA, SAE THRU-HARD HIGH STRENGTH, PLATED 18,
6	1	970181647	SUCTION FILTER, HYDRAULIC, STEEL, 15 GPM, 90 MICRON, 1.25 NPT FEMALE,
7	1	970431502	SIGHT GAUGE OIL LEVEL / TEMP, HYDRAULIC OIL, STEEL GUARD, UV RATED
8	8	020401102	WASHER, STEEL, FLAT TYPE A NARROW, .31 IN DIA, MTS 16 18
9	8	020031104	CAPSCREW, STEEL, HEX HEAD, .31-18 UNC, .75 IN L, GR 5, MTS 16 18
10	1	970199018	GASKET, RUBBER, HYDRAULIC TANK, CLEAN OUT COVER,
11	1	970179289	COVER, HYDRAULIC, PLASTIC, IKRON,
12	1	970116564	ADAPTER, PLUG, .50 NPTF, BRASS
13	1	970179294	FILTER AND SPRING, HYDRAULIC, IKRON,
14	1	970179296	BREATHER ELEMENT, HYDRAULIC, IKRON,

20 IN DIA DRUM ASSEMBLY

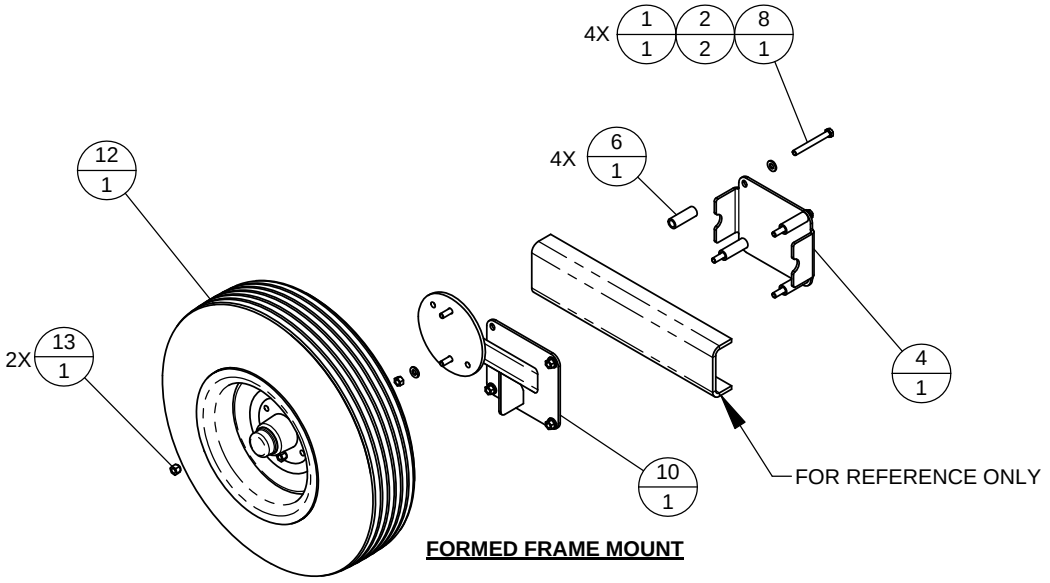


ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970181850	DRUM CONTROL FED,DUAL FIN,20 IN,ASSEMBLY
1	1	970181825	DRUM, 20.00 IN, TWO BLADE, DUAL FAN BLADES,
2	8	970116577	CAPSCREW, STEEL, HEX HEAD, .63-11 UNC, 4.00 IN L, BOMALLOY, OIL COATED, WITH
3	2	970108987	BLADE, DRUM, 9 IN, CONTROL FED
4	2	970109216	BAR, BLADE MOUNTING, DRUM, 20 IN,

SPARE TIRE MOUNT ASSEMBLY



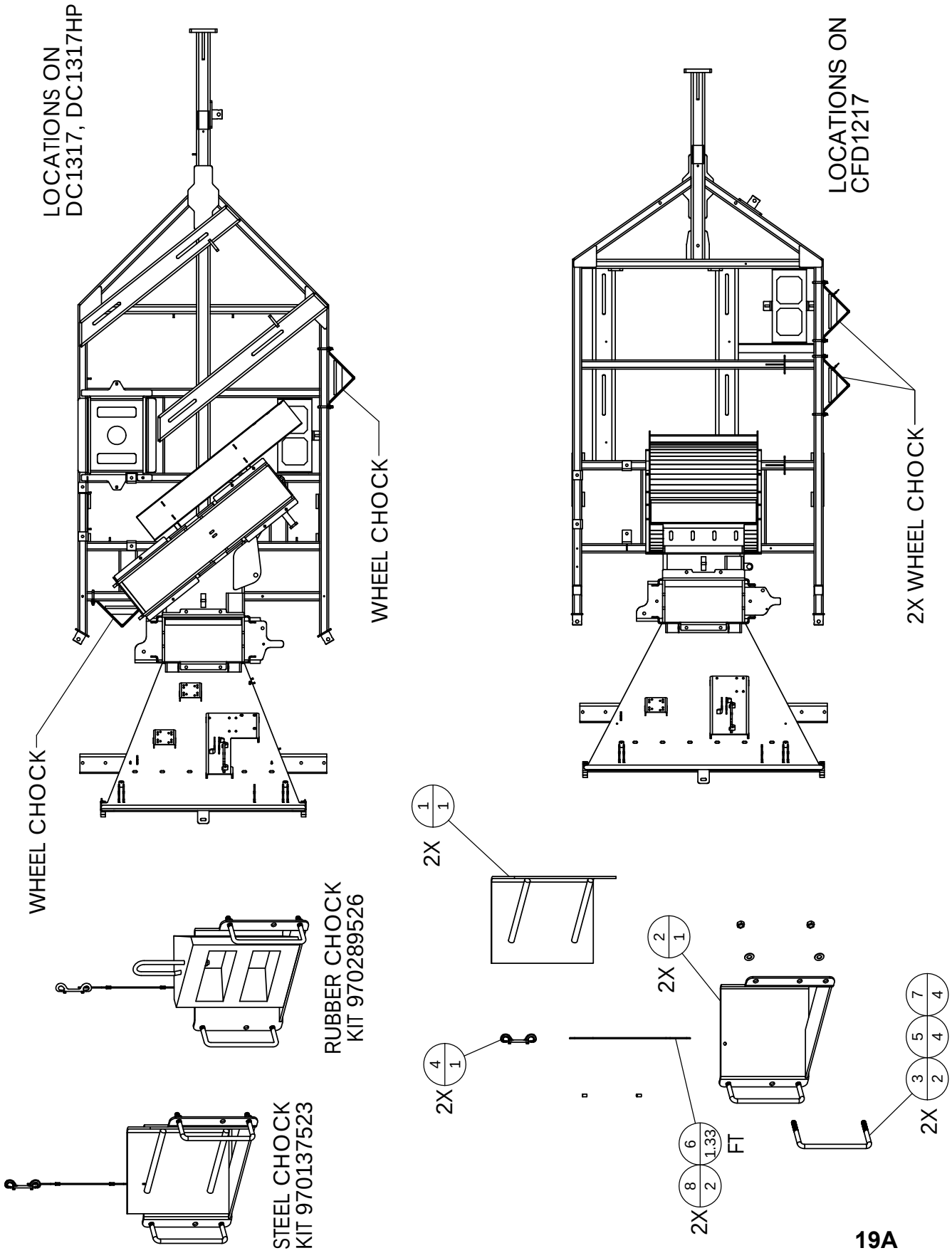
TUBE FRAME MOUNT



FORMED FRAME MOUNT

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970220097	KIT,SPARE TIRE & RIM,BOLT-ON,DC1317/DC1317HP/CFD1217
		970208781	KIT,SPARE TIRE & RIM,BOLT-ON,DC912A/WC126A/WC166A
1	4	020391404	NUT, STEEL, TOP LOCK, .50-13 UNC, GR C, PLATED,
2	8	020401405	WASHER, STEEL, FLAT, .50 IN DIA, THRU HARD HIGH STRENGTH, PLATED
3	1	970208490	PLATE,MOUNTING,SUPPORT,SPARE TIRE
4	1	970220108	BACKING PLATE, SPARE TIRE HOLDER, DC-912A
5	4	970208789	SPACER, TUBE,SPARE TIRE MOUNT, 1.844IN L, DC-1317,CFD-1217
6	4	970220121	SPACER, TUBE, SPARE TIRE MOUNT, 2.84 IN L, DC-912A,
7	4	020041416	CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 3.50 IN L, GR 8, MTS 16,18
8	4	201437210	CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 4.50 IN L, GR 8, PLATED,
9	1	970220221	MOUNT, SPARE TIRE, BOLT-ON,8 LUG 6.50 IN B.C., DC-1317,CFD-1217
10	1	970208494	MOUNT, SPARE TIRE, BOLT-ON, 6 LUG 5.50 IN B.C., DC-912A, WC-126A
11	1	970181371	KIT, SPARE TIRE AND RIM, SHIPPED LOOSE, 245/75 R16,8 LUG
12	1	970181373	KIT, SPARE TIRE AND RIM, SHIPPED LOOSE, 225/75 R15, 6 LUG,
13	4	970130501	NUT,STEEL, 60 DEGREE TAPERED LUG,.50-20 UNF,MTS 16, 18

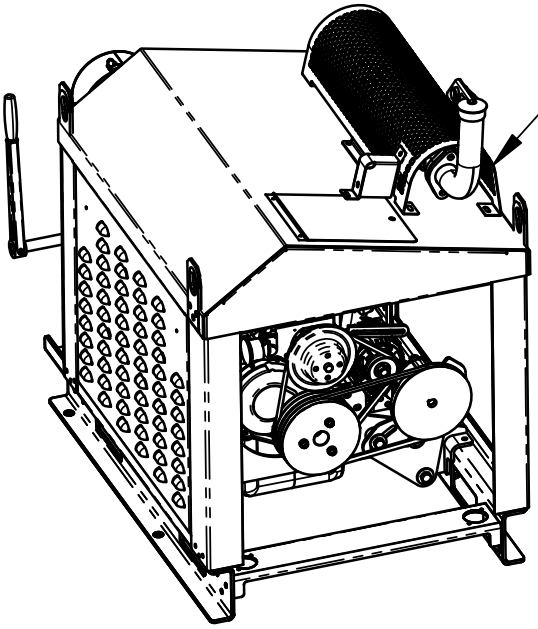
WHEEL CHOCKS WITH BOLT ON CHOCK HOLDERS, DC1317/DC1317HP/CFD1217



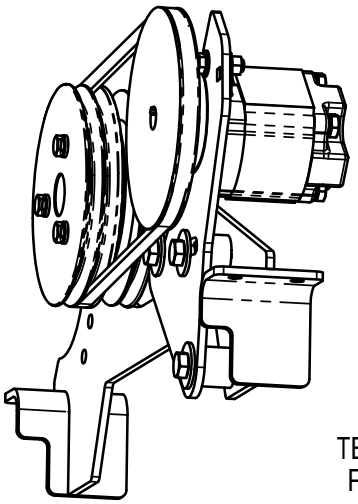
WHEEL CHOCKS WITH BOLT ON CHOCK HOLDERS, DC1317/DC1317HP/CFD1217

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970137523	KIT;WHEEL CHOCKS & HOLDERS;PAIR;BOLT-ON;STEEL CHOCKS;CFD1217, DC1317,
		970289526	KIT;WHEEL CHOCKS & HOLDERS;PAIR;BOLT-ON;RUBBER CHOCKS;CFD1217, DC1317,
1	2	870200968	CHOCK, WHEEL, 020-0968-42 (STEEL CHOCK)
		066001017	WHEEL CHOCK;RUBBER;ALTEC LOGO;METAL HAIRPIN HANDLE
2	2	970137507	HOLDER, WHEEL CHOCK,
3	4	970162554	U BOLT, STEEL, SQUARE BEND, 2.88 IN L, .38-16, 6.00 IN W, 1.25 IN THREAD LENGTH
4	2	970078439	SPRING SNAP, .375 IN DIA, SNAP ON BOTH ENDS, 4 IN LONG,
5	8	020401207	WASHER, STEEL, FLAT, .38 IN DIA, SAE THRU-HARD HIGH STRENGTH, PLATED 18,
6	3 FT	970147698	CABLE, AIRCRAFT, .09 IN DIA, ATTACHMENT CABLE,
7	8	020391225	NUT, STEEL, TOP LOCK, .38-16 UNC, GR C, PLATED,
8	4	970122491	FERRULE, ALUMINUM, CABLE TWIN EYE, .094 IN DIA,

KIT, HYDRAULIC PUMP DRIVE, 3.0L GM GASOLINE ENGINE



ENGINE PACKAGE SHOWN FOR REFERENCE ONLY

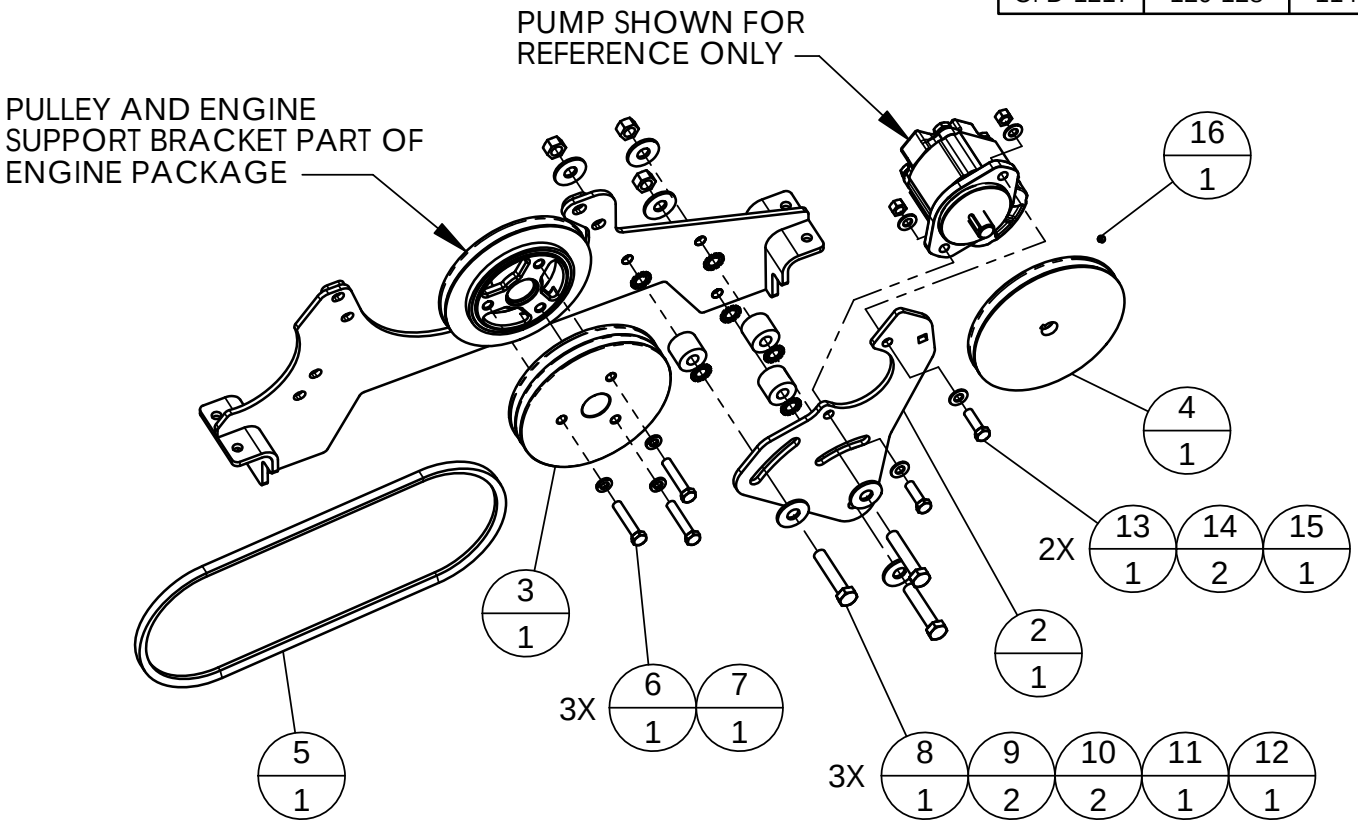


ASSEMBLED AUXILIARY PUMP BELT DRIVE

ENGIENE SHOWN WITH SIDE PANEL, RADIATOR, AND GUARD HIDDEN TO REVEAL AUX DRIVE

TENSION BELT TO THE FOLLOWING SPECS:

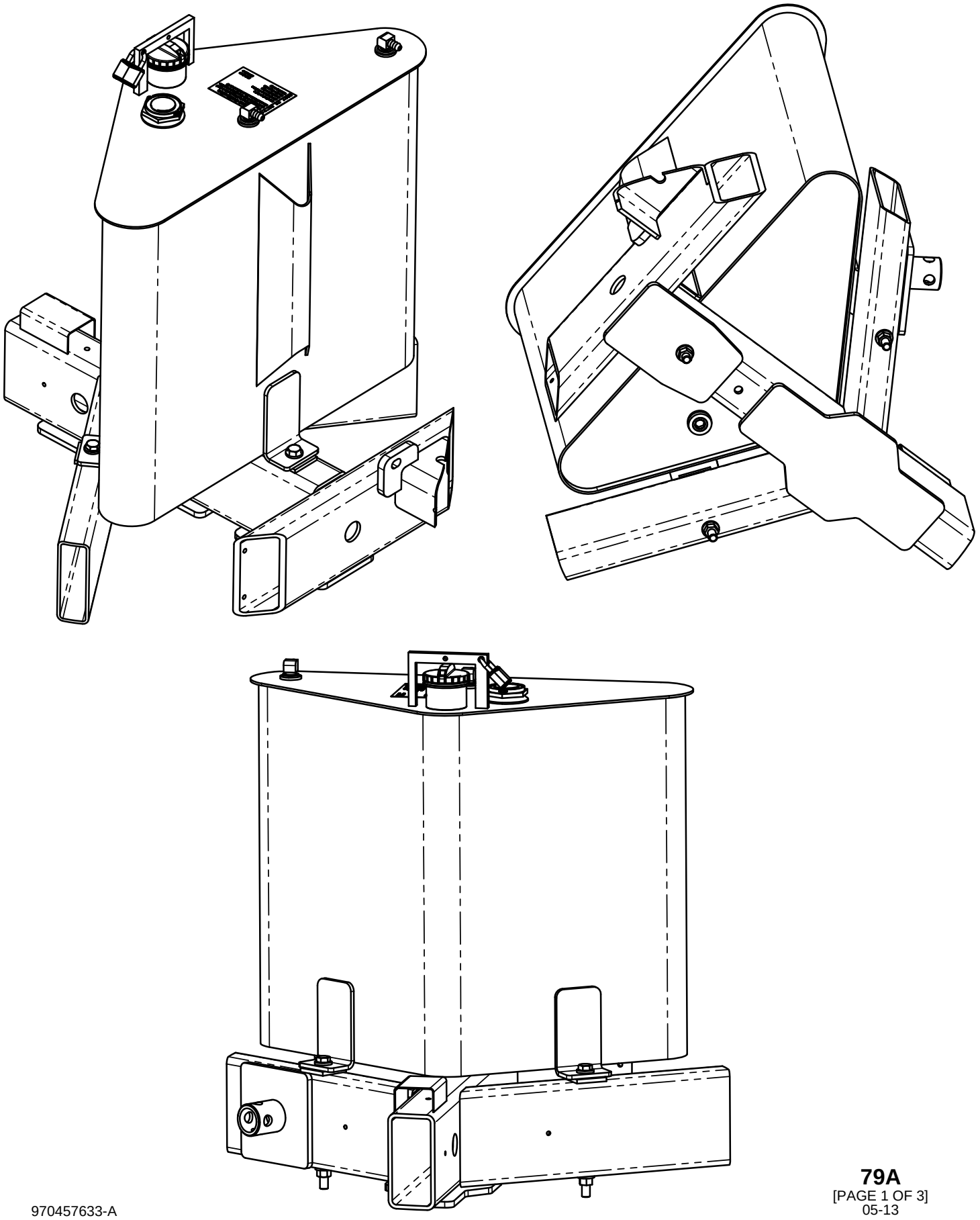
UNIT MODEL	NEW BELT FREQ(HZ)	USED BELT FREQ(HZ)
DC-1317	128-136	120-126
DRM-12	100-108	94-100
CFD-1217	120-128	114-120



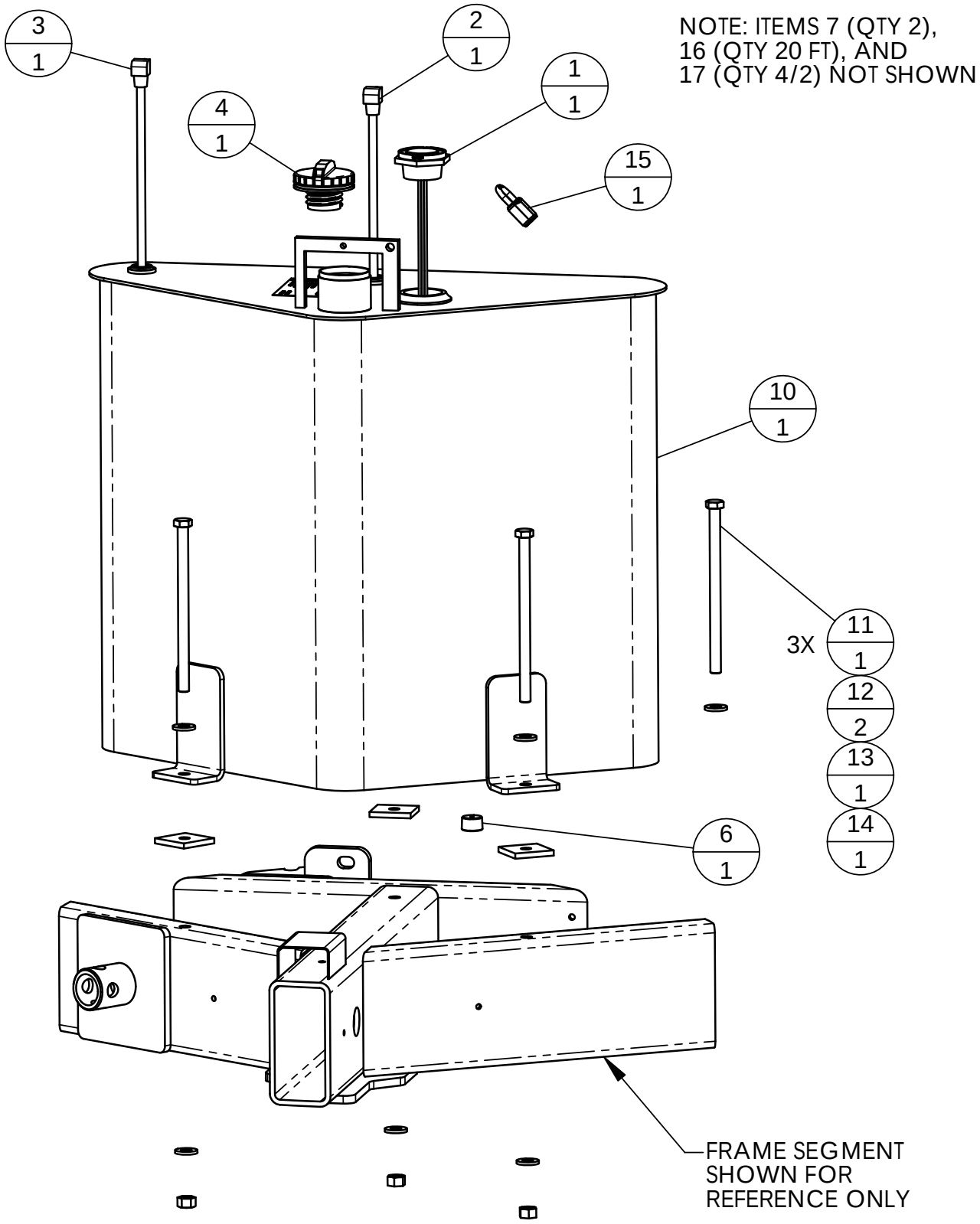
KIT, HYDRAULIC PUMP DRIVE, 3.0L GM GASOLINE ENGINE

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970387567	KIT, AUXILIARY BELT DRIVE, HYDRAULIC PUMP, 3.0L GM GASOLINE ENGINE, DC1317,
2	1	970434186	BRACKET, SAE "A" PUMP MOUNT, 3.0L GM ENGINE, PAINTED, W/ TENSIONING SOCKET
3	1	970434187	SHEAVE, CUSTOM, 1.27 DIA BORE, 2 GROOVE, 6.94 IN DIA, KEYLESS, BOLT ON
4	1	970434188	SHEAVE, CUSTOM, .75 IN DIA BORE, SINGLE GROOVE, 6.95 IN DIA, .19 X .13 KEYWAY, .75 IN
5	1	970435136	BELT, V WEDGED, RUBBER, SINGLE GROOVE, 42.58 IN CIR, 7420
6	3	020031210	CAPSCREW, STEEL, HEX HEAD, .38-16 UNC, 2.00 IN L, GR 5, PLATED,
7	3	020411201	WASHER, STEEL, LOCK SPLIT TYPE, .375 IN DIA, PLATED,
8	3	020031412	CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 2.50 IN L, GR 5, PLATED,
9	6	020401401	WASHER, STEEL, USS FLAT, .562 IN ID / 1.375 IN OD, PLATED 18, YELLOW ZINC
10	6	020421401	WASHER, STEEL, EXTERNAL TOOTH LOCK, .50 IN DIA, PLATED,
11	3	970434184	SPACER TUBE, HYDRAULIC PUMP MOUNT, 3.0L GM ENGINE, PAINTED, 1.04 IN L, 1.00 IN DIA
12	3	020391404	NUT, HEX, SELF-LOCKING, STEEL, OVALATED, .50-13 UNC, GR C, PLATED,
13	2	020031207	CAPSCREW, STEEL, HEX HEAD, .38-16 UNC, 1.25 IN L, GR 5, PLATED,
14	4	020401202	WASHER, STEEL, SAE FLAT TYPE A NARROW, .38 IN DIA, PLATED 18,
15	2	020391211	NUT, STEEL, HEX, OVALATED, .38-16 UNC, GR 8,
16	1	020131001	SET SCREW, STEEL, CUP POINT HEX SOCKET, .25-20 UNC, .25 IN L,

ASSEMBLY, FUEL SYSTEM, DRM12 & CFD1217



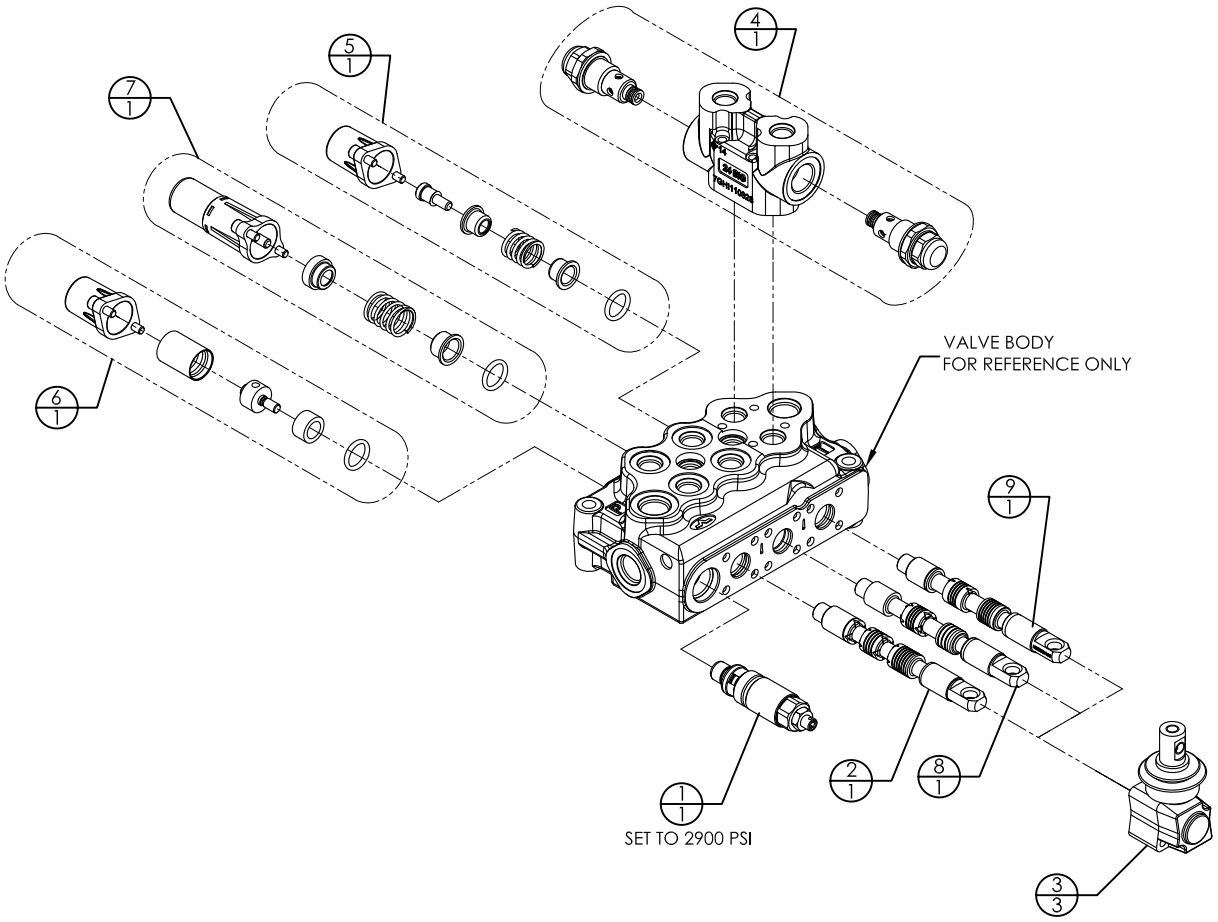
ASSEMBLY, FUEL SYSTEM, DRM12 & CFD1217



ASSEMBLY, FUEL SYSTEM, DRM12 & CFD1217

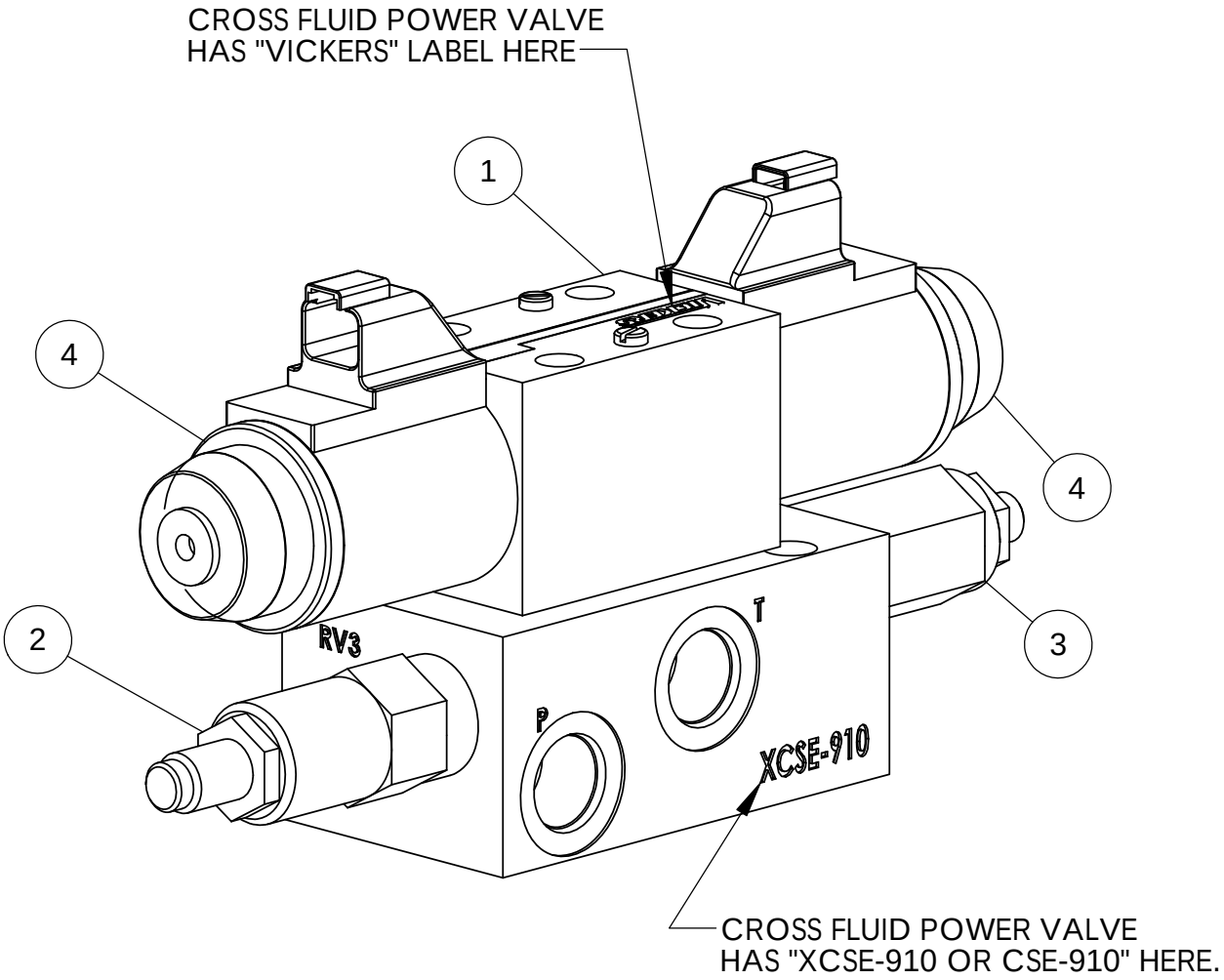
ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970159564	TANK, DIESEL, STEEL, 18.0 GAL, TRIANGULAR, ASSEMBLED **(DT)**
		970393300	TANK, GASOLINE, STEEL, 18.0 GAL, TRIANGULAR, ASSEMBLED **(GT)**
		970457661	ASSEMBLY, FUEL SYSTEM, DIESEL, DRM12 **(DFS)**
		970403940	ASSEMBLY, FUEL SYSTEM, GASOLINE, DRM12 & CFD1217 **(GFS)**
1	1	970233442	FUEL GUAGE, DIESEL/GASOLINE, PLASTIC, 22.00 ON L,
2	1	970233443	PICKUP TUBE, FUEL, STEEL/PLASTIC, 970159564/970393300, 22.0 IN L,
3	1	970122097	**(DT)** ADAPTER, 90 DEG, .38 NPTF, .31 HOSE BARB,
	1	970233443	**(GT)** PICKUP TUBE, FUEL, STEEL/PLASTIC, 970159564/970393300, 22.0 IN L,
4	1	970233286	**(DT)** FILLER CAP, DIESEL FUEL, STEEL, IFH GROUP VERSION, SMOOTH TOP, COPRENE
	1	970175437	**(GT)** FILLER CAP, FUEL, PLASTIC, GASOLINE, NON/LOCKING,
6	1	027524005	ADAPTER, SOCKET HEAD PLUG, .75 NPT
7	2	970457528	**(GT)** HOSE ASSEMBLY, 96 IN., 30R12, FUEL, GASOLINE,
10	1	970159564	**(DFS)** TANK, DIESEL, STEEL, 18.0 GAL, TRIANGULAR, ASSEMBLED
	1	970393300	**(GFS)** TANK, GASOLINE, STEEL, 18.0 GAL, TRIANGULAR, ASSEMBLED
11	3	020031426	CAPSCREW, STEEL, HEX HEAD, .50-13 UNC, 8.00 IN L, GR 5, PLATED,
12	6	020401405	WASHER, STEEL, FLAT, .50 IN DIA, THRU HARD HIGH STRENGTH, PLATED
13	3	970122462	RUBBER, .250 IN T, 2.00 IN W, 2.00 IN L, RUBBER SHOCK ISO TANKS, 60 DUROMETER
14	3	020391404	NUT, HEX, SELF-LOCKING, STEEL, OVALATED, .50-13 UNC, GR C, PLATED,
15	1	970116628	PADLOCK, KEYED, .25 IN DIA SHACKLE, 1.50 IN W, .81 IN X .81 IN CLEARANCE, KEY 5401,
16	20 FT	970175472	**(DFS)** HOSE, FUEL, 0.562 OD, 0.3125 ID, CUT TO LENGTH,
17	4	970179959	**(DFS)** CLAMP, HOSE, WORM GEAR, .31 MAX ID, .13 MIN ID, .31 IN WIDE, STAINLESS STEEL,
	2	970179959	**(GFS)** CLAMP, HOSE, WORM GEAR, .31 MAX ID, .13 MIN ID, .31 IN WIDE, STAINLESS STEEL,

3 SPOOL MANUAL MAIN CONTROL VALVE ASSEMBLY



ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970151945	HYDRAULIC VALVE, MANUAL, 3 SPOOLS, 3000 PSI, SERIES VALVE, RELIEF ON THIRD
1	1	970024635	RELIEF VALVE,MANUAL VALVE DETENTED,W/RELIEF,TOOL VALVE,1 SPOOL,3600 PSI,45
2	1	035209305	HYDRAULIC VALVE COMPONENT;SPOOL
3	3	970028823	HYDRAULIC VALVE,KIT CONTROL LEVER BOX,MANUAL,1 SPOOL
4	1	970215234	HYDRAULIC VALVE,RELIEF,DUAL CROSSOVER,WALVOIL
5	1	970078486	KIT, SPRING CENTERING KIT,
		970254407	END CAP ONLY FOR SPRING CENTERING AND TWO POSITION KITS
6	1	970175043	HYDRAULIC VALVE COMPONENT,TWO POSITION DETENT KIT
		970254407	END CAP ONLY FOR SPRING CENTERING AND TWO POSITION KITS
7	1	970229323	HYDRAULIC VALVE COMPONENT,HEAVY DETENT KIT
		970288697	END CAP ONLY FOR HEAVY DETENT KIT
		035209475	O RING FOR ALL SPRING AND DETENT KITS
8	1	035209385	2/SD5 SPOOL
9	1	970229331	HYDRAULIC VALVE COMPONENT,LOW FLOW,SPOOL
		970255117	SCREW

ELECTRO HYDRAULIC VALVE, FEED CONTROL, DC610

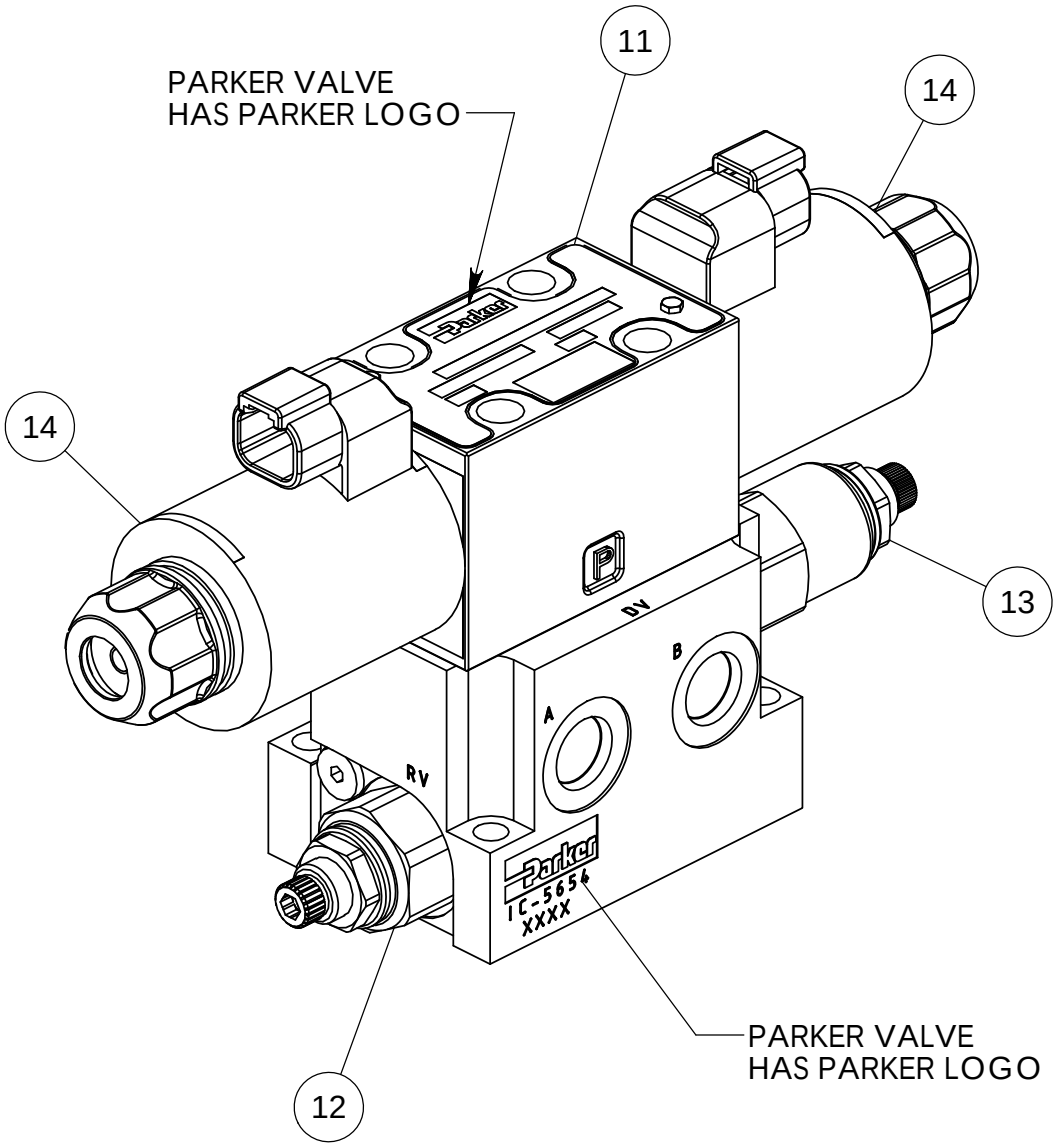


NOTE: YOU MUST IDENTIFY MANUFACTURER,
CROSS FLUID POWER (THIS PAGE) OR PARKER (PAGE 2)

FOR VALVES MANUFACTURED BY CROSS FLUID POWER

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970256923	HYDRAULIC VALVE, ELECTRO HYDRAULIC, MANIFOLD, 3000 PSI, WITH SYSTEM RELIEF
1	1	970301077	HYDRAULIC VALVE, ELECTRO HYDRAULIC, D03, 1 SPOOL, 5000 PSI, 10 GPM
2	1	970301078	HYDRAULIC VALVE, RELIEF, CARTRIDGE ONLY, 3000, 10 GPM
3	1	970301079	HYDRAULIC VALVE, CROSS OVER RELIEF, CARTRIDGE ONLY, 2750 PSI, 10 GPM
4	2	970301080	HYDRAULIC VALVE COMPONENT, 12 V SOLENOID, WITH DEUTSCH CONNECTOR, COIL ONLY

ELECTRO HYDRAULIC VALVE, FEED CONTROL, DC610



NOTE: YOU MUST IDENTIFY MANUFACTURER
PARKER (THIS PAGE) OR CROSS FLUID POWER (PAGE 1)

FOR VALVES MANUFACTURED BY PARKER

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
		970256923	HYDRAULIC VALVE, ELECTRO HYDRAULIC, MANIFOLD, 3000 PSI, WITH SYSTEM RELIEF
11	1	970301037	HYDRAULIC VALVE, ELECTRO HYDRAULIC, D03, 1, 5000 PSI, 10 GPM
12	1	970052996	HYDRAYLIC VALVE COMPONENT, -10 P.O. RELIEF VALVE
13	1	970301038	HYDRAULIC VALVE, CROSS OVER RELIEF, CARTRIDGE ONLY, 2750 PSI, 10 GPM
14	2	970212771	KIT, SOLENOID COIL, SILVER METAL CAN, INTEGRATED DEUTSCH CONNECTOR