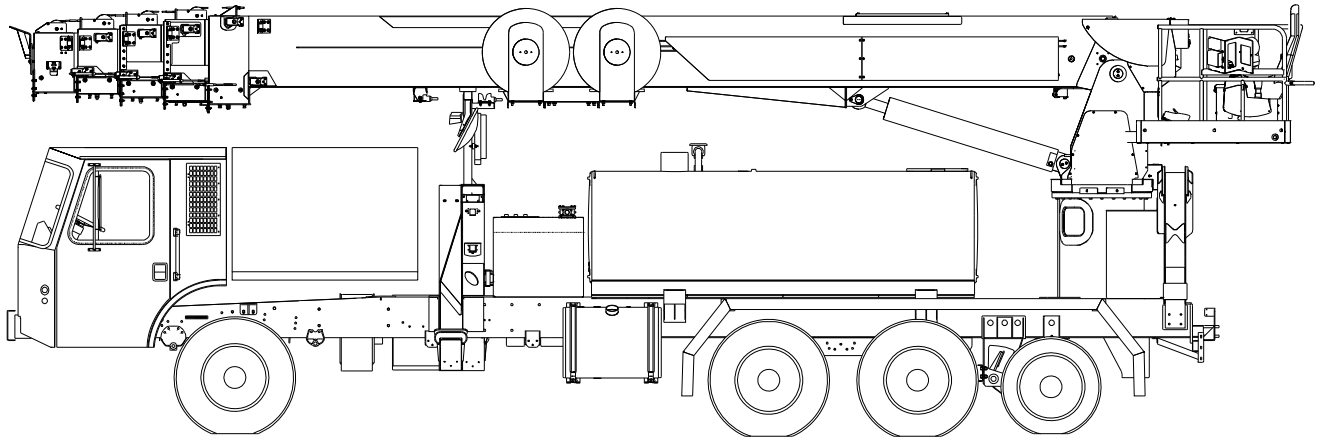




HW145



Operator's Manual

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

749-30109
August 2007

Copyright © 2007 by Altec Industries, Inc.

All rights reserved. No part of this publication may be used or reproduced by any means, or stored in a database or retrieval system, without prior written permission of the publisher. Making copies of any part of this publication for any purpose other than personal use is a violation of United States copyright laws.



Altec Industries, Inc.
210 Inverness Center Drive
Birmingham, Alabama 35242
www.Atec.com

MODEL SERIAL NO.

MAXIMUM REACH FT

MAXIMUM HYDRAULIC SYSTEM PRESSURE SETTING PSI

OPERATION AND INSTRUCTIONS

DANGER - ELECTROCUTION HAZARD THIS MACHINE IS NOT INSULATED

MAINTAIN SAFE CLEARANCES FROM ELECTRICAL POWER LINES AND APPARATUS.

THIS UNIT DOES NOT PROVIDE PROTECTION FROM CONTACT WITH OR PROXIMITY TO AN ELECTRICALLY CHARGED CONDUCTOR.

DEATH OR SERIOUS INJURY WILL RESULT FROM SUCH CONTACT OR INADEQUATE CLEARANCE.

THE OPERATOR OF THIS MACHINE MUST BE FAMILIAR WITH AND UNDERSTAND THE SAFETY INFORMATION IN THE MANUAL AND ON THE PLACARDS BEFORE OPERATING IT.

IF YOU DO NOT HAVE A MANUAL OR, IF PLACARDS ARE MISSING/UNREADABLE, PLEASE CALL 1-877-462-5832 FOR ASSISTANCE.

1. SET PARKING BRAKE AND PUT WHEEL CHOCKS IN PLACE.
2. CHECK UNIT FOR LOOSE OBJECTS, HYDRAULIC LEAKS, OR PHYSICAL DAMAGE.
3. START ENGINE AND ENGAGE POWER TAKE-OFF.
4. PROPERLY EXTEND ALL OUTRIGGERS AND CLOSE OUTRIGGER LOCKING VALVES. (IF SO EQUIPPED)
5. THIS UNIT MUST BE OPERATED WHEN LEVEL ON A FIRM SURFACE. USE OUTRIGGER PADS IF NECESSARY.
6. RAISE BOOMS SUFFICIENTLY TO CLEAR ALL OBSTRUCTIONS BEFORE ROTATING BOOMS.
7. OPERATE CONTROLS SLOWLY FOR SMOOTH MOVEMENTS.
8. INSPECT AND SERVICE UNIT PER INSTRUCTIONS GIVEN IN MANUAL.

WARNING

KEEP PEOPLE AWAY FROM THIS VEHICLE WHEN OPERATING UNIT

Preface

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 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.

Impacts to and excessive forces on the hydraulic utility equipment, through vehicular accidents, rollovers, excessive loading, and the like, may result in structural damage not obvious during a visual inspection. If the hydraulic utility equipment is subjected to such impacts or forces, a qualified person may need to perform additional testing such as acoustic emissions, magnuflux 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 a mobile 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.



Danger

Death or serious injury will result from unprotected contact with energized conductors. Non-insulating units have no dielectric rating. Maintain safe clearances, as defined by federal, state, and local authorities, and your employer, from energized conductors.

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.

Table of Contents

Section 1 — Introduction

About This Manual...	1
----------------------	---

Section 2 — Unit Specifications

Purpose of the Unit	3
General Specifications	3
Component Identification	4
Reach Diagram	5

Section 3 — Safety

Safety Instructions	7
General Operating Information	7
Capacity	7
Accident Prevention Signs	7
Accident Prevention Signs Diagram	8

Section 4 — Before You Operate...

Capacity and Stability	11
Operation Near Energized Conductors	11
Daily Preoperational Inspection	11
Inspection Diagram	12
Preparing for Operation	15
Cold Weather	15

Section 5 — Operation

Cab Controls	17
PTO	17
Boom Latch	17
Outriggers	17
Cold Oil/Clogged Filter	17
Beacon Lights	17
Pump Floodlight Switch	17
Side Gun Controls	17
Water Level Below Seven Inches	18
Water Level Test Switch	18
Water Level Below Five Inches	18
Water Level Above Seven Inches	18
Water Resistivity	18
Intercom	18
Lower Water System	18
Water Tank	18
Ground Level Controls	19
Side Guns	19
Resistivity Override	20
Outriggers	20
Outrigger Deployment	20
Motion Alarm	20
Setting the Outriggers	21
Outrigger Interlock System	21
Left Side Console	22
Outrigger Toggle Switches	22
Intercom	22
Engine Start	22
PTO Disengage	23

Main Console	23
Water Pump	23
Water Level	23
Water Resistivity	24
Resistivity Override	24
Boom Extents	24
Emergency Retract	24
Outrigger Light	24
Rotation Light	24
Boom Controls	24
Operator's Platform Seat	24
Interlock	25
Proportional Controls	25
Boom Lift/Turntable Rotation	25
Boom Extension	26
Boom and Water Monitor Storage	26
Boom Rest Interlock	26
Water Monitor Controls	27
 Section 6 — Emergency Operation	
Operation From Other Controls	29
Operation From Valve Box	29
Manual Operation	29
Manually Lowering/Stowing the Unit	30
Rotating the Turntable	30
Retracting the Boom	31
Lowering the Boom	31
Auxiliary Power Source	31
Manually Raising the Outriggers	32
 Section 7 — Troubleshooting	
Power Distribution Module	35
 Section 8 — Care of the Unit	
Hydraulic System	37
Structures and Mechanical Systems	37
 Appendix	
Glossary	
Troubleshooting Chart	

Section 1 — Introduction

About This Manual...

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

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

Contact the following organizations for additional information.

- American National Standards Institute (ANSI)
- 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)
- Institute of Electrical and Electronic Engineers (IEEE)

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

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

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



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

Danger

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

Warning

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

Caution

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

Notice

Indicates information considered important, but not hazard related.

Section 2 — Unit Specifications

Purpose of the Unit

The unit has been designed and built for service to the utility industry. It is intended to place a high-pressure water stream in the vicinity of the insulators on transmission and distribution towers. The high-pressure water stream is used for cleaning contaminants off the insulators, conductors, and structures.

General Specifications

This Hot Line Insulator Washer (HW145) consists of a six section telescopic boom with a multidirectional articu-

lated monitor positioned at the tip of the upper boom. The lower boom is fabricated from steel and the five upper boom sections are fabricated from aluminum.

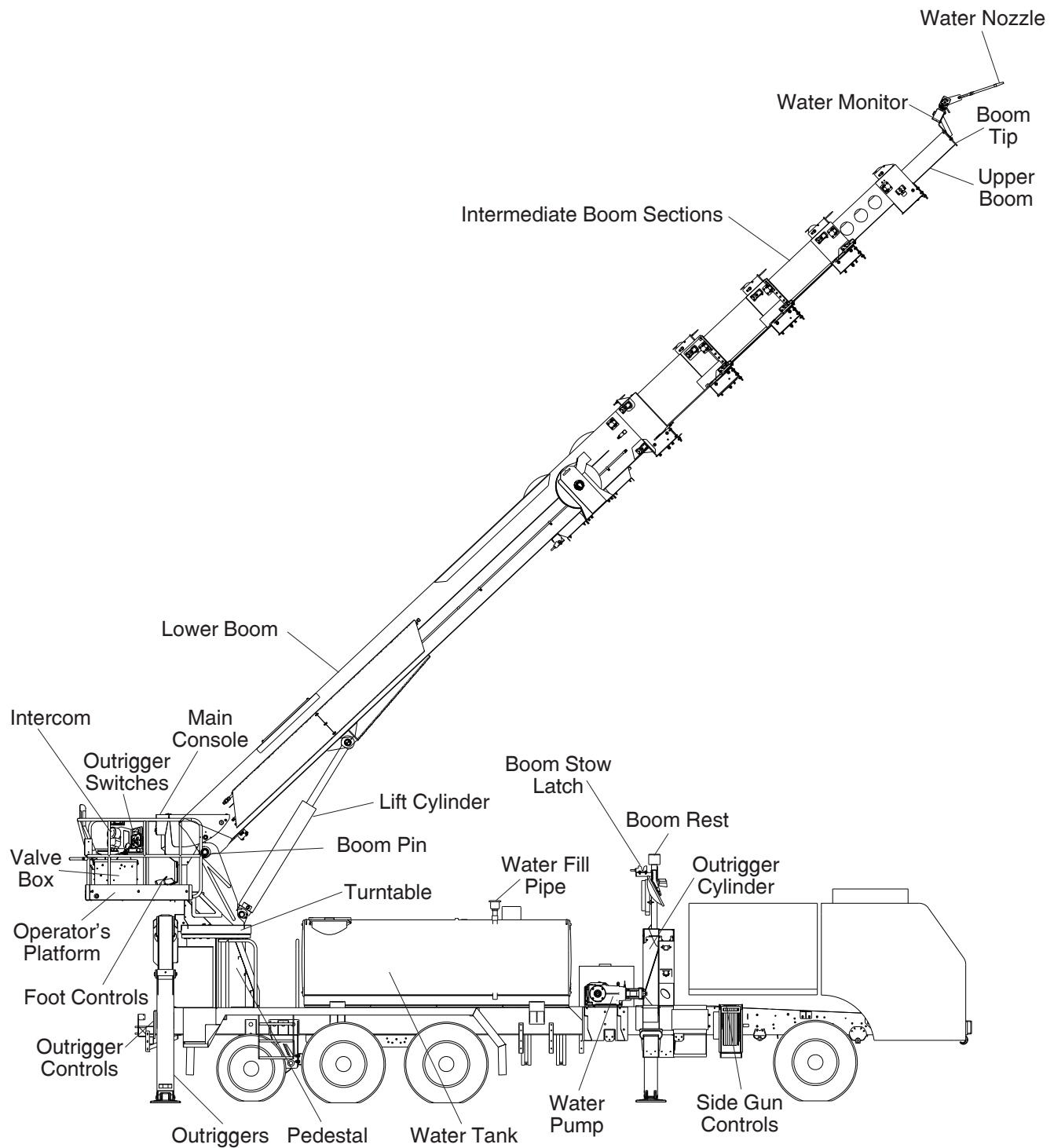
Figure 2.1 provides the general unit specifications. Unit height specifications are based on a 52-inch frame height.

The HW145 extendable boom is not an insulated device, and carries no dielectric rating. There are limits to protection that can be provided by the unit. Some of the hazards, but not all of the hazards, of operating the boom near energized conductors are presented in this manual in Section 4 under Operation Near Energized Conductors.

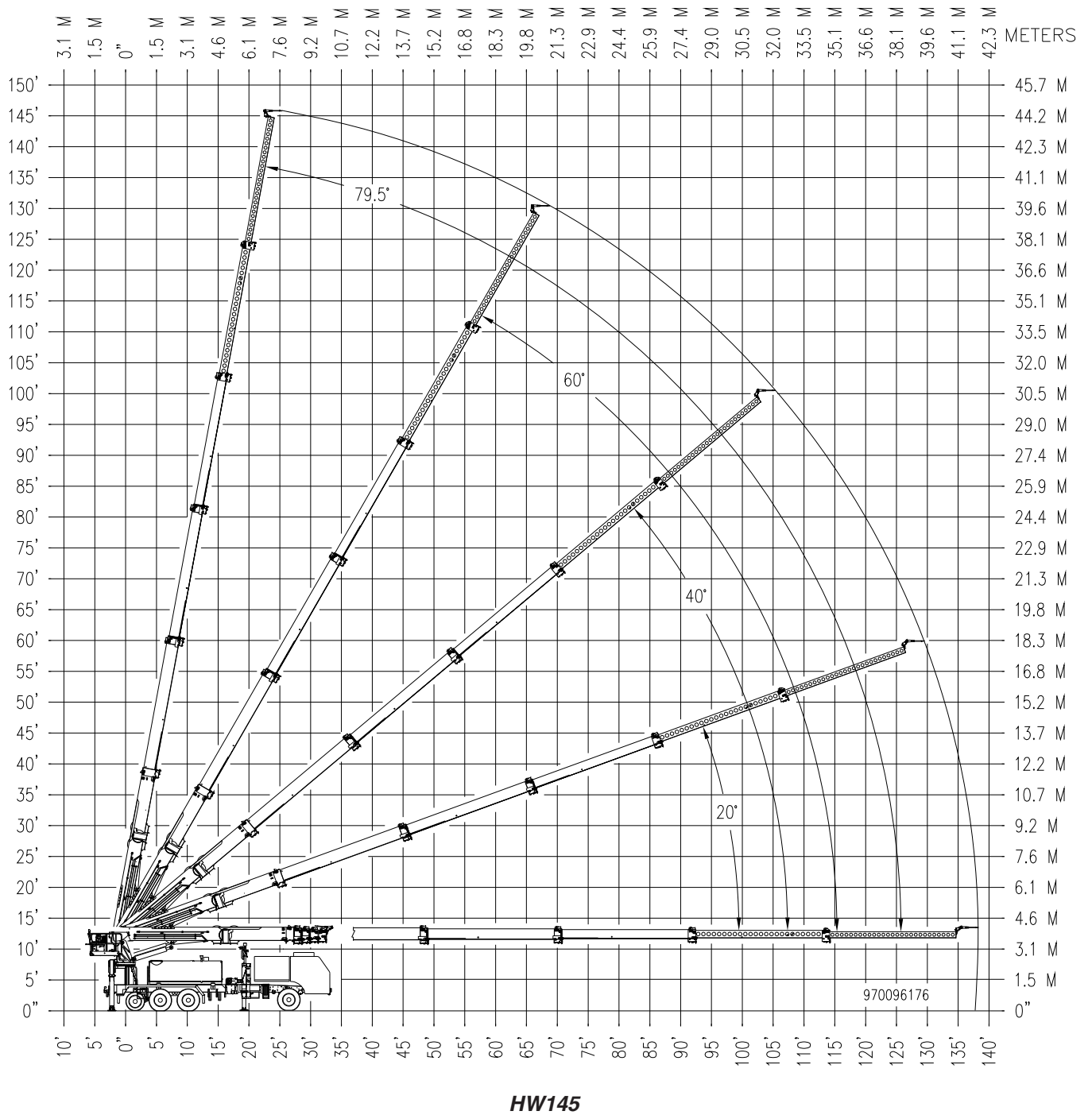
Item	Specification
Maximum ground to horizontal water nozzle	145'
Boom angle	-9° to 79.5°
Travel height	13'5"
Maximum hydraulic pressure setting	2,750 psi
Dielectric rating	None
Rotation	375°, noncontinuous
Oil reservoir capacity	80 gallon
Boom full extend/retract time	30-35 sec
Boom full up/down time - horizontal to 79.5° when boom length is less than 67.6'	30-35 sec
Boom full up/down time - horizontal to 79.5° when boom length is greater than 67.6'	60-65 sec
Turntable/platform full rotation (360°) - when boom length is less than 67.6'	90-95 sec
Turntable/platform full rotation (360°) - when boom length is greater than 67.6'	180-190 sec
Total water capacity	2,000 gallons
Maximum water pressure at boom tip	600 psi
Maximum monitor travel each direction	270°
Outrigger full extension time	12-16 sec
Outrigger full retraction time	12-16 sec

Figure 2.1 — Unit Specifications

Component Identification



Reach Diagram



Section 3 — Safety

Safety Instructions

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

It is very important that all personnel 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.



Units that are not insulated carry no dielectric rating. Death or serious injury could result from contact with energized conductors. Always maintain safe clearance, as defined by your employer, from energized conductors.

It is impossible to foresee all situations and combinations for the 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.

Users may refer to IEEE Standard 957-IEEE Guide for Cleaning Insulator Washers.

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

General Operating Information

- Do not operate the unit without proper training.

- Be aware of the surroundings.
- Perform the Daily Preoperational Inspection before operating the unit each day.
- Properly set up the unit before moving the booms from the rest.
- Operate the controls smoothly, avoiding sudden starts and stops.
- Never use this unit for lifting materials or personnel.
- Follow all of your employer's work rules and applicable government regulations.

Capacity

This unit is to be used for placing a high-pressure water stream in the vicinity of the insulators on transmission and distribution towers. The maximum reach of the unit can be found on the serial number placard located on the pedestal.

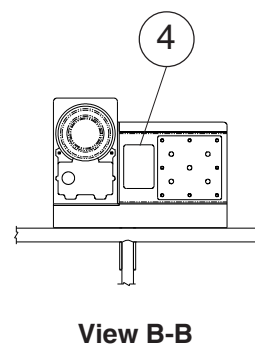
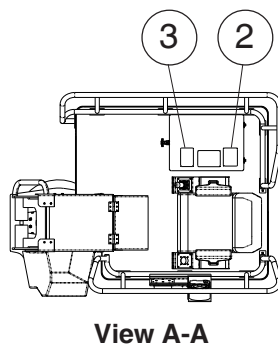
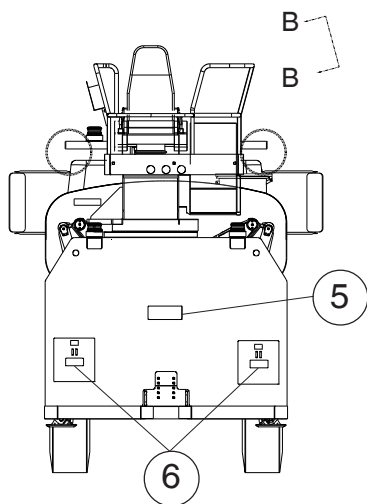
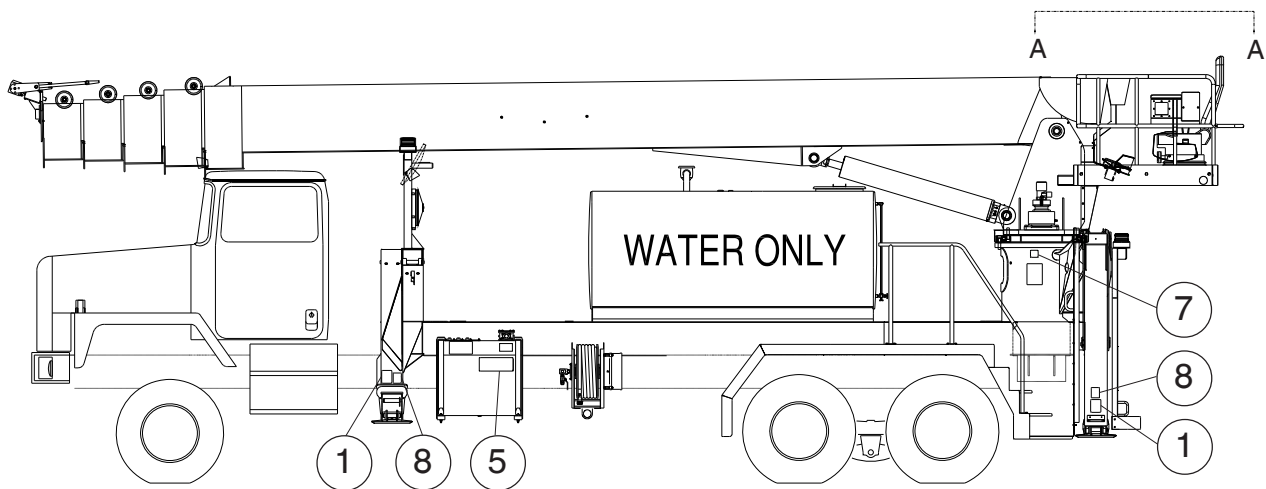
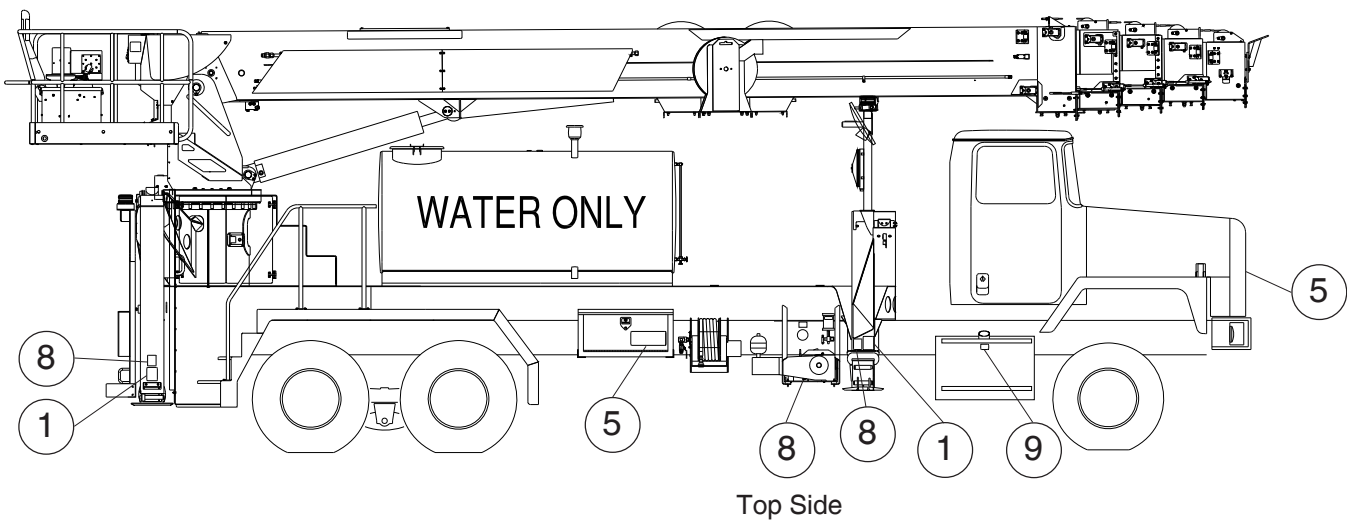
At no time should this unit be used for lifting either materials or personnel.

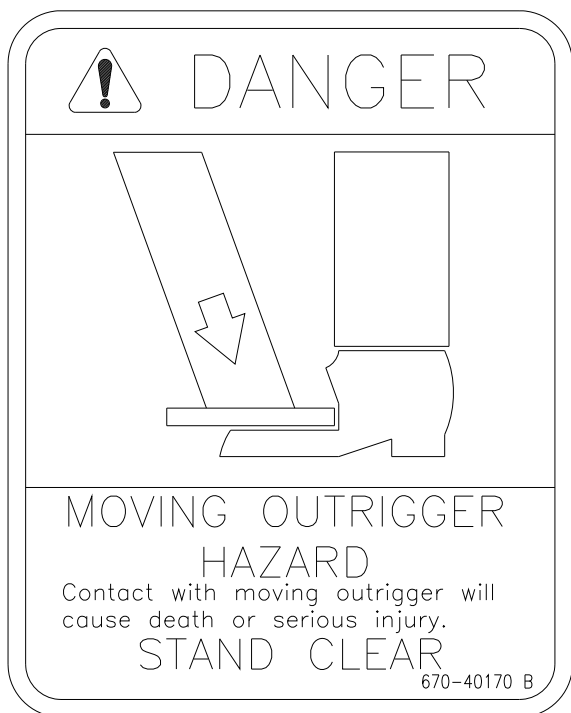
Accident Prevention Signs

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.

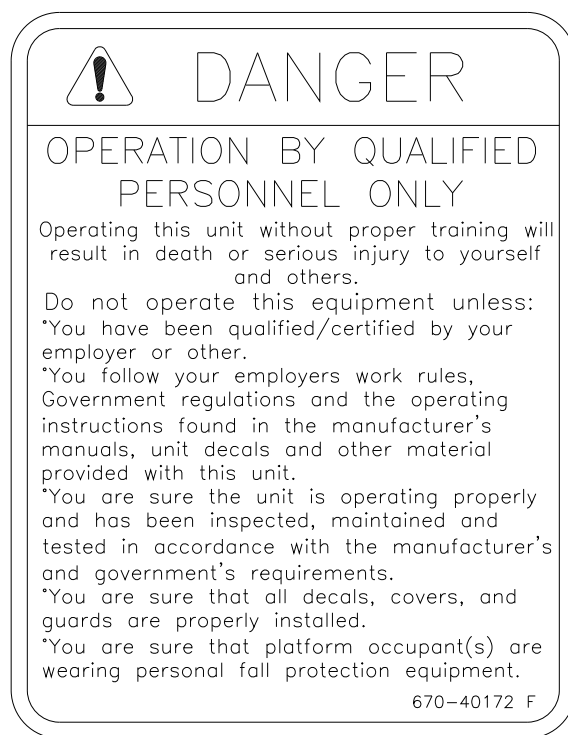
The location, part numbers, and descriptions of all placards are listed in the Parts Manual. Refer to the Accident Prevention Signs Diagram for examples of the placards and their locations.

Accident Prevention Signs Diagram

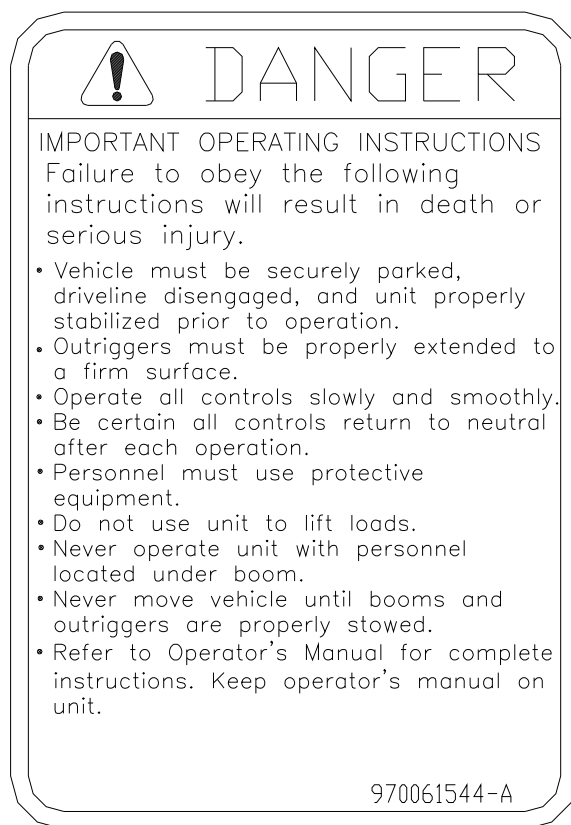




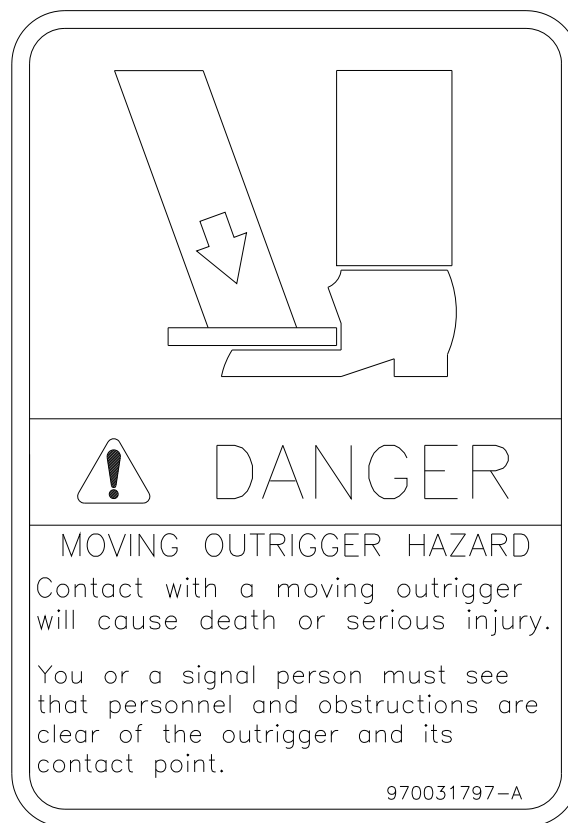
1



2



3



4

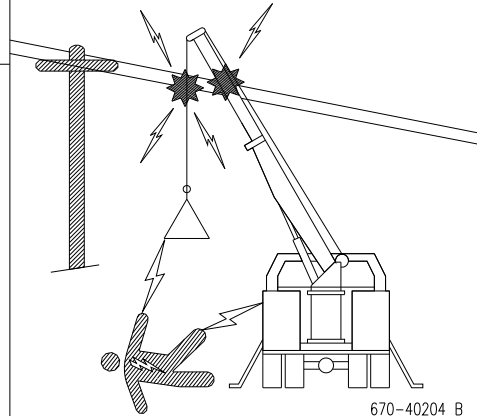


DANGER

ELECTRICAL HAZARDS

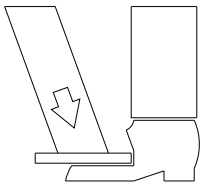
Death or serious injury will result from contact with load, unit, vehicle, or vehicle attachments if any part of the unit becomes energized. All workers must understand and follow safe electrical work practices. If any part of the unit is elevated within the minimum approach distance of an energized conductor. All unauthorized personnel must

KEEP CLEAR



670-40204 B

5

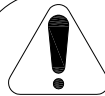


DANGER

MOVING OUTRIGGER HAZARD
Contact with a moving outrigger will cause death or serious injury. You or a signal person must see that personnel and obstructions are clear of the outrigger and its contact point.

670-40229 D

6



WARNING

FAILURE TO INSPECT AND PROPERLY TORQUE THE ROTATION BEARING MOUNTING BOLTS CAN CAUSE STRUCTURAL FAILURE. DEATH OR SERIOUS INJURY COULD RESULT.

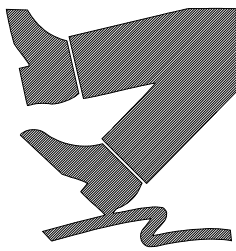
Keep capscrews properly torqued to prevent fastener fatigue.
Pre-lubricated fasteners do not require additional anti-seize lubricant.
See maintenance manual for proper installation, torquing procedure, and retorquing time intervals.

067040345 D

7



WARNING



FALL HAZARD

Death or serious injury could result from slips and falls. Do not use this area as a step.

NOT A STEP

670-01123 C

8



CAUTION

DIESEL FUEL ONLY

670-40383

9

Section 4 — Before You Operate...

All operators involved in the use and/or care of this unit must know the location and understand the operation of each control on the unit. Control locations are pointed out in Component Identification. Operation of the controls is explained in Section 5.

Capacity and Stability

Do not lift materials or personnel with this unit. Death, serious injury, and/or property damage could result.



Park on a firm surface before operating the unit. Always use parking brakes and wheel chocks. Outriggers must be extended as instructed under Outriggers.

It is impossible to foresee all situations and combinations for set up of the unit. This unit is intended to be operated when level on a firm surface. Criteria for establishing a level unit must be developed and established by the user. This criteria must be evaluated based on actual conditions, work procedures, and experience. The owner and operator bear ultimate responsibility for ensuring that the unit is properly set up.



Do not permit untrained personnel to use this equipment.

Understand the stability characteristics of this unit before using it.

NOTICE

Using the unit in an unsafe manner can cause weld fatigue and eventual failure.

Stability, or resistance to tipping, is determined by many factors including the size and weight of the chassis and the location of the unit mounting on the chassis. The unit is equipped with outriggers to help stabilize the unit while it is in use. Before operating the unit, apply the parking brake and position the wheel chocks. Properly set the outriggers as described in Section 5 under Outriggers.



Operate the controls smoothly, avoiding sudden reversals in direction or abrupt starts or stops.

Operation Near Energized Conductors



It is impossible to foresee all situations and combinations for the 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.

Units that are not insulated carry no dielectric rating. Death or serious injury could result from contact with energized conductors. Always maintain safe clearance, as defined by your employer, from energized conductors.

Only qualified operators who are fully trained and proficient should use this unit near energized conductors. All personnel using this unit must understand the hazards of contact with energized conductors, for the protection of themselves, their coworkers, and the public.

Electricity seeks earth ground by any means available. Non-insulated units not known to be in good condition must not be taken close to energized conductors. OSHA regulations prescribe minimum clearances required for such equipment.

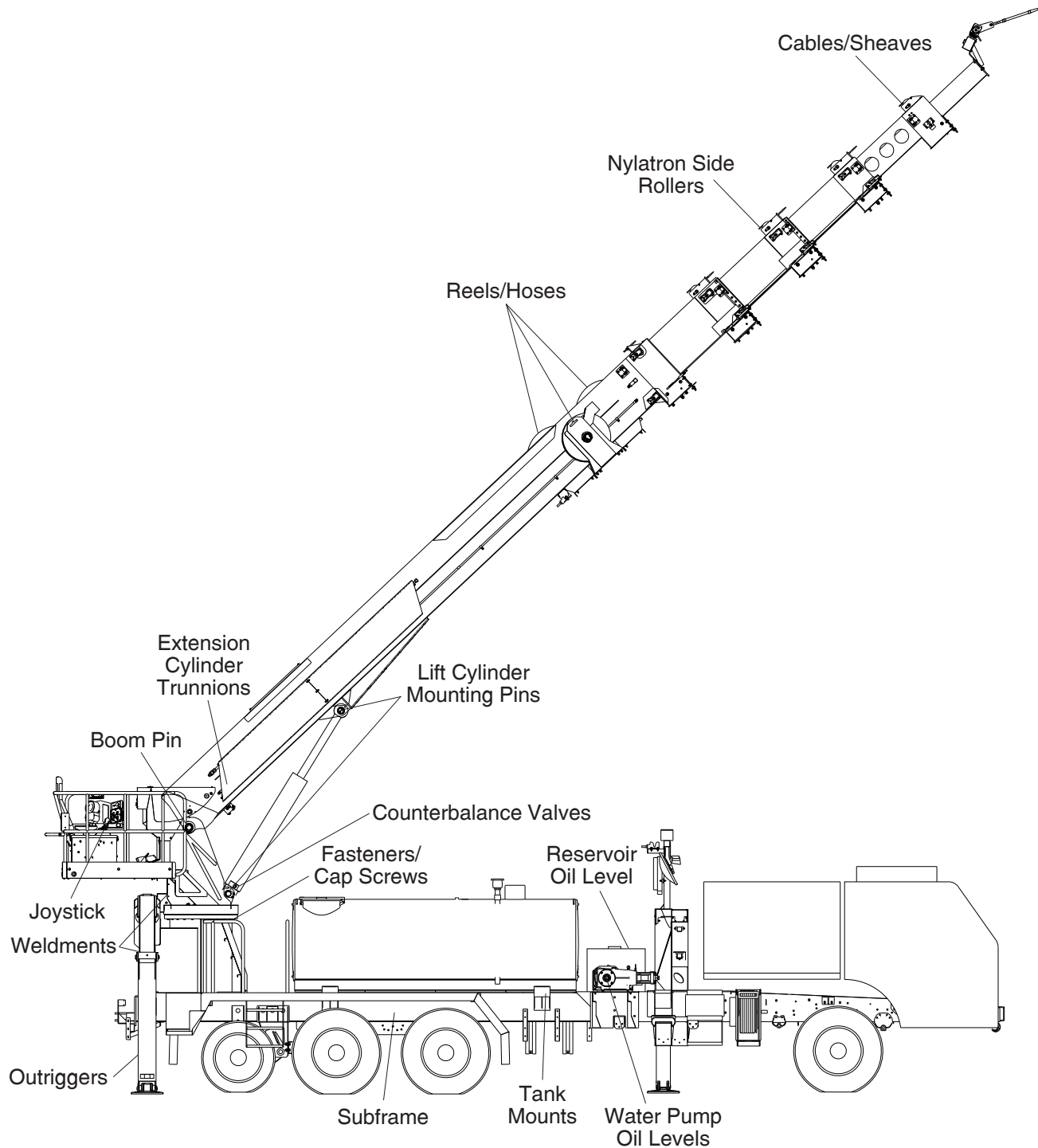
Potentially hazardous situations may endanger personnel. Personnel must be aware of and practice all regulations and safety rules of their employer and/or any state or federal law.

Daily Preoperational Inspection

Inspect the unit at the beginning of each work day before going out on the job to detect potential service and safety problems. Check the following items during the daily preoperational inspection (refer to Inspection Diagram). Components may be installed on your unit that require additional inspection. Refer to these component manuals for more information. If any problem is found, including oil leaks or improper operation, stop and have the problem corrected before placing the unit in service.

1. Position the unit on a level surface. With the boom and outriggers stowed check the oil level in the hydraulic reservoir. The oil level must be within the acceptable range shown on the sight gauge. If necessary, add oil of the proper type as described in the Maintenance Manual. The need to add oil on a regular basis indicates a leak in the hydraulic system that should be corrected.

Inspection Diagram



This diagram is for representational purposes only.
The operator bears ultimate responsibility for properly inspecting all components.



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 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

Use care to avoid slipping and/or falling when getting on or off the unit or when entering or exiting the operator's platform.

2. Visually inspect the unit for hydraulic leaks. Continue to look for hydraulic leaks while performing the inspection.
3. Throughout the inspection, pay particular attention to the following components, looking for proper operation and any damage, cracks or corrosion, missing or loose fasteners, cracked or broken inspection marks, and excessive wear.
 - Boom pin
 - Boom cylinder mounting pins
 - Extension cylinder trunnions
 - Monitor mounting cap screws
 - Rotation bearing
 - Rotation gearbox
 - Outrigger anchor pins
 - Outrigger swivel pad pins
 - Water tank mounts
 - Water pump mounts
4. Inspect all covers to make sure they are in place, secure, and in good condition.
5. Check visual and audible safety devices for proper operation. Replace any missing and/or illegible placards.
6. Throughout the inspection, while the cylinders are extended to put a load on the cylinder and the controls are in neutral, watch for any movement. If movement occurs, a cylinder or its holding valve may not be functioning properly. If any problem is found, stop and have the problem corrected before placing the unit in service.

7. Apply the parking brake, chock the wheels, start the engine, and engage the PTO.

When the PTO is engaged and the outriggers are deployed, the front brakes are engaged.

NOTICE

Do not run the hydraulic pumps at normal operating speeds until the hydraulic oil reservoir feels warm to the touch.

8. Properly set all four outriggers using the manual control handles that are accessible above the rear bumper. Make sure the outriggers operate properly. Check for oil leakage from the outrigger cylinders. If any problem is found, have it corrected before using the unit on the job.
9. Properly set the outriggers using the controls from the operator's platform. If the outriggers do not operate properly, or an oil leak is found, have it corrected before further operation.



CAUTION

The interlock trigger is to be fully engaged before the boom function joystick handle is moved in any direction. Moving the joystick handle before engaging the interlock trigger may produce sudden and rough movement of the boom. Releasing the interlock trigger before centering the joystick handle may produce sudden and abrupt stopping of movement.

Under no circumstances, including the daily preoperational inspection, should the turntable be rotated to the side of the unit unless the outriggers are properly set on that side of the unit.

10. With the outriggers retracted, sit in the operator's seat and attempt to raise the boom from the boom rest. If boom movement occurs, the interlock system is not functioning properly. If any function does not operate properly, or an oil leak is found, have it corrected before further operation.



CAUTION

Injury and property damage can result from abrupt reversals in direction, starts, or stops. Fully engage the interlock trigger before moving the control. Center the control before releasing the trigger.

11. Properly set the two curb side outriggers using the controls from the operator's platform. The boom

should be operational only in the operating zone on the curb side with the outriggers deployed (refer to Section 5, under Outrigger Interlock System). With the boom retracted, rotate the turntable slowly until the turntable is in the center of the curb side operating zone, on the side with the outriggers properly set. Extend the boom until the red extend limit lamp goes out. To test the operating zone limits, slowly rotate the turntable until the stop is reached at each end of the operating zone. At no time should the boom be allowed to cross the center of the unit, even if the limit switch is not functioning properly. If rotation occurs outside the operating zone, the interlock system is not functioning properly. If any function does not operate properly, or an oil leak is found, have it corrected before further operation. In order to leave the operating zone and return the boom over the front of the unit to the boom rest, the boom must be fully retracted.

12. Properly set the two street side outriggers using the controls from the operator's platform. The boom should be operational only in the operating zone on the street side with the outriggers deployed (refer to Section 5, under Outrigger Interlock System). With the boom retracted, rotate the turntable slowly until the turntable is in the center of the street side operating zone, on the side with the outriggers properly set. Extend the boom until the red extend limit lamp goes out. To test the operating zone limits, slowly rotate the turntable until the stop is reached at each end of the operating zone. At no time should the boom be allowed to cross the center of the unit, even if the limit switch is not functioning properly. If rotation occurs outside the operating zone, the interlock system is not functioning properly. If any function does not operate properly, or an oil leak is found, have it corrected before further operation. In order to leave the operating zone and return the boom over the front of the unit to the boom rest, the boom must be fully retracted.
13. Properly set all four outriggers using the controls from the operator's platform. Sit in the seat and operate each function of the boom using the joystick with the trigger interlock engaged. While the unit is operating, look for oil leaks from the hydraulic lines and components. If any function does not operate properly, or an oil leak is found, have it corrected before further operation.
14. Properly set all four outriggers using the controls from the operator's platform. Sit in the seat and operate the boom function joystick without engaging the interlock trigger. If boom movement occurs, the interlock system is not functioning properly. If the interlock does not operate properly, or an oil leak is found, have it corrected before further operation.

15. Properly set all four outriggers using the controls at the operator's platform. Sit in the seat and engage the boom function joystick interlock trigger and use the foot control to operate the extend and retract boom functions. While the unit is operating, look for oil leaks from the hydraulic lines and components. If any function does not operate properly, or an oil leak is found, have it corrected before further operation.
16. Properly set all four outriggers using the controls from the operator's platform. Sit in the seat and operate the boom extend and retract functions with the foot control without engaging the interlock trigger on the joystick. If boom movement occurs, the interlock system is not functioning properly.
17. Properly set all four outriggers using the controls from the operator's platform. Operate each of the water monitor functions using the joystick. While the unit is operating, look for oil leaks from the hydraulic lines and components. If any function does not operate properly, or an oil leak is found, have it corrected before further operation.
18. Properly set all four outriggers using the controls from the operator's platform. Sit in the seat and operate the boom and monitor controls with the PTO switch pushed in the off position. If movement occurs, the PTO off control is not functioning properly.



CAUTION

The water pump that provides the pressurized water for the wash system should never be run dry. Severe damage to the pump is likely when the pump is activated without water being supplied to the pump inlet.

19. Position the unit on a level surface and check the oil level in the water pump crankcase. The oil level must be within the guides shown on the dipstick. If necessary, add oil of the proper type as described in the Maintenance Manual.
20. Check the oil level for the water pump piston oiler reservoir. The oil should be at least half full in the reservoir.
21. Activation of the water pump opens the solenoid valve and allows the oil to drip into the three water pump piston packings. The drip adjustment screws are to be adjusted to allow one drop of oil per hour to each pump cylinder.
22. The shutoff valve that is located between the water tank and the suction inlet on the water pump should be fully opened.

DANGER

This unit is intended to place a high-pressure water stream in the vicinity of the insulators on transmission and distribution towers. Criteria for qualifying the resistivity of the water that is used for operation of this unit must be developed and established by the user. This criteria must be evaluated based on actual conditions, work procedures, and experience. The owner and operator bears ultimate responsibility for ensuring that the unit is properly set up for the particular conditions encountered.

Users may refer to IEEE Standard 957-IEEE Guide for Cleaning Insulator Washers.

23. Check the water level and the resistivity of the water in the water tank.

Preparing for Operation

Before using this unit each day, perform the daily preoperational inspection. This unit may be operated in accordance with the following procedure on firm surfaces. Consider the reach of the unit and the work to be done when positioning the unit.

1. Place the transmission in neutral, apply the parking brake, and chock the wheels. Apply the supplemental holding brake, if so equipped.

WARNING

Park on a firm surface before operating the unit. Always use parking brakes and wheel chocks. Use of outriggers is mandatory as instructed under Outriggers. Use outrigger pads on all unpaved surfaces, asphalt pavement, and other soft surfaces.

It is impossible to foresee all situations and combinations for set up of the unit. This unit is intended to be operated when level on a firm surface. Criteria for establishing a level unit must be developed and established by the user. This criteria must be evaluated based on actual conditions, work procedures, and experience. The owner and operator bear ultimate responsibility for ensuring that the unit is properly set up.

2. Engage the PTO according to the manufacturer's operating instructions for the transmission and PTO provided. The hydraulic pump will begin operation as soon as the PTO is engaged.

CAUTION

Injury can result from slipping and falling. Use care and the handles and steps provided.

3. Properly set the outriggers as described in Section 5 under Outriggers.
4. While operating the unit, continuously monitor the outriggers and booms for any unintended movement that could be an indication of a malfunction. Stow the unit and remove it from service if any malfunction is suspected.

Cold Weather

The water delivery system on this unit is not designed for operation at temperatures below 32 degrees Fahrenheit.

NOTICE

The water delivery system on this unit must be drained and prepared for cold storage if the unit is going to be exposed to temperatures below 32 degrees Fahrenheit. If water is allowed to freeze in the water system, the resulting damage to the water delivery system may be severe.

For winterization of the water delivery system, refer to the Maintenance Manual.

When operating the hydraulic system in cold temperatures, refer to the Maintenance Manual for cold weather oil recommendations.

WARNING

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.

NOTICE

Do not run the hydraulic pumps at normal operating speeds until the hydraulic oil reservoir feels warm to the touch.

The engine and pump speeds should be no greater than a fast idle until the oil has warmed up. Cold, thick oil does not flow well and may cause delays in response to control handle movement, as well as cavitation and consequent pump damage.

Section 5 — Operation

This unit is equipped with outriggers to help stabilize the unit. Before operating the unit, follow the steps in Section 4 under Preparing for Operation.



WARNING

The boom must be positioned in the boom rest before raising the outriggers or moving the vehicle. Do not operate the unit while the vehicle is in motion.

Park on a firm surface before operating the unit. Always use parking brakes and wheel chocks. Outriggers must be extended as instructed under Outriggers.

It is impossible to foresee all situations and combinations for set up of the unit. This unit is intended to be operated when level on a firm surface. Criteria for establishing a level unit must be developed and established by the user. This criteria must be evaluated based on actual conditions, work procedures, and experience. The owner and operator bear ultimate responsibility for ensuring that the unit is properly set up.

Cab Controls

The cab controls are located in the vehicle cab. These controls allow the vehicle driver to control and monitor some of the unit functions. Figure 5.1 shows the cab control panel.

PTO

A green light will be illuminated on the control panel when the PTO is operating. Engaging the PTO provides power to all vehicle mounted functions except those that are noted in these details.

There are three additional PTO switches, two at the ground level with one above each hose reel, and one on the main console located on the operator's platform. The PTO cannot be engaged if any of these three PTO switches are pushed.

Boom Latch

An amber light is illuminated on the cab control panel when the boom is not stowed.

Outriggers

A red light is illuminated on the cab control panel when any of the outriggers are not retracted. All of the outrig-

gers must be in the up position before this indicator lamp will go out.

Cold Oil/Clogged Filter

In the event of a clogged hydraulic return filter, a red light is illuminated on the cab control panel. Cold thick hydraulic oil at start up can also cause this pressure-activated red light to be illuminated.

When operating the hydraulic system in cold temperatures, refer to the Maintenance Manual for cold weather oil recommendations.



WARNING

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.

NOTICE

Do not run the hydraulic pumps at normal operating speeds until the hydraulic oil reservoir feels warm to the touch.

The engine and pump speeds should be no greater than a fast idle until the oil has warmed up. Cold, thick oil does not flow well and may cause delays in response to control handle movement, as well as cavitation and consequent pump damage.

Beacon Lights

A cab control panel switch is provided to turn the front and rear beacon lights on and off. When the ignition switch is on, these beacon lights can be illuminated. An amber light is illuminated when these lights are on.

Pump Floodlight Switch

A toggle switch provides for operation of the tank/pump floodlight when the ignition switch is on. When the flood light is on a green light is illuminated on the cab control panel.

Side Gun Controls

The toggle switch on the cab control panel must be on to enable the controls for the side guns located on each side of the unit above the ground wash hose reels. When the side guns are enabled, a green light is illuminated on the cab control panel.

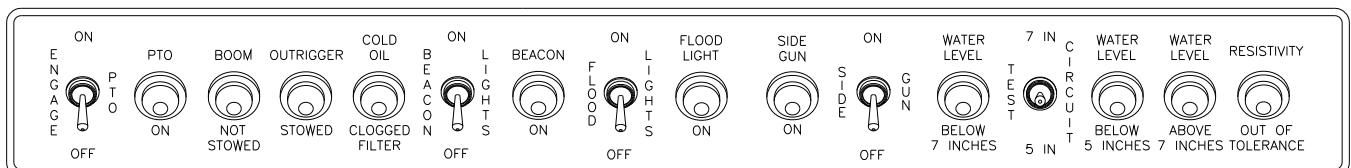


Figure 5.1 — Cab Control Panel

Water Level Below Seven Inches

Whenever the side guns are enabled or the boom water system is enabled at the operator console, and the water level falls below seven inches an amber light on the cab control panel is illuminated and an intermittent alarm on the operator's platform will sound.



CAUTION

The water pump that provides the pressurized water for the wash system should never be run dry. Severe damage to the pump is likely when the pump is activated without water being supplied to the pump inlet.

This is a warning that the water level is low and an indication that the use of the water system should be discontinued to prevent possible damage to the water pump.

Water Level Test Switch

A test switch is provided to test the electronic water level switches, the below seven inch level light, and the below five inch level light. The electronic water level switches have a 10 second delay built into their electronics to reduce false signals that could result from splashing or sloshing.

When a test is initiated, the electronic sender monitors the signal for 10 seconds and then sends a signal that illuminates the selected light on the cab controls.

To test the below seven inch light, move the toggle switch to seven inch and hold the switch in that position for approximately 15 seconds or until the water level below seven inch light is illuminated.

To test the below five inch light, move the toggle switch to five inch and hold the switch in that position for approximately 15 seconds or until the water level below five inch light is illuminated.

If either light fails to operate properly, have the problem corrected before further operation of this unit.

Water Level Below Five Inches

A red light on the cab control panel is illuminated when the water level in the tank is below five inches. When the water level goes below five inches the water pump will not operate and, in the event that the water pump is running, it will be shut down.

Water Level Above Seven Inches

A green light on the cab control panel is illuminated when the water level in the tank is above seven inches.

Water Resistivity

A red light on the cab control panel is illuminated when the resistivity of the water in the tank is below the minimum resistivity setting.



DANGER

This unit is intended to place a high-pressure water stream in the vicinity of the insulators on transmission and distribution towers. Criteria for qualifying the resistivity of the water that is used for operation of this unit must be developed and established by the user. This criteria must be evaluated based on actual conditions, work procedures, and experience. The owner and operator bears ultimate responsibility for ensuring that the unit is properly set up for the particular conditions encountered.

The minimum resistivity is set on the resistivity meter located on the operator's platform main console. When the resistivity is below the minimum setting, the hydraulic motor that powers the water pump will not operate and, in the event that it is running, it will be shut down.

Intercom

Communication from the cab of the vehicle to the operator's platform is provided using the master intercom. Power is provided to the intercom when the ignition is on. To turn on the intercom rotate the volume control clockwise and adjust the volume. An indicator light indicates that the intercom is turned on.

The intercom is normally in the listening mode and requires that the toggle switch located on the face of the intercom be toggled to speak to the operator on the platform. The intercom located on the operator's platform is a hands free intercom that allows the operator to speak and listen without operating any controls.

Lower Water System

Water delivery for the water system is provided by a high-pressure reciprocating piston pump that is driven by a hydraulic motor. A stainless steel tank provides water that is pressurized in the water pump and delivered to the water monitor through a system of hoses, valves, and hose reels.

Water Tank

The stainless steel water tank is filled through the man-hole cover located on top of the tank at the rear of the vehicle.



DANGER

This unit is intended to place a high-pressure water stream in the vicinity of the insulators on transmis-

sion and distribution towers. Criteria for qualifying the resistivity of the water that is used for operation of this unit must be developed and established by the user. This criteria must be evaluated based on actual conditions, work procedures, and experience. The owner and operator bears ultimate responsibility for ensuring that the unit is properly set up for the particular conditions encountered.

Open the manhole cover and position the fill pipe over the center of the open manhole. At ground level, after qualifying the resistivity of the water source, connect the water supply to the fill pipe connection located on the curb side of the vehicle. Open the shutoff valve located near the end of the fill connector and fill the tank with water.

NOTICE

The valve located at the base of the water level sight gage must be open for the water level sight gage to be functional.

A water level sight gage is located on the tank end near the water pump for monitoring the water level while the tank is filling. A valve located at the base of the tank must be opened for the sight gage to be operational. After use this valve should be closed to prevent water loss in the event that the sight tube is damaged.

Ground Level Controls

Side Guns

There are two ground wash hose reels with quick disconnect fittings located on each side of the vehicle. The ground level controls for these side reels are located on a control panel above the ground wash reels. Figure 5.2 shows the layout of the switches for the side guns.

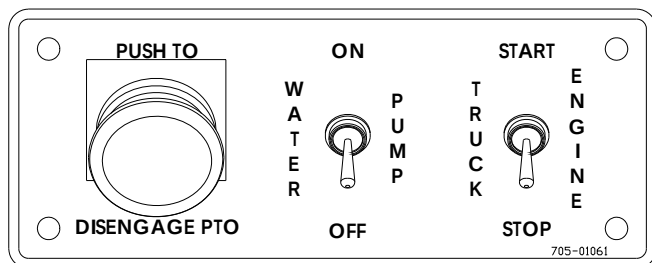


Figure 5.2 — Side Gun Controls

CAUTION

The shutoff valve that connects the water pump to the pressurized water system must be closed before connecting the side guns to the hose reel quick disconnect.

Quick disconnects are provided for connecting the side guns to the ground wash hose reels. Shut off the flow of

water to the hose reel with the shutoff valve and connect the side guns. After connecting the side guns, open the shutoff valve to supply pressure to the side guns.

WARNING

Death or serious injury can result from contact with pressurized water. Use care when operating the side guns.

Only qualified operators should operate the side guns. With a firm grip on the side gun, squeezing the trigger will open the side gun and allow water to stream from the nozzle. Release the trigger to stop the flow of water.

When the side guns are no longer required, shut off the flow of water to the hose reel with the shutoff valve and disconnect the side gun from the ground wash hose reel.

PTO Disengage

Located on the control panel above each ground wash hose reel is a red push/pull switch. This switch is normally pulled and is pushed when it is necessary to disengage the PTO. The center of the switch is illuminated when all of the PTO switches are pulled.

There are three PTO switches, two at ground level with one above each hose reel, and one on the main console on the operator's platform. The PTO cannot be engaged if any of the three PTO switches are pushed.

CAUTION

The water pump that provides the pressurized water for the wash system should never be run dry. Severe damage to the pump is likely when the pump is activated without water being supplied to the pump inlet.

Water Pump Start

The side gun toggle switch located on the control panel in the cab of the vehicle must be enabled before the ground level water pump start switches can be used.

Located on the control panel above each ground wash hose reel is a water pump toggle switch used for off and on control of the water pump. When the water pump toggle switch is set to on, the water pump provides water to the complete water wash system. When the water pump toggle switch is set to off, the water system will be turned off if no other water pump toggle switch is on.

One water pump toggle switch is located above each side reel and one water pump toggle switch is located on the operator's platform main console.

Engine Start

Located on the control panel above each ground wash hose reel is a truck engine momentary toggle switch that is used for off and on control of the vehicle engine. Both vehicle engine toggle switches operate independently.

The switch is operational when the cab ignition switch is turned on and the PTO is engaged. To start the engine, hold the switch in an upward position until the engine is running and then release. If the engine does not start release the switch and then hold the toggle switch in the upward position and release. Repeat the procedure.

To stop the engine, hold the toggle switch in the upward position and release.

Resistivity Override

A keyed resistivity override switch is used to continue pump operation when the resistivity is out of tolerance. The resistivity override light will remain illuminated while the override is engaged. The override can be disabled with the switch or the system will reset itself when the unit is shutdown.

Outriggers

With all four outriggers properly set, the turntable and boom can be operated through a full range of motion. In addition, this machine is equipped with an operating zone option. Using the operating zone option, the turntable can be operated in an operating zone with two outriggers deployed on one side of the unit as described later in this section.

Outrigger Deployment

The boom must be stowed in the boom rest before the outriggers can be operated. The outriggers can be operated from manual lever lower controls accessible above the rear bumper and from toggle switches located on the operator's platform. Figure 5.3 illustrates the location of the outrigger lower controls.

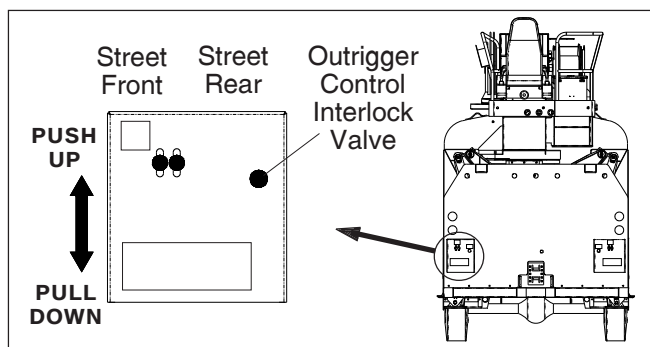


Figure 5.3 — Manual Outrigger Controls

Pulling down on the outrigger control handle and simultaneously pulling out on the outrigger control interlock valve

lowers the outrigger. Pushing down and simultaneously pulling out on the outrigger control interlock valve raises the outrigger. The control handle returns to neutral when released by the operator. The outrigger control handle located toward the center of the vehicle controls the rear outrigger and the outrigger control handle located nearest the outside of the vehicle controls the front outrigger.

Pulling or pushing the outrigger control handle while simultaneously pulling out on the outrigger control interlock valve automatically advances the vehicle throttle to provide the required supply of hydraulic fluid for the outrigger cylinders. The hydraulic pump is capable of operating two outriggers simultaneously at the speeds specified in the unit specification chart.

WARNING

This unit has been designed to be operated only on a firm surface with the outrigger penetration adjusted so that the vehicle chassis is level.

For maximum stability, properly set the outriggers on the ground or supporting surface before the boom is moved from the boom rest. Each outrigger is equipped with a 20 inch by 20 inch rectangular outrigger shoe. The surface that the outrigger shoe will rest on must be firm and capable of supporting a substantial load in a concentrated area. The outrigger shoe cannot be allowed to bridge surface irregularities. If necessary, place sturdy outrigger pad supports beneath each outrigger shoe to increase the support area and load holding capability.

WARNING

Park on a firm surface before operating the unit. Always use parking brakes and wheel chocks. Outriggers must be extended as instructed under Outriggers. Outrigger shoes must rest on a surface that is firm and capable of supporting a substantial load in a concentrated area. The outrigger shoe cannot be allowed to bridge surface irregularities.

It is impossible to foresee all situations and combinations for set up of the unit. This unit is intended to be operated when level on a firm surface. Criteria for establishing a level unit must be developed and established by the user. This criteria must be evaluated based on actual conditions, work procedures, and experience. The owner and operator bear ultimate responsibility for ensuring that the unit is properly set up.

Motion Alarm

Operation of the outriggers causes the backup intermittent alarm to sound a warning signal.

Setting the Outriggers



WARNING

Do not lower the outriggers until all personnel are clear of the area of each outrigger. Setting an outrigger down on a person's foot or other body parts may cause serious injury.

NOTICE

When the PTO is engaged and the outriggers are deployed, the front brakes of the vehicle are engaged.

Properly Setting on a Level Surface

The outriggers will not operate unless the boom is stowed and latched in the boom rest. With the boom in the stowed position, lower all four outrigger legs to a firm footing.

Extend the front outriggers until they are contacting the ground.



WARNING

If uneven grade requires, use cribbing to create a level vehicle.

Level the vehicle with the rear outriggers. If uneven grade requires, use cribbing to create a level vehicle.

Procedures for raising the outriggers in case of hydraulic power loss are explained in Section 6 under Manually Lowering/Stowing the Unit.

Properly Setting on a Sloping Surface

The outriggers will not operate unless the boom is stowed and latched in the boom rest. With the boom in the stowed position, lower both of the low side outrigger legs to a firm footing.

The high side outrigger legs should only be lowered after a firm footing has been reached with the low side outriggers. The high side outriggers should be lowered with penetration adjusted to establish a level vehicle chassis.



WARNING

If uneven grade requires, use cribbing to create a level vehicle.

Lower the front outriggers and level with the rear outriggers until the machine is level. Outrigger pads may be required. If uneven grade requires, use cribbing to create a level vehicle.

Procedures for raising the outriggers in case of hydraulic power loss are explained in Section 6 under Manually Lowering/Stowing the Unit.

Properly Setting on a Slope in the Direction of Travel

Place wheel chocks under the uphill axle. With the boom in the stowed position, lower all four outrigger legs to a firm footing.

The down hill outriggers should be lowered with penetration adjusted to establish a level vehicle chassis. The down hill tires can be off the ground if necessary for leveling. The uphill tires should remain in contact with the ground.

Outrigger Interlock System

This unit is equipped with an outrigger interlock system that provides for the following:

- Alerts the driver if any of the outriggers are not stowed
- Requires deployment of the outriggers for removal of the boom from the boom rest
- Provides for operation in the operating zone (refer to Figure 5.4) when the outriggers are only deployed on one side of the unit

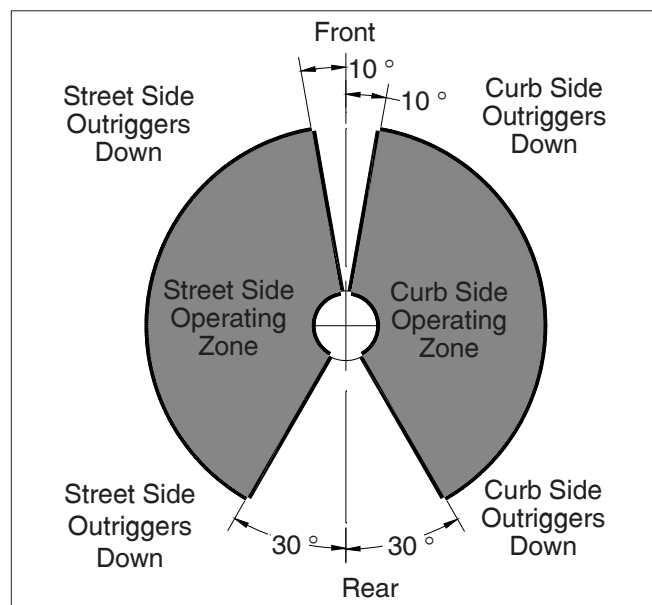


Figure 5.4 — Outrigger Operating Zone

Each outrigger is equipped with two proximity switches that are used in the electrical circuit to monitor the deployment of the outriggers.

Stowed

The first outrigger proximity switch senses when the outrigger is in the stowed position. As the steel outrigger leg is retracted and positioned against the proximity switch a signal is generated. When all four outriggers are stowed the collective signals turn off the red light on the cab control panels. If any one outrigger is moved from the stow position, then a red light is illuminated on the cab control panel. This red light is a warning to the operator

that at least one outrigger is not completely retracted and that the vehicle is not ready for travel.

Deployment

The second outrigger proximity switch is activated when the outrigger reaches a set distance near the ground. When all four outriggers have been deployed, the boom can be moved from the boom rest and operated in all positions. Activating these outrigger proximity switches indicates that the outriggers have been deployed, but does not assure full stability.

Operating Zone

When two outriggers are deployed on either the curb side or street side of the unit, and the turntable is within the operating zone on the same side of the unit, the boom is fully operational as long as it remains within that operating zone. A system of switches and solenoids are placed about the turntable rotation bearing to establish the operating zone control (refer to Figure 5.4). If the boom is moved to the limit of the operating zone, turntable rotation is limited to the direction that returns the turntable to the operating zone. With only two outriggers deployed, the boom can only be rotated inside the operating zone. In order to leave the operating zone and return the boom over the front of the unit to the boom rest, the boom must be fully retracted.

Left Side Console

To the left of the joystick seat is the left side console that includes controls for operating the outriggers and a hands-free intercom (refer to Figure 5.5).

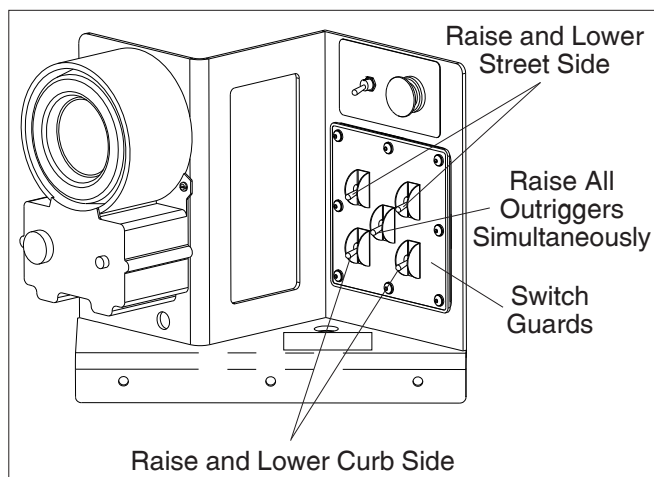


Figure 5.5 — Left Side Console



WARNING

Park on a firm surface before operating the unit. Always use parking brakes and wheel chocks. Outrig-

gers must be extended as instructed under Outriggers.

Outrigger Toggle Switches

There are five momentary toggle switches that control the outriggers. There is a momentary toggle switch to raise and lower each outrigger and a center momentary toggle switch that can be used to raise all four outriggers simultaneously.



WARNING

This unit has been designed to be operated only on a firm surface with the outrigger penetration adjusted so that the vehicle chassis is level.

Do not lower the outriggers until all personnel are clear of the area of each outrigger. Setting an outrigger down on a person's foot or other body parts may cause serious injury.

Do not lower the outriggers until all personnel are clear of the area of each outrigger. Convex mirrors are provided for viewing outriggers that are not easily visible from the operator's platform. The outriggers cannot be operated unless the boom is stowed and latched in the boom rest.

For maximum stability, the outriggers must be properly set on the ground or supporting surface before the booms are moved from the rest.

Intercom

Communication from the cab of the vehicle to the operator's platform is provided using the intercom system. Power is provided to the intercom when the ignition is powered up. To turn on the intercom rotate the volume control clockwise and adjust the volume.

The intercom located on the operator's left side is a hands-free intercom that allows the operator to communicate with a person in the cab of the vehicle without operating any controls.

Engine Start

Located on the Left Side Console above the outrigger toggle switches is a truck engine momentary toggle switch that is used for off and on control of the vehicle engine.

NOTICE

For the vehicle engine start/stop switch to function, the PTO must be engaged.

The switch is operational when the cab ignition switch is turned on and the PTO is engaged. To start the engine, hold the switch in an upward position until the engine is running and then release. If the engine does not start, release the switch and then hold the toggle switch in the upward position and release. Repeat the procedure.

To stop the engine, hold the toggle switch in the upward position and release.

PTO Disengage

Located on the Left Side Console above the Engine Start toggle switch is a red push/pull switch. This switch is normally pulled and is pushed when it is necessary to disengage the PTO. The center of the switch is illuminated when all of the PTO switches are pulled.

There are three PTO switches, two at ground level with one above each hose reel, and one on the Left Side Console on the operator's platform. The PTO cannot be engaged if any of the three PTO switches are pushed.

Main Console

The operator's platform main console (refer to Figure 5.6) provides switches and indicators for the water system, the PTO, and the positions of the boom. These controls

are positioned in front of the joystick seat and are readily accessible from the seat. Power is supplied to the main console when the PTO is engaged.

Water Pump

A water pump toggle switch provides for off and on control of the water pump. When the water pump toggle switch is set to on, the water pump provides water to the complete water wash system. When the water pump toggle switch is set to off, the water system will be turned off if no other water pump toggle switch is on. There is one water pump toggle switch located above each side reel in addition to this toggle switch.

A green indicator lamp on the main console is illuminated when the water pump is on.

A red indicator lamp on the main console is illuminated when the water pump is off.

A pressure gauge is located on the console and provides the water pressure of the water that is being provided to the water monitor nozzle.

Water Level

The water level for the tank is monitored with six indicator lights.

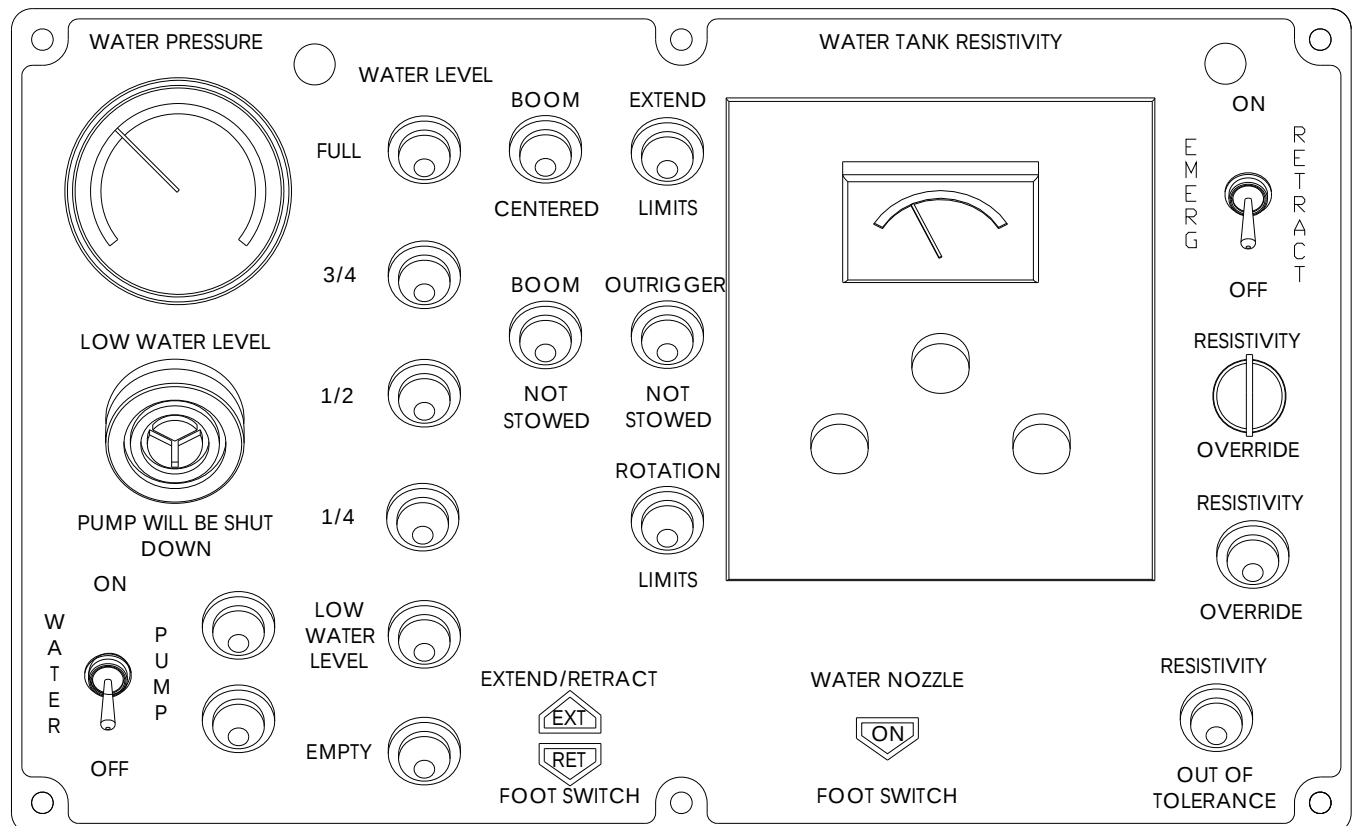


Figure 5.6 — Operator's Platform Main Console

When the water level is at seven inches or above, three green lights display the relative water level in the tank with all three being on when the tank is full. Each time the water falls below one of the specified levels, the green light adjacent to that level is turned off.

When the water level reaches seven inches the only light illuminated will be the amber low water level light.



The water pump that provides the pressurized water for the wash system should never be run dry. Severe damage to the pump is likely when the pump is activated without water being supplied to the pump inlet.

When the water level reaches seven inches an alarm will also sound an intermittent warning to notify the operator that the water level is low and the water pump is going to be automatically shut down when the five inch water level is reached. This is a warning to the operator that the use of the water system should be discontinued to prevent possible damage to the water pump.

The low water level light will remain illuminated until the five inch water level is reached.

When the water level reaches five inches the water pump system will not operate and will be automatically shut down if it is being operated. A red empty light will be the only water level light illuminated.

Water Resistivity



This unit is intended to place a high-pressure water stream in the vicinity of the insulators on transmission and distribution towers. Criteria for qualifying the resistivity of the water that is used for operation of this unit must be developed and established by the user. This criteria must be evaluated based on actual conditions, work procedures, and experience. The owner and operator bears ultimate responsibility for ensuring that the unit is properly set up for the particular conditions encountered.

A resistivity meter is provided to set and check the resistivity of the water in the tank. If the resistivity falls below the setting on the meter, the hydraulic motor that powers the water pump will not operate. If the water pump system is operating it will be shut down.

A red indicator lamp on the main console is illuminated when the resistivity is out of tolerance.

Resistivity Override

A keyed resistivity override switch is used to continue pump operation when the resistivity is out of tolerance. The resistivity override light will remain illuminated while the override is engaged. The override can be disabled with the switch or the system will reset itself when the unit is shutdown.

Boom Extents

An amber indicator lamp on the main console is illuminated to signal full extension or complete retraction of the boom.

A green indicator lamp on the main console is illuminated to signal when the boom rotation is centered and positioned to be stowed.

A blue indicator lamp on the main console is illuminated to signal when the boom is not latched. The boom stow latch is released when the interlock trigger is engaged.

Emergency Retract

A toggle switch located on the main console provides for retraction of the booms without the use of the foot switch.

Outrigger Light

An indicator lamp on the main console is illuminated to signal when the outriggers are not stowed.

Rotation Light

An indicator lamp on the main console is illuminated to signal when rotation of the turntable has reached the limit of rotation for either direction.

Boom Controls

The joystick boom controls and foot treadle boom controls have been designed to be operated from the operator's seat. The boom control joystick is equipped with an interlock trigger switch. To operate the boom functions the interlock trigger must be engaged.

Operator's Platform Seat



Wear the seatbelt at all times when operating the unit to avoid serious injury.

The operator's platform is equipped with a joystick seat that tilts forward for travel and reclines for operation. The seat is positioned to provide easy access to the main console, left side console, and foot controls. The seat is equipped with a seatbelt that is to be worn at all times when operating the unit. Joysticks for operation of the boom functions and monitor functions are built into the armrests of the seat.

Interlock

The interlock system prevents unintentional boom movement that might result from accidental bumping of the joystick at the operator's platform.



Releasing the interlock trigger before centering the joystick handle may produce sudden and abrupt stopping of movement, resulting in serious injury and/or property damage.

The interlock trigger is to be fully engaged before the boom function joystick handle is moved in any direction. Moving the joystick handle before engaging the interlock trigger may produce sudden and rough movement of the boom.

A blocking valve is incorporated into the boom control hydraulic circuit. The interlock trigger that is engaged on the joystick controls the blocking valve. The interlock trigger (refer to Figure 5.7) can be engaged as a natural part of grasping the joystick.

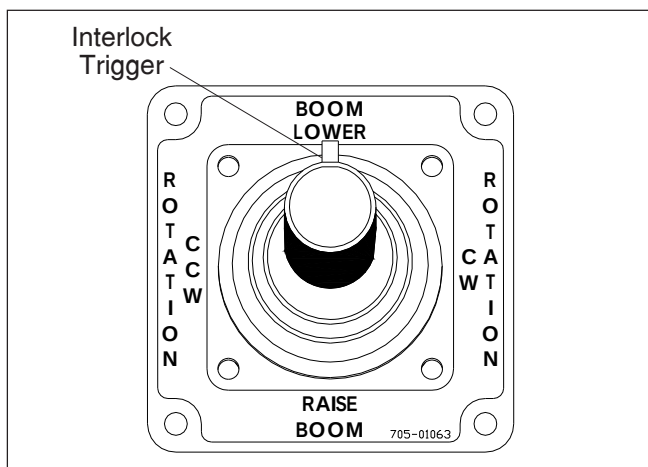


Figure 5.7 — Boom Function Joystick



Operate the controls smoothly, avoiding sudden reversals in direction or abrupt starts and stops.

The vehicle engine throttle is automatically increased when the demand for hydraulic oil exceeds the low throttle supply. A variable displacement pump then supplies the amount of hydraulic oil that is required to operate the boom functions.

Releasing the trigger closes the blocking valve and stops the flow of hydraulic oil into the boom control hydraulic valve.

Proportional Controls

All three boom functions are controlled with the boom control joystick and the foot control that is located just below the main console. The boom lift and rotation functions are controlled with the boom function joystick and extend and retract functions are controlled with the foot control.

To operate any of these controls it is necessary to engage the interlock trigger on the boom function joystick. All three boom functions controlled with the joystick and foot control are proportional. Increasing the travel of the foot control and/or the tilt of the joystick increases the speed of operation of the boom functions.

Boom Lift/Turntable Rotation



Operate the controls smoothly, avoiding sudden reversals in direction or abrupt starts and stops.

NOTICE

When the boom is extended beyond 67 feet in length, the speed of the lift and rotation functions are reduced automatically by 50 percent.

Movement of the boom function joystick in a given direction produces a corresponding movement. The speed of movement is directly proportional to the movement of the control.

Boom Lift

When the boom is centered and stowed in the boom rest, it is held in place with a hydraulically opened latch.

When the boom function joystick interlock trigger is engaged, the hydraulic oil flows to the latch and the boom latch opens.

Pulling back on the boom function joystick lifts the boom and pushing forward lowers the boom.

Turntable Rotation

Leaning the joystick to the right causes clockwise rotation of the turntable and operator's platform, and leaning the joystick to the left causes counterclockwise rotation (refer to Figure 5.7).



This unit has a noncontinuous rotation turntable that can only be rotated through a total of 375 degrees. Rotating the turntable at full speed into the limit switches is not recommended and could cause over travel resulting in damage to the unit.

After the boom is elevated out of the boom rest, the turntable can be rotated through 375 degrees. This unit has a noncontinuous rotation turntable.

CAUTION

Operate the controls smoothly, avoiding sudden reversals in direction or abrupt starts and stops.

NOTICE

When the boom is extended beyond 67 feet in length, the speed of the lift and rotation functions are reduced automatically by 50 percent.

Rotational position of the turntable is monitored with a rotary encoder driven off the turntable bearing. This encoder is used to limit the rotation of the turntable to 375 degrees. If the turntable reaches a limit, the boom function joystick can only be used to rotate the turntable in the opposite direction away from the limit.

The rotation motor is equipped with a spring applied, hydraulically released brake. When operating the boom function joystick, the brake is automatically released prior to rotation of the turntable. When the joystick is returned to neutral, the rotation stops and the brake is applied.

Boom Extension

A self-centering foot control located below the main console (refer to Figure 5.8) extends and retracts the boom.

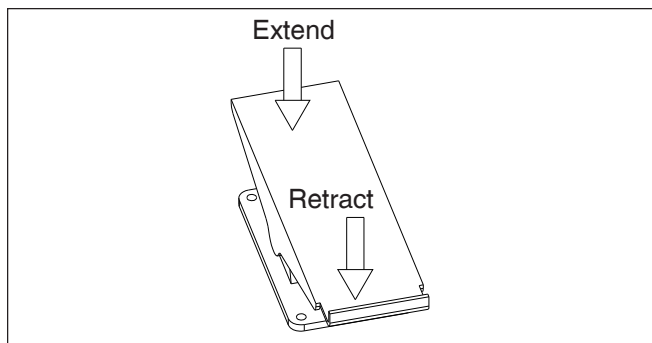


Figure 5.8 — Foot Control

With the boom function joystick trigger engaged, pressure with the toe extends the boom and pressure with the heel retracts the boom. When the foot is removed, the foot control self centers and no extension or retraction occurs.

Boom and Water Monitor Storage

If the boom bounces while the vehicle is in motion, damage may be caused to booms, lift cylinder, turntable, and/or the operator's platform.

As the boom is properly stowed in the rest, hydraulic pressure is diverted to tank to prevent damage to the boom and chassis.

CAUTION

Failure to properly stow the boom and water monitor may result in property damage.

An amber light is illuminated on the main console when the boom is not stowed. This amber light indicates that the boom has not been properly centered and positioned in the boom rest.

When stowing the booms and water monitor for transportation, use the following procedure.

1. Fully retract the boom, which will cause an amber light to be illuminated on the main console. This occurs when the boom is either fully extended or fully retracted.
2. Rotate the turntable to position the boom over the boom rest. A green light is illuminated on the main console when the boom is centered over the boom rest and ready for stow.
3. Stow the boom, which will cause an amber light on the main console to go out. When the boom is properly stowed the amber light illuminated on the main console Boom Not Stowed will not be illuminated.
4. To stow the water monitor, use the joystick controller and position the water monitor with the nozzle pointing down.

Boom Rest Interlock

When the boom is centered and stowed in the boom rest, it is held in place with a hydraulic latch.

When the boom function joystick interlock trigger is engaged, the hydraulic oil flows to the latch and the boom latch opens. Once the boom is removed from the latch, a signal from a limit switch illuminates the Boom Not Stowed lamps on the cab control panel and main console and also prevents operation of the outriggers. When the boom is placed back into the stowed position, the lamps will go out and the outriggers will be operational.

CAUTION

Failure to properly stow the water monitor with the nozzle pointing down may result in property damage.

Stow the water monitor for travel by using the joystick to position the water monitor with the nozzle pointing down.

Water Monitor Controls

The water monitor is positioned with the water monitor joystick and water flow is controlled with a foot switch.

Pushing the water monitor joystick (refer to Figure 5.9) forward lowers the nozzle and pulling back raises the nozzle. Leaning the joystick to the right rotates the nozzle clockwise and leaning to the left rotates the nozzle counterclockwise. The water monitor control is proportional. The greater the movement of the joystick handle, the faster the monitor moves. When the joystick is released, it returns to the center position.

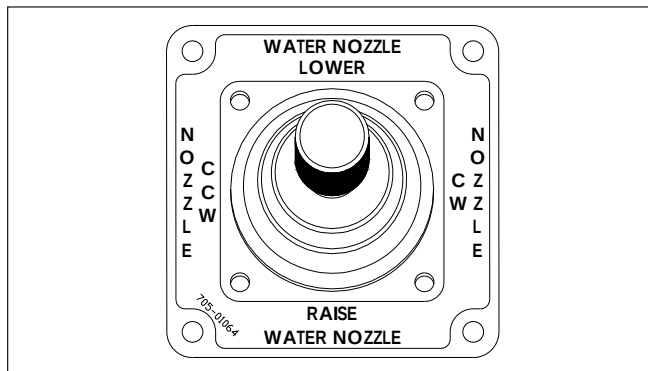


Figure 5.9 — Monitor Joystick

An off and on foot switch (refer to Figure 5.10) located below the main console controls an air solenoid that turns the water to the boom nozzle on and off. Pressing with the toe turns the water on and releasing turns the water off.

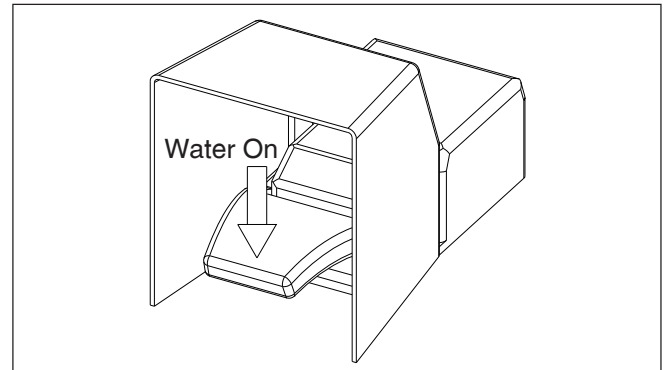


Figure 5.10 — Water Foot Switch

Section 6 — Emergency Operation

If a situation arises where the boom and turntable become inoperable with the joystick and foot control, there are options that can be taken to prepare the unit for travel.



Death or serious injury can result from contact with equipment that has become electrically charged.

After determining that it is safe to touch the vehicle, options for preparing the unit for travel can be undertaken.

Operation From Other Controls

If the unit cannot be operated due to a loss of hydraulic power, such as engine or pump failure, or if the electrical system fails, there are three methods for lowering and/or stowing the unit. Refer to the following section for the appropriate procedure.

- Operation From Valve Box (hydraulic pressure still available)
- Manually Lowering/Stowing the Unit (holding valve adjustment)
- Auxiliary Power Sources (using another unit to supply hydraulic power)

Operation From Valve Box

An electrical failure will cause the joystick and foot controls to become inoperable. In the event of an electrical failure and with the hydraulic pumps still functional, the boom controls located in the valve box on the operator's platform can be used to retract and stow the boom.

Upon determining that it is safe to touch the vehicle, manual valve controls can be used to position the boom and turntable. A placard located adjacent to the boom function control valve indicates the function of each manual valve handle (refer to Figure 6.1).

The boom control valve is equipped with manual control handles. The manual control handles may be used to operate the boom function valve if the electrical system malfunctions. This enables the boom to be stowed for travel.

The boom function control valve is in the valve box located to the right of the joystick seat on the operator's platform. The boom function blocking valve (refer to Figure 6.1) is located inside the valve box on the wall adjacent to the back of the vehicle. The manual control handles may be shifted in two directions. When the manual control handles are centered, they are in neutral.

Before the manual override control handles may be used, the boom function blocking valve must be opened. The boom function blocking valve may be opened one of two ways, depending upon whether the electrical system is operational or not. If the electrical system is working, use option one to stow the boom and turntable. If the electrical system is not working, use option two to stow the boom and turntable.

Manual Operation

Option One

If the electrical system is working, use the following steps to open the boom function blocking valve and stow the boom and turntable.

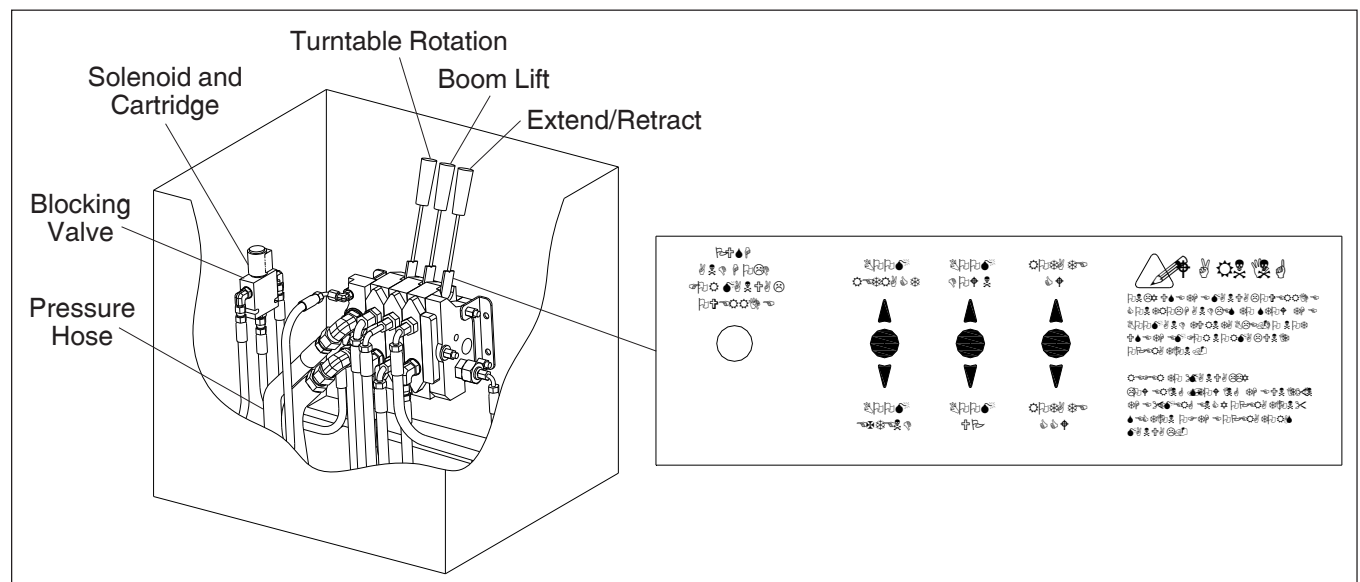


Figure 6.1 — Boom Control Valves

1. Open the boom function blocking valve by pressing and holding the push button switch (refer Figure 6.1) indicated on the placard inside the valve box.

WARNING

Only use the manual override control handles to stow the boom and turntable. Do not use them for normal unit operation. Take the unit out of service until the problem is corrected.

2. With the push button switch pressed, use the manual control handles to stow the boom and turntable. The functions should be operated slowly and cautiously.

Option Two

If the electrical system is not working, use the following steps to hydraulically bypass the boom function blocking valve to stow the boom and turntable.

1. Shut off the engine and disengage the PTO. Release any pressure in the hoses connected to the boom function blocking valve. This may be done by moving all of the boom function manual control handles in both directions for approximately five seconds each.

CAUTION

Failure to remove pressure before loosening a valve cartridge from its housing will cause oil to spray out under pressure as the connection is loosened. Hydraulic oil escaping under pressure can have enough force to inject oil into the flesh.

In case of injury by escaping hydraulic oil, seek medical attention at once. Serious infection or reaction can result if medical treatment is not given immediately.

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

2. Remove the solenoid for the boom function blocking valve from the valve housing and the boom function blocking valve cartridge from the valve housing.
3. Install a -12 SAE O-ring plug in the open port of the valve housing where the boom function blocking valve cartridge was located.

WARNING

Only use the manual override control handles to stow the boom and turntable. Do not use them for normal unit operation. Take the unit out of service until the problem is corrected.

4. Turn on the engine and engage the PTO. Once the boom function blocking valve is opened or bypassed, use the manual control handles to operate the functions. The functions should be operated slowly and cautiously.

5. Shut off the engine and disengage the PTO. Release any pressure in the hoses connected to the boom function blocking valve. This may be done by moving all of the boom function manual control handles in both directions for approximately five seconds each.

6. Remove the plug in the valve housing. Install the boom function blocking valve cartridge. Torque the valve cartridge to 35 foot-pounds. Install the solenoid in the valve housing in the same orientation it was before it was removed. Torque the solenoid mounting nut to five foot-pounds. Take the unit out of service until the problem is corrected.

Manually Lowering/Stowing the Unit

The following text explains how to rotate the turntable and retract the hydraulic cylinders that operate all functions of the boom.

Rotating the Turntable

After determining that it is safe to touch the vehicle, the turntable may be rotated manually. Use another piece of heavy equipment, such as a crane or derrick, to assist in rotation.

CAUTION

Make sure there is sufficient clearance around the unit before moving the booms. Insufficient clearance can cause serious injury and/or property damage.

If the unit is not level, the booms must be positively restrained. If they are not and the rotation brake is released, uncontrolled rotation of the turntable could result. This can cause serious injury and/or property damage.

1. If the disabled unit is not level, position a suitable anchor point uphill from the unit. Wrap a sling around the base boom tip of the disabled unit and attach to the anchor point. This will restrain the booms and prevent uncontrolled rotation when the rotation brake is released.

NOTICE

When the rotation brake is removed, all rotation braking is released. If the unit is not level, restrain the booms at the tip of the base boom with rope or cables.

2. Remove the two 1/2" hex head cap screws that hold the rotation brake to the rotation gearbox housing (refer to Figure 6.2).

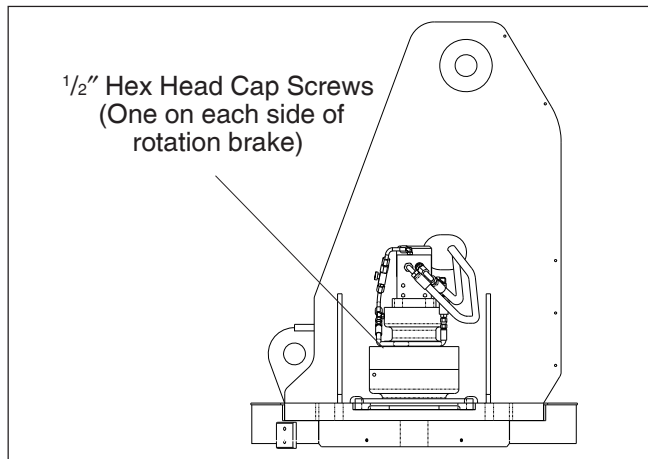


Figure 6.2 — Rotation Gearbox

3. Remove the rotation brake and motor from the gearbox housing.
4. Use the best available method to rotate the booms until they are positioned above the boom rest.
5. Install the rotation brake and motor.

Retracting the Boom

To retract the boom, a retract solenoid valve can be opened.

The retract solenoid valve is located in the base end of the boom cylinder which is attached to the base of the base boom.



Extreme care should be taken when energizing the retract solenoid. When the momentary push button switch is pressed the boom will begin to retract. Releasing the push button will stop the retraction. Keep all personnel and material away from moving parts.

A switch located on the operator's platform main console can be used to energize the retract solenoid valve to allow the boom to be retracted by gravity when the booms are elevated. Boom retraction with this switch will be slow. Releasing the push button will stop the retraction of the boom.

Lowering the Boom

To lower the boom, the lift cylinder counterbalance holding valve can be adjusted to the open position.

The counterbalance holding valve is located in the base end of the lift cylinder (refer to Figure 6.3).

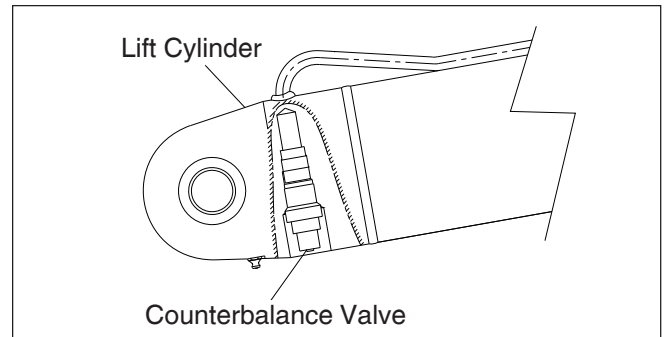


Figure 6.3 — Lift Cylinder Holding Valve



Extreme care should be taken when turning the counterbalance valve adjusting screw. As the adjusting screw is turned, the boom will begin to lower. The rate of movement will increase as the boom is lowered. Keep all personnel and material away from moving parts.

The rate of movement can be adjusted by how far the counterbalance valve adjusting screw is turned after movement of the boom starts.

To adjust the counterbalance holding valve, unlock the locknut and turn the adjusting screw inward (clockwise). Control the rate of descent by turning the counterbalance valve adjusting screw.



All counterbalance valves that have had the relief setting changed must be replaced or reset to the proper setting using an Altec test block before the unit is operated.

After the manual lowering/stowing procedure is completed, replace or properly adjust the lower boom cylinder counterbalance valve to its original setting.

Auxiliary Power Source

Another hydraulically powered unit may be used as an auxiliary power source to stow a unit that has lost its hydraulic power. The alternate power source must contain compatible hydraulic oil and should produce a flow no greater than 40 gpm.

Only use the alternate power source to stow the unit for road travel. It should not be used to operate the unit for an extended period of time.

Before beginning the following procedure, disengage the PTO and hydraulic pump on both the disabled unit and operable unit.

The following instructions refer to the disabled unit, except where specified.

1. Close the shutoff valves below the oil reservoir in the suction line of the pump (refer to Figure 6.4).

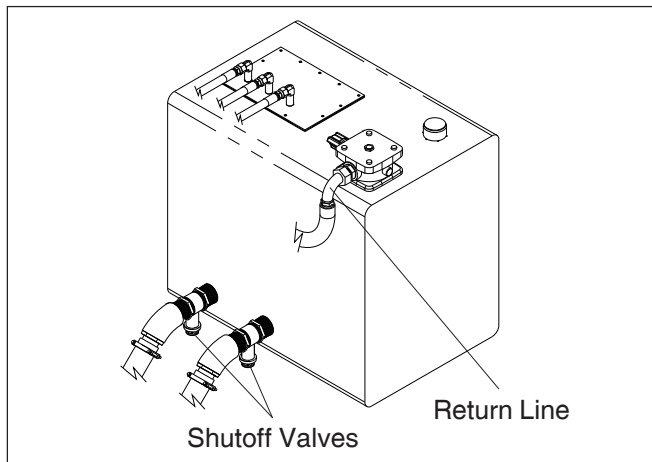


Figure 6.4 — Hydraulic Reservoir

2. Locate the pressure hose that runs from the pump to the boom function valve that is located in the valve box shown in Figure 6.1. Disconnect the pressure line from the hydraulic pump (refer to Figure 6.5), and plug the pump outlet.

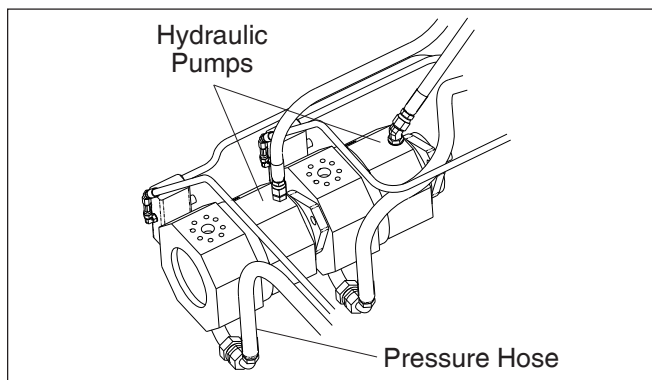


Figure 6.5 — Hydraulic Pump

3. Connect a pressure outlet from the operable unit to the pressure hose that was disconnected from the disabled unit in step 2. If the operable unit is equipped with a power tools hose reel, use the pressure hose on the reel for this purpose. If a tool reel is not available, use another pressure hose from the operable unit of sufficient length. The hose should have a minimum rating of 3,000 psi. Appropriate fittings will need to be added to the pressure hose on the disabled unit to do this.

4. Locate the return line that runs from the washer platform to the return line filter (refer to Figure 6.4). Disconnect this hose at one end, and cap or plug the reservoir side of this connection.
5. Connect a return inlet from the operative unit to the return line disconnected from the disabled unit in step 4. If available, use the return hose on the tools reel on the operable unit for this purpose. Otherwise, use another hose of sufficient length from a return inlet on the operable unit. Appropriate fittings will need to be added to the return hose of the disabled unit to do this.
6. If a return inlet is not available, connect a hose to the return line disconnected in step 4. Insert the free end of the hose in the fill opening on top of the reservoir of the operable unit.
7. Start the engine and pump on the operable unit. If the electrical system on the washer is still operable, use the boom joystick and foot controls to stow the boom and turntable. If the electrical system is not working, use the manual control handles on the boom function valve as described in Operation From Valve Box in this section.
8. Once the boom is stowed, the outriggers can be retracted using the manual controls located on the rear bumper. Follow the procedure for operating the outriggers in this manual.
9. Once the boom is stowed and the outriggers are retracted, stop the engine and pump on the operable unit. Return all the hydraulic hoses to their original connections on both units. Open the shutoff valves on the disabled unit.

Manually Raising the Outriggers

After the booms are stowed, the outriggers may be manually raised using the following procedure.



CAUTION

Failure to properly stow the unit can result in property damage.

1. Stow the booms.
2. If the equipment is available, raise the vehicle to remove the load from the outrigger leg.
3. Locate the two pilot operated check valves installed near the base end of the cylinder (refer to Figure 6.6). One of the check valves has a screw with a $\frac{3}{16}$ " hex head in the top of the cartridge. Use a $\frac{3}{16}$ " hex wrench and turn the screw in (clockwise) until the cylinder

begins to retract. Control the speed of cylinder retraction using the hex screw.

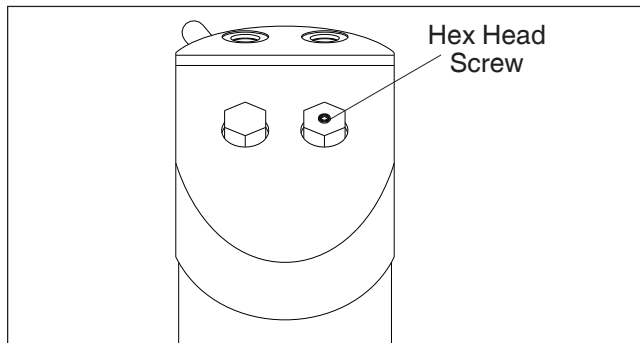


Figure 6.6 — Outrigger Holding Valve

4. When there is no vehicle weight on the outrigger, lift the outrigger leg with a come-along or a pry bar. Block up the outrigger shoe at intervals if lifting in successive steps with a pry bar. Use the come-along to completely retract the extended outrigger leg.

5. Secure the outrigger legs in the stowed position until the hydraulic system is again operational.
6. Turn the $\frac{3}{16}$ " hex head screw out (counterclockwise) to close the check valve before again using the outrigger.
7. Repeat steps 2 through 6 for each outrigger.

NOTICE

Purge the air from all the outrigger cylinders before using the outriggers to support the unit. Failure to do this may result in drifting of the outriggers.

8. Once hydraulic power is restored to the unit, purge the air out of all the outrigger cylinders. This may be done by operating the cylinders to full extension and retraction several times.

Section 7 — Troubleshooting

Power Distribution Module

This unit is equipped with a Power Distribution Module (PDM) located in the cab of the vehicle behind the seats.

The PDM is a self-contained electronic system that uses microprocessors, electronic controls, and sensing systems to simplify and monitor the electrical machine con-

trols. The PDM's microprocessor controls have built in diagnostic tests with light emitting diodes (LEDs) to provide for quick assessment of the system's performance.

Refer to the Power Distribution Module Information Manual for additional information and troubleshooting.

Section 8 — Care of the Unit

An alert operator can contribute to the care of the unit. The observation and correction of minor maintenance problems, as they occur, may prevent costly repairs and lengthy downtime, and improve safety.

At no time should an Altec unit be altered or modified without specific written approval from Altec Industries, Inc.

Hydraulic System

The condition of the hydraulic oil is a major factor in obtaining long life and trouble-free service from the hydraulic system components. The oil temperature, level, and cleanliness must be properly maintained.

NOTICE

Do not put the unit in service and run the pump at normal operating speeds until the hydraulic oil reservoir feels warm to the touch.

The minimum temperature at which oil will flow to the pump varies with the type of oil in the reservoir. Regardless of the hydraulic oil used, improper start-up can quickly damage the pump. Always allow the oil to warm up before running the engine or pump at high speed.

The maximum temperature at which the hydraulic system can operate depends on the hydraulic oil used. Cold weather oil should not exceed 160 degrees Fahrenheit and warm weather oil should not exceed 180 degrees Fahrenheit.

If overheating occurs during normal use, identify the cause and have it corrected immediately.



WARNING

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

Check the oil level in the hydraulic reservoir daily. When checking the oil level the vehicle should be on level ground with the booms and outriggers stowed. The oil level must be within the acceptable range shown on the sight gage. If oil must be added, use the proper type as described in the Maintenance Manual.

Immediately report any unusual hydraulic system noise observed during operation so the cause can be identified and corrected.

Structures and Mechanical Systems

Report any unusual noises, loose fasteners, pins, pin retainers, etc., so the cause can be identified and corrected.



CAUTION

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

Proper lubrication on a regular basis will increase the life of the unit and help to prevent maintenance problems. Report any sign of lubricant leaking from a gearbox so that it may be corrected.

Start and stop all operations as smoothly as possible. Do not allow debris, tools, etc., to accumulate on the unit. The booms must be free to extend and retract without obstruction.

When cleaning with high pressure washers or steam cleaning equipment, do not directly spray the electrical components or control panels. All electrical connections are sealed and designed for outside use. However, high pressure fluids can force their way past the seals and cause corrosion to start.

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.

ATB — see anti-two-block (ATB) system.

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).

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.

blade — the replaceable component on the rotating cutting implement that cuts wood to produce wood chips.

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 as 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.

CADI — see calibration and diagnostic instrument.

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.

calibration and diagnostic instrument (CADI) — a hand-held instrument that can be temporarily connected to the control system of a unit to adjust various system control parameters.

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 removable hydraulic valve that is screwed into place in a cavity in a hydraulic manifold or cylinder.

catrac — see hose carrier.

caution — indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

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.

crane — a machine used for hoisting and moving objects by means of cables attached to a movable boom.

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 movable piston and rod, or plunger, operating within a cylindrical bore.

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.

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.

decals — 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 blades 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 radio 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 blades 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.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 as 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 that has four ports, normally a pressure (inlet) port, a return (tank) port, and two work ports. Used to change direction of a cylinder or other output device.

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 blades 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 — see blade.

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.

LMAP — see load moment and area protection.

LML — see load moment limiter (LML) system.

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 moment — the moment that acts in the direction to attempt to overturn the unit, consisting of the total moment produced by the weights of the boom, boom attachments, and load on the winch line.

load moment and area protection (LMAP) — monitors load on the unit and also monitors the working area.

load moment limiter (LML) system — the system on a digger derrick that shuts off certain functions to help prevent overturning of the unit when the load moment reaches a value that could cause instability if increased further.

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 distribution 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 globe 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.

notice — indicates information considered important, but not hazard related.

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 movable 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 movable 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 movable 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 load 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 from the point the outriggers contact the ground surface until extension of the outrigger cylinders is stopped.

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.

pinthle hitch — a common heavy duty coupling type which utilizes a pinthle hook attached to a tow vehicle to pull a trailer having a lunette eye.

pinthle hook — the “jaw” portion of a pinthle 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 — movable 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 — identifies the number of operating positions of a valve spool; i.e. a two-position valve has two operating positions.

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 distribution 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 PTO is engaged or 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.

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 action 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 movable 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.

rollover protection structure (ROPS) — operator compartment structure (usually cab or frame) intended to protect equipment operators from injuries caused by overturns or rollovers.

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.

ROPS — see rollover protection structure.

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. Can be electronic or hydraulic.

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.

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 — see 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 that has three ports, normally a pressure (inlet) port, a normally closed port, and a normally open port. Used to block or open a common flow passage.

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 that has two ports, normally a pressure (inlet) port and an outlet port. Used to open or close a flow passage. May be configured as normally closed or normally open.

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 — indicates a 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 — describes how many ports are in a valve or valve section. See two-way valve, three-way valve, or four-way valve.

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.

Troubleshooting Chart

Symptom	Possible Cause	Test Procedure/Corrective Action
All functions stop working.	PTO is not engaged.	Check the PTO switch on the cab control panel. If it is not engaged, properly engage it. PTO push/pull switch is pushed in at one of the side gun panels or at the operator's platform console.
	Hydraulic oil is not reaching the pump.	Fully open the two suction line shutoff valves.
Excessive heat buildup.	Low fluid level in reservoir.	Fill the reservoir to the proper level.
	High pressure oil return to reservoir caused by twisted or kinked hydraulic hose.	Check fluid level. Add proper fluid type.
Severe hydraulic leak.	Failure of hose, tube, fitting, seal, etc.	Stow without hydraulic power.
Boom controls do not work.	Outriggers are not properly set.	Set all four outriggers. All four green lights on the outrigger control panel must be illuminated before the boom can be removed from the boom rest.
	The boom joystick trigger is not engaged.	Engage the trigger on the boom function joystick before operating the boom functions.
	PTO is not engaged.	Engage the PTO.
No water flow.	PTO is not engaged.	Engage the PTO.
	Water pump is not turned on.	Turn on the water pump switch located on the main console.
	Resistivity out of tolerance.	If the resistivity falls below the low set point, the water system is shut down. Fill the tank with water of the proper resistivity.
	Water level in the tank is below five inches.	If the water level in the tank falls below five inches the water system is shut down. Fill the tank with water of the proper resistivity.
Water pump will not come on at side gun locations.	The side gun switch is not turned on at the cab console.	Turn on the side gun switch located on the cab control panel.
	PTO is not engaged.	Engage the PTO.
Turntable operates slowly.	Boom is extended beyond 67 feet.	When the boom is extended beyond 67 feet the turntable speed is reduced by 50 percent for improved safety.
Boom lift operates slowly.	Boom is extended beyond 67 feet.	When the boom is extended beyond 67 feet the boom lift speed is reduced by 50 percent for improved safety.
Outriggers will not operate.	PTO is not engaged.	Engage the PTO.
	Boom is not stowed.	The boom must be stowed to enable the operation of the outriggers. If the boom not stowed light is illuminated, the boom interlock latch is not closed.

