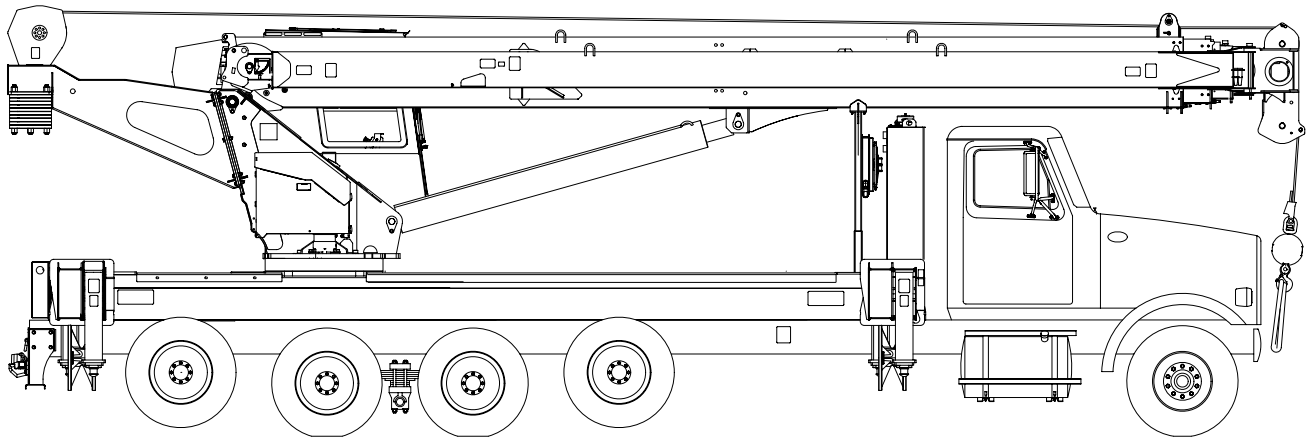




AC45 Series



Operator's Manual

www.altec.com

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

749-30188
2015

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<https://cranemanuals.com>

Safety Bulletin

Electrical Hazards

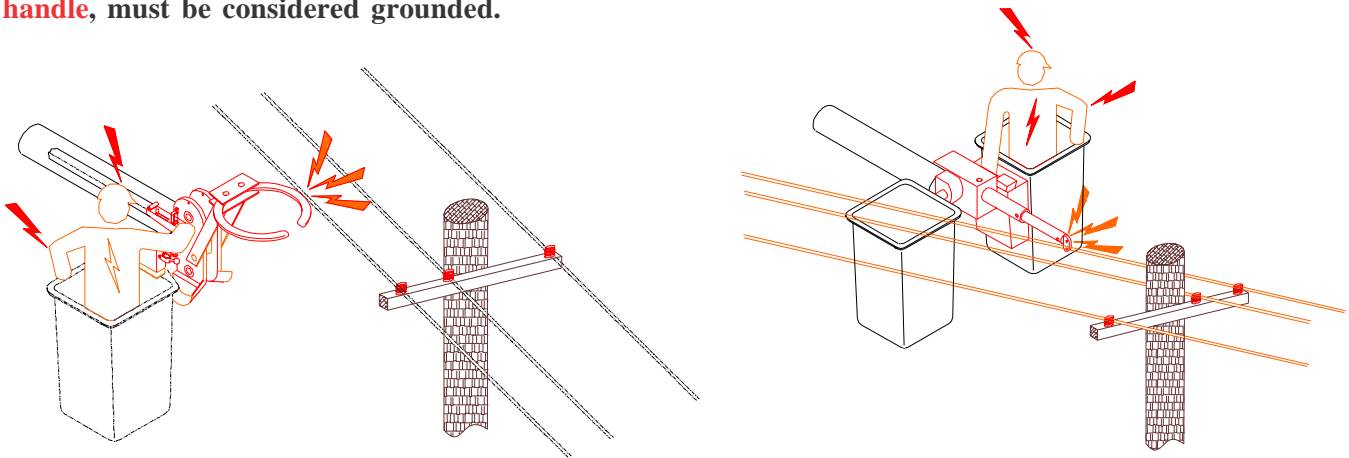
Always wear insulating protective equipment, use conductor cover-ups, and maintain required clearances when in the vicinity of energized conductors.

Aerial devices and digger derricks with insulating booms can only isolate the operator from grounding through the boom and vehicle. They cannot provide protection against phase-to-phase or phase-to-ground contacts occurring at the boom-tip, above the insulating boom sections.

Boom-tips of aerial devices and digger derricks, of necessity, must contain metal components. Metal conducts electricity. Moreover, under certain circumstances, and to varying degrees, electricity will track across or through non-metallic components (fiberglass covers and structures, hoses, etc.). Electricity can even arc through air. Thus, **the boom-tip of an aerial device or a digger derrick must be considered conductive!**

If any part of the boom-tip contacts an energized conductor, the entire boom-tip, including the control handle, must be considered energized.

If any part of the boom-tip contacts a grounded object, the entire boom-tip, including the control handle, must be considered grounded.



Hydraulic fluid is flammable. If electricity flows through the boom-tip, it can cause the hydraulic fluid to burn or to explode. **Contact by any part of the boom-tip with an energized conductor while the boom-tip also is in contact with another energized source or a grounded object can cause the hydraulic fluid at the boom-tip to burn or explode.**

These are among the reasons aerial devices¹ and digger derricks are **never** considered **primary** protection for the operator from electrical contact. **An operator's primary protection comes through use of protective equipment (insulating gloves, insulating sleeves, hot sticks) and maintenance of appropriate clearances.**

Do not rely on the boom-tip of an aerial device or digger derrick to protect you from an energized conductor or a ground. It cannot do so. Rely, instead, on the only things that can protect you, use of appropriate protective equipment and maintenance of appropriate clearances.

¹ Except ANSI Category A units



ALTEC INDUSTRIES, INC.
210 INVERNESS CENTER DRIVE
BIRMINGHAM, ALABAMA 35242
WWW.ALTEC.COM

MODEL SERIAL NO.

MAXIMUM HYDRAULIC WINCH PRESSURE SETTING PSI(MPa)

MAXIMUM HYDRAULIC BOOM PRESSURE SETTING PSI(MPa)

MAXIMUM HYDRAULIC SWING PRESSURE SETTING PSI(MPa)



WARNING

BEFORE OPERATING UNIT, READ AND UNDERSTAND ALL OPERATING AND SAFETY INFORMATION IN THE MANUAL, ON LOAD CAPACITY CHARTS, AND ON ALL OTHER PLACARDS. IF YOU DO NOT HAVE MANUAL OR, IF PLACARDS ARE MISSING/UNREADABLE, PLEASE CALL 1-877-462-5832 FOR ASSISTANCE.



**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.



WARNING

KEEP PEDESTRIANS AWAY FROM THIS VEHICLE WHEN OPERATING UNIT.

THIS UNIT COMPLIES WITH ASME B30.5

970019637 A



ALTEC INDUSTRIES, INC.
210 INVERNESS CENTER DRIVE
BIRMINGHAM, ALABAMA 35242
WWW.ALTEC.COM

MODEL SERIAL NO.

MAXIMUM HYDRAULIC WINCH PRESSURE SETTING PSI(MPa)

MAXIMUM HYDRAULIC BOOM PRESSURE SETTING PSI(MPa)

MAXIMUM HYDRAULIC SWING PRESSURE SETTING PSI(MPa)

PLATFORM CAPACITY LBS(kg)

PLATFORM HEIGHT ON MAIN BOOM FT(m) PLATFORM HEIGHT ON EXTENDED JIB FT(m)

ALLOWABLE SLOPE FRONT/REAR DEG

INDICATOR LIMITS SIDE/SIDE DEG

OPERATING TEMPERATURE RANGE: -40°F TO 130°F / (-40°C TO 55°C)



**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.

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WARNING

KEEP PEDESTRIANS AWAY FROM THIS VEHICLE WHEN OPERATING UNIT.



WARNING

BEFORE OPERATING UNIT, READ AND UNDERSTAND ALL OPERATING AND SAFETY INFORMATION IN MANUAL AND ON ALL PLACARDS.

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

1. DO NOT EXCEED UNIT CAPACITY.
2. PERFORM RECOMMENDED DAILY PREOPERATION INSPECTION.
3. PROPERLY EXTEND ALL OUTRIGGERS.
4. USE FALL PROTECTION EQUIPMENT.
5. OPERATE CONTROLS SLOWLY FOR SMOOTH MOVEMENTS.
6. INSPECT AND SERVICE UNIT PER INSTRUCTIONS GIVEN IN MAINTENANCE MANUAL.
7. IT IS THE RESPONSIBILITY OF THE DEALERS, OWNERS, USERS, OPERATORS, LESSORS, LESSEES AND INSTALLERS TO COMPLY WITH THE APPROPRIATE SECTIONS OF ANSI/SIA A92.2.

THIS UNIT IS NOT ELECTRICALLY INSULATING

THIS UNIT COMPLIES WITH ASME B30.5 AND ANSI/SIA A92.2 970490300-A

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. Keep this manual with the unit.

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

Impacts to and excessive forces on the 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, magnaflux or ultrasonic testing as applicable. If structural damage is suspected or found, contact Altec for additional instructions.



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.



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.

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Section 1 — Introduction

About This Manual...

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

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

Contact the following organizations for additional information.

- American National Standards Institute (ANSI)
A92.2 for aerial devices; A10.31 for digger derricks
- American Society of Mechanical Engineers (ASME)
B30.5
- American Public Power Association (Safety Manual for an Electric Utility)
- American Society for Testing and Materials (ASTM)
- American Welding Society (AWS)
- Canadian Standards Association (CSA)
- 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)

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

The Appendix contains reference items to assist in unit operation. A glossary of industry terms is provided for your convenience. The 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 located 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

This unit has been designed and built for service to the construction industry. It is a multipurpose unit that can accommodate lifting and positioning of materials at the work site.

General Specifications

This unit uses a telescopic boom design. Unit height specifications are based on 3' 5" (1.04 m) frame height. Figures 2.1 and 2.2 provide general specifications.

This unit is not insulated and is not intended to be used in the vicinity of energized electrical conductors. Some of the hazards, but not all hazards, of operating the unit near energized conductors are presented in this manual in Section 4 under Operation Near Energized Conductors.

This unit shall be used only by fully trained and qualified operators who are trained and proficient as crane

operators and are familiar with the hazards of contact with energized conductors. Operators must maintain safe clearances from electrical power lines in accordance with applicable government regulations and safe work practices.

Every unit is tested by the installer before delivery to meet the stability requirements for truck crane use according to ANSI. A load capacity chart for truck crane use is located on the side of the turntable.

The personnel platform option is required on all cranes intended for personnel handling. The units may be equipped with radio remote controls.

Cranes with this specification will be equipped with a load capacity chart for platform use and a rated capacity chart which should not exceed 50 percent of units rated capacity as required by OSHA regulations. A crane may not be used for combined personnel lifting and material handling.

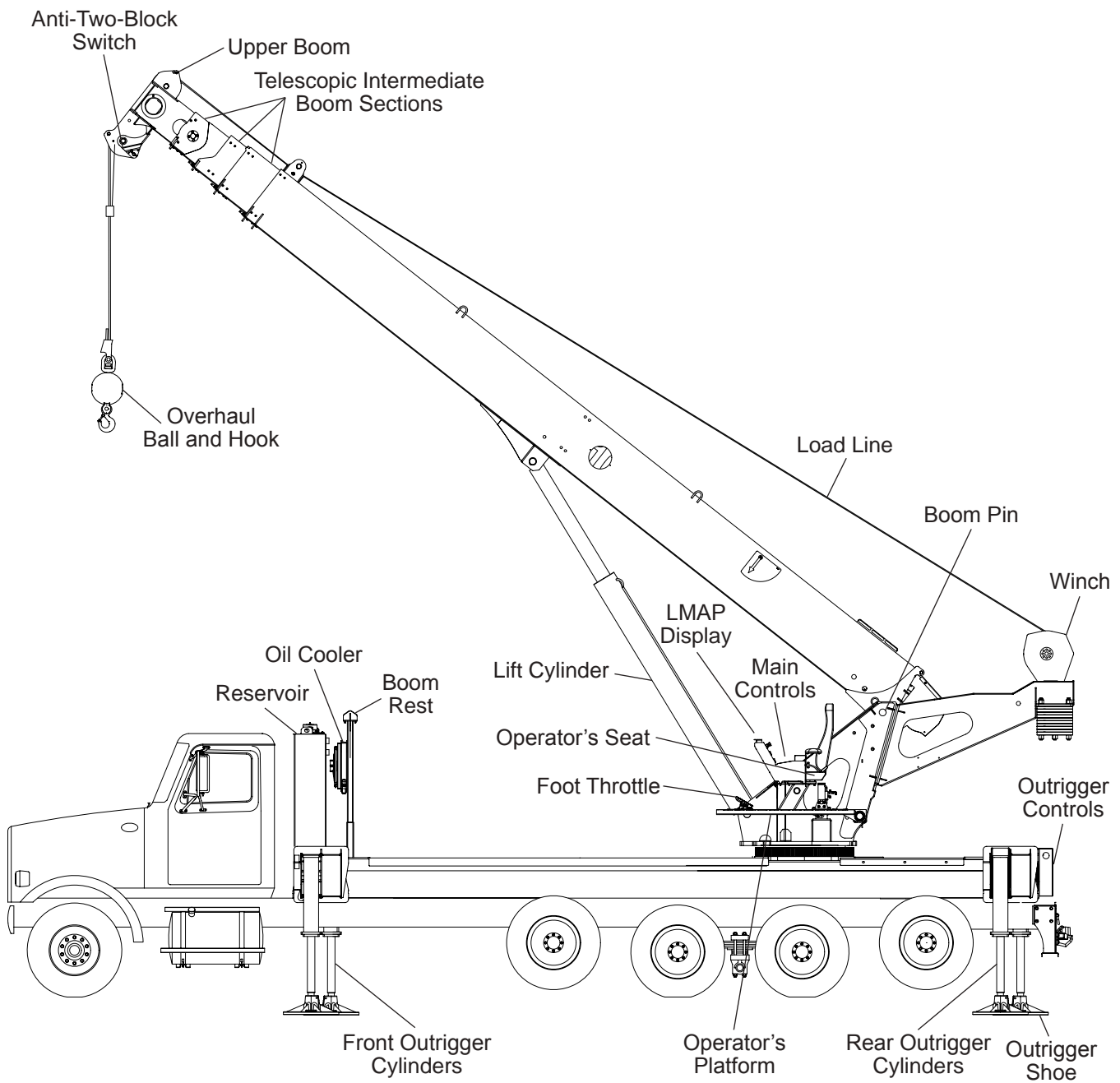
Item	AC45-127S
Maximum rated capacity	45 tons (40,823 kg)
Boom length	127' (38.71 m)
Jib length	55' (16.76 m)
Maximum sheave height at 80°	
All boom sections retracted without jib	42' (12.80 m)
All boom sections extended with jib	189' (57.61 m)
All boom sections extended without jib	135' (41.15 m)
Stowed travel height	13' 1" (3.99 m)
Boom angle	-10° to 80°
Oil reservoir capacity	90 gallon (340.69 l)
Maximum hydraulic pressure setting	3,300 psi (227.53 bar)
Dielectric rating	Non-insulated
Rotation	360°, continuous

Figure 2.1 — Unit Specifications

Layer	Low Speed		High Speed		Cumulative 5/8 Cable ft (m)
	Line Pull lbs (kg)	Line Speed fpm (mpm)	Line Pull lbs (kg)	Line Speed fpm (mpm)	
1	15,060 (6,831)	100 (31)	6,340 (2,876)	234 (71)	64 (19.51)
2	13,560 (6,151)	112 (34)	5,710 (2,590)	260 (79)	135 (41.15)
3	12,340 (5,597)	123 (38)	5,200 (2,359)	286 (87)	213 (64.92)
4	11,320 (5,135)	134 (41)	4,770 (2,164)	312 (95)	298 (90.83)
5	10,450 (4,740)	145 (44)	4,400 (1,996)	338 (103)	390 (118.87)

Figure 2.2 — Two-Speed Winch Specification

Component Identification



Section 3 — Safety

Safety Instructions

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

DANGER

Death or serious injury will result from careless or improper use of the unit. Do not operate the unit without proper training. Operators shall be required to successfully meet the qualifications for operating commercial truck mounted cranes.

WARNING

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

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

DANGER

Death or serious injury will result from unprotected contact with energized conductors. Maintain safe clearances from electrical power lines and apparatus. Allow for platform or line sway, rock, or sag.

Death or serious injury will result from unprotected contact with energized conductors. This unit does not provide protection from contact with or proximity to an electrically charged conductor when you are in contact with or in proximity to another conductor or any grounded device, material, or equipment. Maintain safe clearances from energized conductors.

Death or serious injury will result from unprotected contact with energized conductors. Read and understand the contents of Section 4 before operating the unit near energized conductors.

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

Operator Qualifications

General Operating Information

- Do not operate the unit without proper training.
- Be sure the unit is operating properly, and has been inspected, maintained, and tested in accordance with the manufacturer's and government's requirements.
- Use the personal fall protection system if operating the unit from the platform.
- Be aware of the surroundings. Position the unit in an area free of obstructions and power lines.
- Perform the appropriate Shift Preoperational Inspection before operating the unit each day.
- Apply the parking brake, start the engine, and engage the power take-off (PTO). Properly set the outriggers.
- Properly set up the unit before moving the boom from the rest.
- Operate the controls smoothly, avoiding sudden starts and stops.
- Never exceed the listed capacity values and be aware of your operating radius and actual weight of the load being lifted.
- Follow all of your employer's work rules and applicable government regulations.

Qualified Operators

Cranes should be operated only by the following personnel.

- Operators who have successfully met all of the qualifications identified in this section and all of the operator training and qualifications established by the owner of the equipment.
- Trainees under the direct supervision of a designated, qualified operator who is trained for the type of crane being operated.
- Crane maintenance personnel who have completed all operator trainee qualification requirements. Operation by these persons should be limited to those crane functions necessary to perform maintenance on the crane or to verify the performance of the crane after maintenance has been performed.

- Inspectors who have completed all operator trainee qualification requirements. Operation by these persons should be limited to those crane functions necessary to accomplish the inspection.

Operator Physical Requirements

Operator and trainees shall meet the following physical qualifications unless it can be shown that failure to meet the qualifications will not affect the operation of the crane. In such cases, specialized clinical or medical judgements and tests may be required.

- Operator and trainee requirements shall include, but not be limited to evidence of successfully passing a physical examination.
- Operators and trainees must have vision of at least 20/30 Snellen in one eye and 20/50 in the other with or without corrective lenses.
- Operators and trainees must have adequate hearing, to meet operational demands, with or without hearing aid.
- Operators and trainees must have sufficient strength, endurance, agility, coordination, and speed of reaction to meet the operation demands.
- Operators and trainees must be capable of color differentiation if color differentiation is required, including the ability to distinguish colors, regardless of position.
- Operators and trainees must have normal depth perception, field of vision, reaction time, manual dexterity, coordination, and no tendencies to dizziness or similar undesirable characteristics.
- Each operator or trainee shall successfully pass with a negative result a substance abuse test. The level of testing will be determined by the standard practice for the industry where the crane is employed and this test shall be confirmed by a recognized laboratory service.
- No evidence shall be present of physical defects or emotional instability that could render a hazard to the operator or others, or that in the opinion of the examiner could interfere with the operator's performance. If evidence of this nature is found, it may be sufficient cause for disqualification.
- Evidence that an operator is subject to seizures or loss of physical control shall be sufficient reason for disqualification. Specialized medical tests may be required to determine these conditions.

Qualification of Operators

Operator and trainees shall meet the following qualifications.

- Satisfactory completion of a written examination covering operational characteristics, controls, and emergency control skills such as responsiveness to fire, power line contact, loss of stability, or control malfunction, as well as characteristic and performance questions appropriate to the crane type for which qualification is sought.
- Demonstration of their ability to read, write, comprehend, and exhibit arithmetic skills and load/capacity chart usage, in the language of the crane manufacturer's operation and maintenance instruction materials.
- Satisfactory completion of a combination written and verbal test on load/capacity chart usage that covers a selection of the configurations (the crane may be equipped to handle) for the type crane for which qualification is being sought.
- Completion of an operation test demonstrating proficiency in handling the specific type crane, including both pre-start and post-start inspection, maneuvering skills, shut down, and securing procedures.
- Operators shall demonstrate understanding of all applicable standards and federal, state, and local requirements.

Requalification of Operators

Operators who have successfully qualified for a specific type crane shall be required to be requalified if supervision deems necessary.

- Requalification shall include, but not be limited to evidence of successfully passing a current physical examination.
- Satisfactory completion of a written examination covering operational characteristics, controls, and emergency control skills such as responsiveness to fire, power line contact, loss of stability or control malfunctions, as well as characteristic performance stability questions appropriate to the crane type for which they are being requalified.
- Demonstration of their ability to read, write, comprehend, and exhibit arithmetic skills and load/capacity chart usage, in the language of the crane manufacturer's operation and maintenance instruction materials.

- Satisfactory completion of a combination written and verbal test on load/capacity chart usage that covers a selection of the configurations (the crane may be equipped to handle) for the type of crane for which the operator is being requalified.
- Completion of an operations test demonstrating proficiency in handling the specific type crane on which they are being requalified, including both pre-start and post-start inspections, maneuvering skills, shutdown, and securing procedures.
- Operators shall demonstrate understanding of all applicable standards and federal, state, and local safety requirements.

Operator Conduct

Operators who have been successfully qualified for a specific type crane shall conduct themselves in the following manner.

- The operator shall be familiar with the equipment and its proper care. If adjustments or repairs are necessary, the operator shall promptly report this to the appointed person, and notify the next operator.
- All controls shall be tested by the operator at the start of a new shift. If any controls fail to operate properly, they shall be adjusted or repaired before operations are to begin.
- The operator shall not engage in any practice that will divert his attention while actually engaged in operating the crane.
- When physically or mentally unfit, an operator shall not engage in the operation of the equipment.
- The operator shall respond to signals from the person who is directing the lift or to an appointed signal person.
- When a signal person or crane follower is not required as part of the crane operation, the operator is then responsible for the lifts. However, the operator shall obey a stop signal at all times, no matter who gives it.
- Each operator shall be held responsible for those operations under the operator's direct control. Whenever there is any doubt as to safety, the operator shall consult with the supervisor before handling loads.
- Before leaving the crane unattended the operator shall do the following.
 - Land any load, bucket, lifting magnet, or other device

- Set controls in the off or neutral position
- Secure the crane against accidental travel
- Stop the engine

- An exception to stopping the engine when leaving the controls may exist when crane operation is frequently interrupted during a shift and the operator must leave the crane. Under these circumstances, the engine may remain running and the following conditions listed above shall apply. The operator shall be situated where unauthorized entry of the crane can be observed, and the crane shall be located within an area protected from unauthorized entry.
- The maximum in service wind speed is 20 mph (32 kph). It is recommended when wind velocity is between 20 mph (32 kph) and 30 mph (48 kph) rated loads and boom lengths shall be appropriately reduced and/or other measures shall be taken to ensure stability and load control. When wind speed exceeds 30 mph (48 kph) main boom should be retracted and stowed.
- If there is a warning sign on the switch or engine starting controls, the operator shall not close the switch or start the engine until the warning sign has been removed by an appointed person.
- Before closing the switch or starting the engine, the operator shall see that all controls are in the off or neutral position and that all personnel are in the clear.
- If power fails during operations, the operator shall set all brakes and locking devices, move all clutches or other power controls to the off or neutral position and if practical, land the suspended load under brake control.

Movement of the Load

Preparation for Operation

The manufacturer's boom assembly and disassembly procedures should be followed. Any deviation from the manufacturer's procedure shall require blocking of the boom or boom sections to prevent inadvertent dropping of the boom.

When removing pins or bolts from a jib, workers must follow the erection and stowage procedures and stay clear of the swing area.

Outriggers

Use of outriggers is required anytime the boom is removed from the rest. The outriggers shall be fully extended or deployed per load rating chart specifications and set to remove the machine weight from wheels.

Each outrigger shall be visible to the operator or to a signal person during extension or setting. The person directing the lift shall see that the crane is level and, where necessary blocked. The load must be well secured and balanced in the sling or lifting device before it is lifted more than a few inches. The lift and swing path must be clear of the swing radius and the swing path of the crane counterweight must also be clear.

Outrigger shoes shall be attached to the outriggers. Blocking under outrigger shoes, when required, shall meet the following requirements.

- Sufficient strength to prevent crushing, bending, or shear failure.
- Such thickness, width, and length as to completely support the pad, transmit the load to the supporting surface, and prevent shifting, topping, or excessive settlement under load.
- Use blocking only under the outrigger shoe, not under the extended outrigger beam.

Preparation for Lifting the Load

Before starting to lift, the following conditions should be noted.

- The hoist rope shall not be kinked.
- Multiple part lines shall not be twisted around each other.
- The hook shall be brought over the load in such a manner as to minimize swinging.
- If there is a slack rope condition, it shall be determined that the rope is seated on the drum and in the sheaves as the slack is removed.
- The effect of ambient wind on the load and on crane stability shall be considered.

Lifting the Load

As the operator begins to lift the load, the following procedures should be followed.

- During lifting operations, care shall be taken to ensure that there is no sudden acceleration or deceleration of the moving load.
- Make sure that the load, booms, or other parts of the machine do not contact any obstruction.
- The operator shall avoid lifting loads over people.

- Personnel shall not be permitted to ride the bare hook or a load of material suspended from the hook.
- The operator shall test the brakes each time a load approaching the rated load is handled by lifting it a few inches and returning the controls to neutral.
- Lifts shall be limited to freely suspended loads. Cranes shall not be used for dragging loads sideways.
- When rotating the crane, sudden starts and stops shall be avoided. Rotational speed shall be such that the load does not swing out beyond the radius at which it can be controlled. A tag or restraint line shall be used when rotation of the load is hazardous.
- Wire rope shall not be handled on a capstan head without the knowledge of the operator. While a winch head is being used, the operator shall be within convenient reach of the power unit control lever.
- The load shall not be lowered below the point where less than three full wraps of rope remain on the drum.
- When two or more cranes are used to lift one load, one designated person shall be responsible for the operation. That person shall analyze the operation and instruct all personnel involved in the proper positioning, rigging of the load, and the movements to be made. Decisions such as the necessity to reduce crane ratings, load position, boom location, ground support, and speed of movement shall be in accordance with this determination.

Transit

While in transit the following additional precautions shall be exercised.

- The boom shall be carried in line with the direction of motion.
- The empty hook shall be lashed or otherwise restrained so that it cannot swing freely.
- The optional personnel platform shall be firmly stowed on the deck of the unit.

Standard Signals

Signals shall be discernible or audible at all times. No response shall be made unless signals are clearly understood.

Hand signals shall be in accordance with the decal titled Standard Hand Signals for Controlling Crane Operations which is mounted on the unit (refer to the Appendix).

Crane Inspection

Inspection procedures for cranes in regular service are divided into three general classifications based upon the intervals at which inspection should be performed. The intervals are dependent in turn upon the nature of the critical components of the crane and the degree of their exposure to wear, deterioration, and/or malfunction. The three general classifications are herein designated as shift, monthly, and annual/comprehensive with the respective intervals between inspections defined as follows.

- Shift inspection includes each shift the equipment will be used.
- Monthly inspection includes each month the equipment is in service.
- Annual/comprehensive inspection means at least every 12 months the equipment will be inspected.



Death or serious injury can result from failure to properly inspect this unit each shift.

Shift Inspections

A competent person must complete a visual inspection prior to use in each shift that the equipment is in service. The inspection must consist of observation for apparent deficiencies. Taking apart equipment components and booming down is not required as part of this inspection unless the results of the visual inspection or trial operation indicate that further investigation will be necessary to take apart equipment components or boom down. Determinations made in conducting the inspection must be reassessed in light of observations made during operation. Refer to the Appendix for the Shift/Monthly Inspection Checklist.

Identified Deficiency

If any deficiency is identified during the inspection, an immediate determination must be made by the competent person as to whether the deficiency constitutes a safety hazard. If the deficiency is determined to constitute a safety hazard, the equipment must be taken out of service until it has been corrected.

Safety devices must be in proper working order for operation to begin. If a device stops working properly during operation, the operator must safely stop operation. If any of the devices listed in the inspection are not in proper working order, the equipment must be taken out of service and operation must not resume until the device is working properly. Alternative measures are not permitted to be used.

Operational aids must be in proper working order for operation to begin. When an operational aid is being repaired, the employer uses the specified temporary alternative measures. If an operational aid stops working properly during operation, the operator must safely stop operation until the temporary alternative measures are implemented or the device is working properly. Follow the proper procedures for the following operational aids.

- Anti-two-blocking – Clearly mark the winch hoist cable(s) so that the operator can easily see it at a point that will give the operator sufficient time to stop the hoist to prevent two-blocking. Use a spotter when extending the boom.
- Boom angle or radius indicator (LMAP) – Refer to Maintenance Manual for LMAP details. Radii or boom angle must be determined by measuring the radii or boom angle with a measuring device.
- Boom length indicator (LMAP) – Use one or more of the following methods: mark the boom with measured marks; measure the boom with a measuring device; calculate boom length from boom angle and radius measurements.
- Load weighing device (LMAP) – The weight of the load must be determined from a source recognized by the industry (such as the load's manufacturer) or by a calculation method recognized by the industry (such as calculating a steel beam from measured dimensions and a known per foot weight). This information must be provided to the operator prior to the lift.
- Outrigger/boom interlocks – The operator must verify that the position of the outrigger is correct before beginning operation.
- Hoist drum rotation indicator – Mark the drum to indicate the rotation. In addition, install mirrors or remote video cameras and displays if necessary for the operator to see the mark.

Operational aids that are not working properly must be repaired or parts ordered no later than seven calendar days after the deficiency occurs. The repair must be completed within seven calendar days of receipt of the parts.

If equipment adjustments or repairs are necessary, the operator must, in writing, promptly inform the person designated by the employer to receive such information and, where there are successive shifts, to the next operator. In addition, the employer must notify all affected employees at the beginning of each shift of the necessary adjustments or repairs and all alternative measures.

Monthly Inspection

Each month the unit is in service it must be inspected in accordance with the shift inspection. The unit must not be used until a complete shift and monthly inspection shows that no corrective action is required.

The Shift/Monthly Inspection Checklist must be documented and maintained by the employer that conducts the inspection for a minimum of three months. Refer to the Appendix for the Shift/Monthly Inspection Checklist.

Annual/Comprehensive

Every 12 months the equipment must be inspected by a qualified person in accordance with the Shift/Monthly Inspection Checklist plus the Annual Inspection Checklist. Disassembly is required to complete the inspection. Refer to the Appendix for the Annual Inspection Checklist.

Identified Deficiency

If any deficiency is identified, an immediate determination must be made by the qualified person as to whether the deficiency constitutes a safety hazard or, though not yet a safety hazard, needs to be monitored in the monthly inspections.

If the qualified person determines that a deficiency is a safety hazard, the equipment must be taken out of service until it has been corrected except when temporary alternative measures are implemented as specified in shift inspection.

If the qualified person determines that, though not presently a safety hazard, the deficiency needs to be monitored, the employer must ensure that the deficiency is checked in the monthly inspections.

Documentation of Annual/Comprehensive Inspection

The Annual Inspection Checklist must be documented, maintained, and retained for a minimum of 12 months by the employer that conducts the inspection. Refer to the Appendix for the Annual Inspection Checklist.

Severe Operation

Where the severity of use/condition is such that there is a reasonable probability of damage or excessive wear (such as loading that may have exceeded rated capacity, shock loading that may have exceeded rated capacity, prolonged exposure to a corrosive atmosphere), the employer must stop using the equipment and a qualified person must do the following.

- Inspect the equipment for structural damage to determine if the equipment can continue to be used safely.
- Determine whether any items or conditions listed under the annual/comprehensive inspection need to

be inspected; if so, the qualified person must inspect those items or conditions.

- If a deficiency is found, the employer must follow the requirements found in this manual under Identified Deficiency.

Equipment Not In Regular Use

Equipment that has been idle for three months or more must be inspected by a qualified person in accordance with the requirements of the monthly inspection.

Any part of a manufacturer's procedure regarding inspections that relates to safe operation (such as to a safety device or operational aid, critical part of a control system, power plant, braking system, load-sustaining structural components, load hook, or in-use operating mechanism) that is more comprehensive or has a more frequent schedule of inspection than the requirements of this section must be followed.

Available Documents

All documents produced under this section must be available during the applicable document retention period to all persons who conduct inspections per requirements of this manual.

Wire Rope Inspection

Inspection procedures for wire rope in regular service are divided into three general classifications based upon the intervals at which inspection should be performed. The intervals are dependent in turn upon the nature of the critical components of the wire rope and the degree of their exposure to wear, deterioration, and/or malfunction. The three general classifications are herein designated as shift, monthly and annual/comprehensive with the respective intervals between inspections defined below.

- Shift inspection includes each shift the equipment will be used.
- Monthly inspection includes each month the equipment is in service.
- Annual/comprehensive inspection means at least every 12 months the equipment will be inspected.



WARNING

Death or serious injury can result from failure to properly inspect this unit each shift.

Shift Inspection

A competent person must complete a visual inspection prior to use in each shift that the equipment is in service.

The inspection must consist of observation of wire ropes (running and standing) that are likely to be in use during the shift for apparent deficiencies as listed in this section. Untwisting (opening) of wire rope or booming down is not required as part of this inspection. Refer to the Wire Rope Inspection Checklist for the proper shift inspection.

Removal From Service

If a deficiency in Category 1 as listed in the checklist is identified, an immediate determination must be made by the competent person as to whether the deficiency constitutes a safety hazard. If the deficiency is determined to constitute a safety hazard, operation involving use of the wire rope in question must be prohibited until the following measures are followed.

- The wire rope is replaced.
- If the deficiency is localized, the problem is corrected by severing the wire rope in two; the undamaged portion may continue to be used. Joining lengths of wire rope by splicing is prohibited. If a rope is shortened under this paragraph, the employer must ensure that the drum will still have three wraps of wire when the load and/or boom is in its lowest position.

If a deficiency in Category 2 as listed in the checklist is identified, operations involving use of the wire rope in question must be prohibited until the following measures are followed.

- The employer complies with the wire rope manufacturer's established criterion for removal from service or a different criterion that the wire rope manufacturer has approved in writing for that specific wire rope.
- The wire rope is replaced.
- If the deficiency is localized, the problem is corrected by severing the wire rope in two; the undamaged portion may continue to be used. Joining lengths of wire rope by splicing is prohibited. If a rope is shortened under this paragraph, the employer must ensure that the drum will still have three wraps of wire when the load and/or boom is in its lowest position.

If a deficiency in Category 3 as listed in the checklist is identified, operations involving use of the wire rope in question must be prohibited until the following measures are followed.

- The wire rope is replaced.
- If the deficiency (other than power line contact) is localized, the problem is corrected by severing the wire rope in two; the undamaged portion may continue

to be used. Joining lengths of wire rope by splicing is prohibited. Repair of wire rope that contacted an energized power line is also prohibited. If a rope is shortened under this paragraph, the employer must ensure that the drum will still have two wraps of wire when the load and/or boom is in its lowest position.

NOTICE

Where a wire rope is required to be removed from service under this section, either the equipment (as a whole) or the hoist with that wire rope must be tagged out in accordance with requirements in this manual under Tag Out until the wire rope is repaired or replaced.

Wire Rope Monthly Inspection

Each month an inspection must be conducted in accordance with the wire rope shift inspection (refer to Wire Rope Inspection Checklist). The inspection must include any deficiencies that the qualified person who conducts the wire rope annual/comprehensive inspection determines must be monitored. Wire ropes on equipment must not be used until a monthly inspection demonstrates that no corrective action is required under the section removal from service.

Annual/Comprehensive

Every 12 months, wire ropes in use on equipment must be inspected by a qualified person in accordance with the Wire Rope Inspection Checklist.

In the event an annual/comprehensive inspection is not feasible due to existing set-up and configuration of the equipment (such as where an assist crane is needed) or due to site conditions (such as a dense urban setting), such inspections must be conducted as soon as it becomes feasible but no longer than an additional six months for running ropes and at the time of disassembly for standing ropes.

If a deficiency is identified, an immediate determination must be made by the qualified person as to whether the deficiency constitutes a safety hazard.

- If the deficiency is determined to constitute a safety hazard, operation involving use of the wire rope in question must be prohibited until the following measures are taken.
- The wire rope is replaced.
- If the deficiency is localized, the problem is corrected by severing the wire rope in two; the undamaged portion may continue to be used. Joining lengths of wire rope by splicing is prohibited. If a rope is shortened

under this paragraph, the employer must ensure that the drum will still have three wraps of wire when the load and/or boom is in its lowest position.

- If the qualified person determines that, though not presently a safety hazard, the deficiency needs to be monitored, the employer must ensure that the deficiency is checked in the monthly inspections.

NOTICE

Rope lubricants that are of the type that hinder inspection must not be used.

Where a wire rope is required to be removed from service under this section, either the equipment (as a whole) or the hoist with that wire rope must be tagged out in accordance with requirements in this manual under Tag Out until the wire rope is repaired or replaced.

Available Documents

All documents produced under this section must be available during the applicable document retention period to all persons who conduct inspections per requirements of this manual.

Tag Out

Tagging Out of Service Equipment/Functions

Where the employer has taken equipment out of service, a tag must be placed in the cab and/or at all control stations stating that the equipment is out of service and is not to be used. Where the employer has taken a function(s) out of service, a tag must be placed in a conspicuous position at all control stations stating that the function is out of service and is not to be used.

Response to Do Not Operate/Tag Out Signs

- If there is a warning (tag out or maintenance/do not operate) sign on the equipment, starting control, or any other switch or control, the operator must not activate the switch or start the equipment until the sign has been removed by a person authorized to remove it or until the operator has verified the following.
- No one is servicing, working on or otherwise in a dangerous position on the machine.
- The equipment has been repaired and is working properly.

Maintenance Safety

Maintenance Procedure

Before adjustments and repairs are started on a crane, the following precautions shall be taken as applicable.

- Crane placed where it will cause the least interference with other equipment or operations in the area.
- All controls in the off position and all operating features secured from inadvertent motion by brakes, pawls, or other means.
- Starting means rendered inoperative.
- Power plant stopped or disconnected at PTO.
- Boom lowered to the ground, if possible, or otherwise secured against dropping.
- Lower load block lowered to the ground or otherwise secured against dropping.
- Hydraulic oil pressure must be relieved from all hydraulic circuits before loosening or removing hydraulic components.

Warning or out of order signs shall be placed on the crane controls. Signs or flags shall be removed only by authorized personnel. After adjustments and repairs have been made, the crane shall not be returned to service until all guards have been reinstalled, and trapped air is removed from the hydraulic system. Additionally, operator aids and safety devices must be functioning and maintenance equipment removed.

Lubrication

Machinery shall be stationary while lubricants are being applied and protection provided.

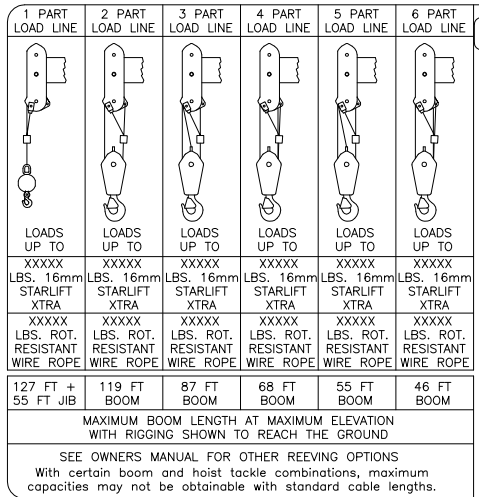
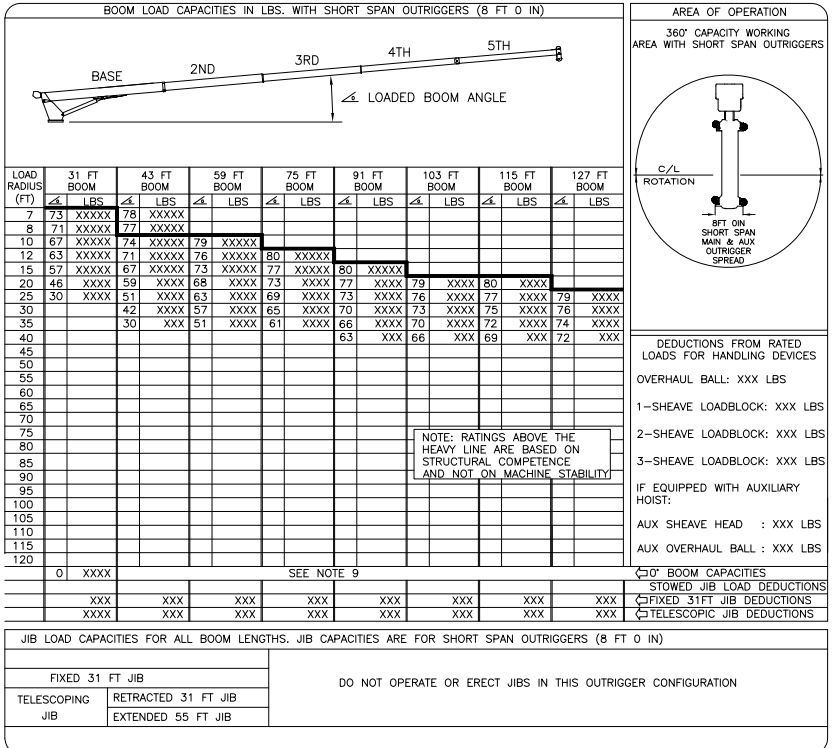
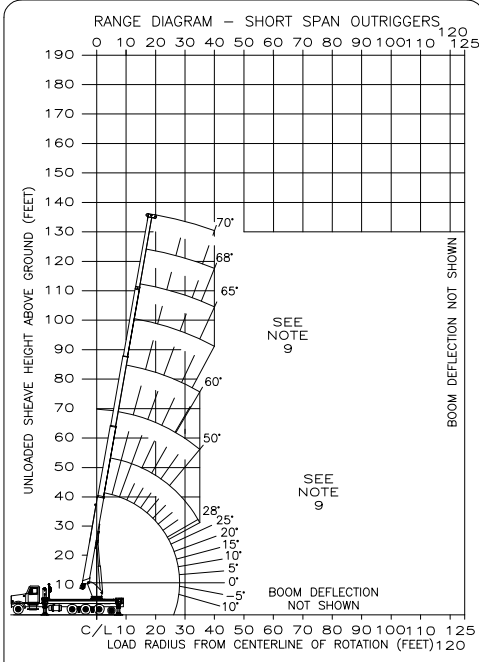
Lubricating systems should be inspected for proper delivery of lubricant. All moving parts of the crane for which lubrication is specified should be regularly lubricated (see unit lubrication chart in the Maintenance Manual).

Capacity

A sample range diagram, load capacity chart, and platform use capacity placard with associated notes is shown in Figures 3.1 through 3.3.

Factors to consider when using the load capacity chart are listed below.

- The load is lifted with the winch line at boom tip or with material handling jib.
- The load being lifted must not exceed the smallest of the following values.
 - Load capacity shown in the chart minus the deductions for load handling devices and all options mounted on the boom.



CAUTION

OPERATOR AIDS MUST BE IN GOOD OPERATING CONDITION BEFORE OPERATING CRANE. REFER TO OWNERS MANUAL.

KEEP AT LEAST 3 WRAPS OF LOADLINE ON DRUM AT ALL TIMES.

USE ONLY 16mm DIAMETER STAR LIFT XTRA WIRE ROPE WITH XXXXX LBS. MIN. BREAKING STRENGTH OR ROTATION RESISTANT WIRE ROPE WITH XXXXX LBS. MIN. BREAKING STRENGTH ON THIS MACHINE.

DANGER

- The operator must read, understand and follow the instructions found in the owners manual before operating this crane.
- Positioning or operation of crane beyond areas shown on this chart is not intended nor approved except where specified in owners manual.
- Loaded boom angles at specified boom lengths give only an approximation of the operating radius. The boom angle before loading should be greater to account for deflections. Do not exceed the operating radius for rated loads.
- When between listed boom lengths or radii, always use the smallest of the values shown. Capacities for the 31-ft boom length must only be lifted with boom fully retracted.
- Do not attempt to tip the machine to determine allowable loads.
- When jib is erected boom must be fully retracted before lowering below minimum boom with jib angles. Retracted boom with jib has no lifting capacity below a 50° angle with full span outriggers and below a 65° angle with mid span outriggers.
- Use rating of next lower boom angle for boom angles not shown on jib load rating chart.
- Do not lift off the main boom tip while the jib is erected. Do not travel with crane boom extended or jib erected.
- Do not lower boom into this area. Instability may occur. Hydraulic pressure may not allow raising the boom without retracting boom first.
- Crane load ratings on outriggers are based on freely suspended loads with the machine leveled and standing on firm uniform supporting surface. Do not move a load horizontally on the ground in any direction.
- Actual working capacities depend on supporting surface, wind and other factors affecting stability such as hazardous surroundings, experience of personnel, and proper handling. All these factors must be taken into account by the operator.
- The maximum in service wind speed is 20 mph. It is recommended when wind velocity is between 20 mph and 30 mph rated loads and boom lengths shall be appropriately reduced and/or other measures shall be taken to ensure stability and load control. When wind speed exceeds 30 mph main boom should be retracted and stowed.
- For duty cycle operations (e.g., clam shell, concrete bucket work) weight of load must not exceed 80% of rated lifting capacities.
- Multi-crane lift operations must be carefully planned well in advance and should only be performed by skilled personnel experienced in such procedures.
- The maximum load which may be telescoped is limited by hydraulic pressure, boom angle and boom lubrication. It is allowable to attempt to telescope any load within the limits of the load rating chart.
- Never handle personnel with this machine unless the requirements of applicable national, state, and local regulations and safety codes are met.
- Do not lift loads when boom is fully lowered. The LMAP senses pressure and will not provide warnings or lockout when the boom cylinder is fully retracted.

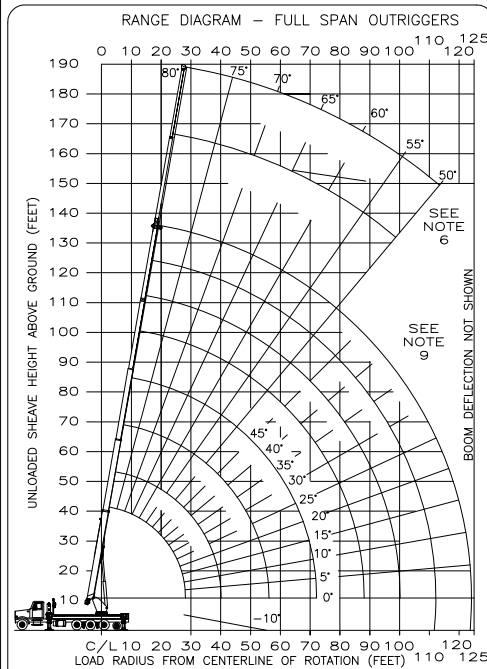
THIS MACHINE COMPLIES WITH ASME B30.5 AND OSHA REGULATIONS 1910.180 AND 1926.1400 WHERE APPLICABLE AT DATE OF MANUFACTURE

REMOVAL OF THIS PLACARD IS A VIOLATION OF THE LAW

Figure 3.1 — Sample Range Diagram and Capacity Placards for Short Span Outriggers (refer to chart on machine for capacities to be used for lifting)



MODEL:
ACXX-XXXX



BOOM LOAD CAPACITIES IN LBS. WITH FULL SPAN OUTRIGGERS (24 FT)

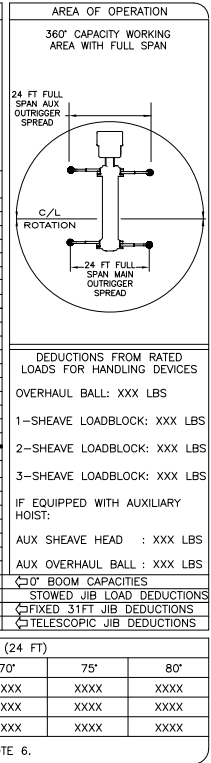
LOAD RADIUS (FT)	31 FT BOOM	43 FT BOOM	59 FT BOOM	75 FT BOOM	91 FT BOOM	103 FT BOOM	115 FT BOOM	127 FT BOOM
7	73 XXXXX	78 XXXXX						
8	71 XXXXX	77 XXXXX						
10	67 XXXXX	74 XXXXX	79 XXXXX					
12	63 XXXXX	71 XXXXX	77 XXXXX	80 XXXXX				
15	57 XXXXX	67 XXXXX	74 XXXXX	78 XXXXX	80 XXXXX			
20	44 XXXXX	59 XXXXX	69 XXXXX	74 XXXXX	78 XXXXX	79 XXXXX	80 XXXXX	
25	28 XXXXX	41 XXXXX	57 XXXXX	66 XXXXX	71 XXXXX	74 XXXXX	76 XXXXX	80 XXXXX
30								
35		28 XXXXX	51 XXXXX	61 XXXXX	68 XXXXX	71 XXXXX	74 XXXXX	75 XXXXX
40			44 XXXXX	57 XXXXX	64 XXXXX	68 XXXXX	71 XXXXX	73 XXXXX
45			36 XXXXX	52 XXXXX	60 XXXXX	65 XXXXX	68 XXXXX	71 XXXX
50			27 XXXX	46 XXXXX	57 XXXXX	62 XXXX	65 XXXX	69 XXXX
55					41 XXXX	53 XXXX	58 XXXX	63 XXXX
60					35 XXXX	48 XXXX	55 XXXX	60 XXXX
65					27 XXXX	44 XXXX	51 XXXX	57 XXXX
70					15 XXXX	39 XXXX	47 XXXX	53 XXXX
75						33 XXXX	43 XXXX	50 XXXX
80						26 XXXX	39 XXXX	46 XXXX
85						17 XXXX	34 XXXX	43 XXXX
90							28 XXXX	39 XXXX
95							20 XXXX	34 XXXX
100							5 XXXX	29 XXXX
105								22 XXXX
110								13 XXXX
115								24 XXXX
120								17 XXXX
0	XXXX	0 XXXX	0 XXXX	0 XXXX	0 XXXX	0 XXXX	0 XXXX	0 XXXX
	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

NOTE: RATINGS ABOVE THE HEAVY LINE ARE BASED ON STRUCTURAL COMPETENCE AND NOT ON MACHINE STABILITY

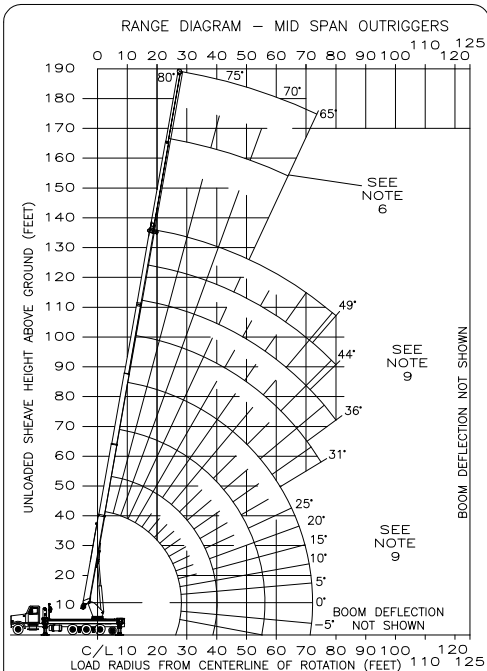
JIB LOAD CAPACITIES (LBS) FOR ALL BOOM LENGTHS. JIB CAPACITIES ARE FOR FULL SPAN OUTRIGGERS (24 FT)

LOADED BOOM ANGLE	50°*	55°	60°	65°	70°	75°	80°
FIXED 31 FT JIB	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
TELESCOPING JIB	RETRACTED 31 FT JIB	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
	EXTENDED 55 FT JIB	XXX	XXXX	XXXX	XXXX	XXXX	XXXX

* DO NOT OPERATE JIBS BELOW THIS ANGLE UNLESS BOOM IS FULLY RETRACTED. SEE NOTE 6.



MODEL:
ACXX-XXXX



BOOM LOAD CAPACITIES IN LBS. WITH MID SPAN OUTRIGGERS (17 FT 11 IN)

LOAD RADIUS (FT)	31 FT BOOM	43 FT BOOM	59 FT BOOM	75 FT BOOM	91 FT BOOM	103 FT BOOM	115 FT BOOM	127 FT BOOM
7	73 XXXXX	78 XXXXX						
8	71 XXXXX	77 XXXXX						
10	67 XXXXX	74 XXXXX	79 XXXXX					
12	63 XXXXX	71 XXXXX	77 XXXXX	80 XXXXX				
15	57 XXXXX	67 XXXXX	74 XXXXX	78 XXXXX	80 XXXXX			
20	44 XXXXX	59 XXXXX	69 XXXXX	74 XXXXX	78 XXXXX	79 XXXXX	80 XXXXX	
25	25 XXXXX	41 XXXXX	57 XXXXX	66 XXXXX	71 XXXXX	74 XXXXX	76 XXXXX	80 XXXXX
30								
35		28 XXXXX	51 XXXXX	61 XXXXX	67 XXXXX	71 XXXXX	73 XXXXX	75 XXXXX
40			45 XXXX	57 XXXX	64 XXXX	67 XXXX	71 XXXX	73 XXXX
45			37 XXXX	52 XXXX	60 XXXX	64 XXXX	68 XXXX	71 XXXX
50			28 XXXX	46 XXXX	56 XXXX	61 XXXX	65 XXXX	68 XXXX
55			12 XXXX	41 XXXX	52 XXXX	58 XXXX	62 XXXX	65 XXXX
60					34 XXXX	48 XXXX	54 XXXX	59 XXXX
65					26 XXXX	43 XXXX	50 XXXX	56 XXXX
70					15 XXXX	38 XXXX	47 XXXX	52 XXXX
75						32 XXXX	42 XXXX	49 XXXX
80							38 XXXX	46 XXXX
85								33 XXXX
90								
95								
100								
105								
110								
115								
120								
0	XXXX	0 XXXX	0 XXXX	0 XXXX				
	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

NOTE: RATINGS ABOVE THE HEAVY LINE ARE BASED ON STRUCTURAL COMPETENCE AND NOT ON MACHINE STABILITY

JIB LOAD CAPACITIES (LBS) FOR ALL BOOM LENGTHS. JIB CAPACITIES ARE FOR MID SPAN OUTRIGGERS (17 FT 11 IN)

LOADED BOOM ANGLE	65°*	70°	75°	80°
FIXED 31 FT JIB	XXXX	XXXX	XXXX	XXXX
TELESCOPING JIB	RETRACTED 31 FT JIB	XXXX	XXXX	XXXX
	EXTENDED 55 FT JIB	XXXX	XXXX	XXXX

* DO NOT OPERATE JIBS BELOW THIS ANGLE UNLESS BOOM IS FULLY RETRACTED. SEE NOTE 6.

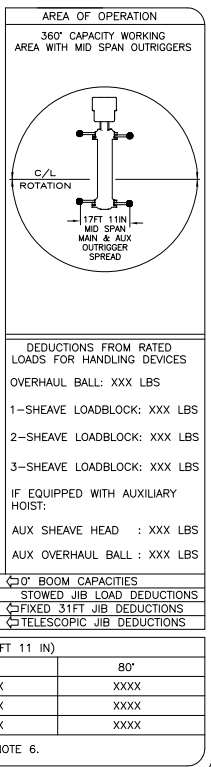
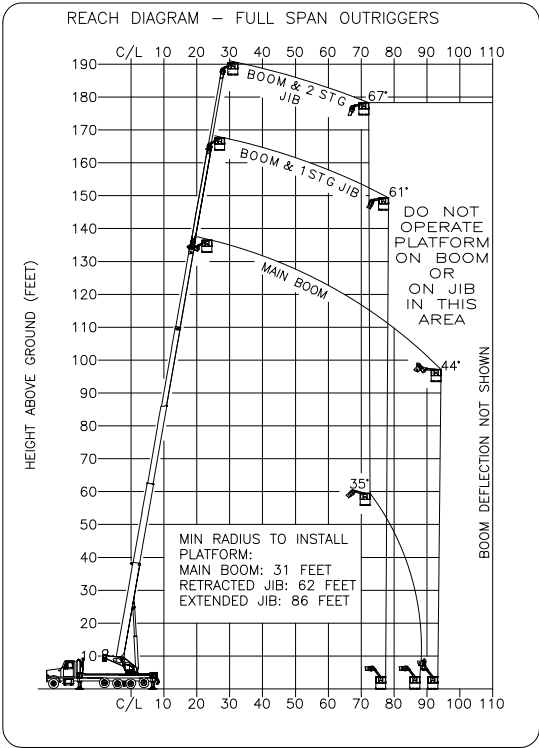


Figure 3.2 — Sample Range Diagram and Capacity Placards for Mid and Full Span Outriggers (refer to chart on machine for capacities to be used for lifting)



AERIAL OPERATION—BOOM & JIB
MODEL ACXX—XXXS

NON—INSULATED
PLATFORM
ASSEMBLY



FOR USE WITH ALTEC PLATFORM ASSEMBLY PART NUMBER 970268044 OR 970369795 ONLY.

ONLY FOR USE ON ALTEC ACXX—XXXS.

DO NOT OPERATE THE PLATFORM IN WINDS IN EXCESS OF 20 MPH AT PLATFORM WORKING HEIGHT.

PLATFORM ASSEMBLY WEIGHT = XXX LBS.

PLATFORM LOAD CAPACITY = XXX LBS.

LOAD LINE MUST BE STOWED AT WINCH WHEN UNIT IS OPERATED IN AERIAL MODE.

ANSI/SIA A92.2 COMPLIANT

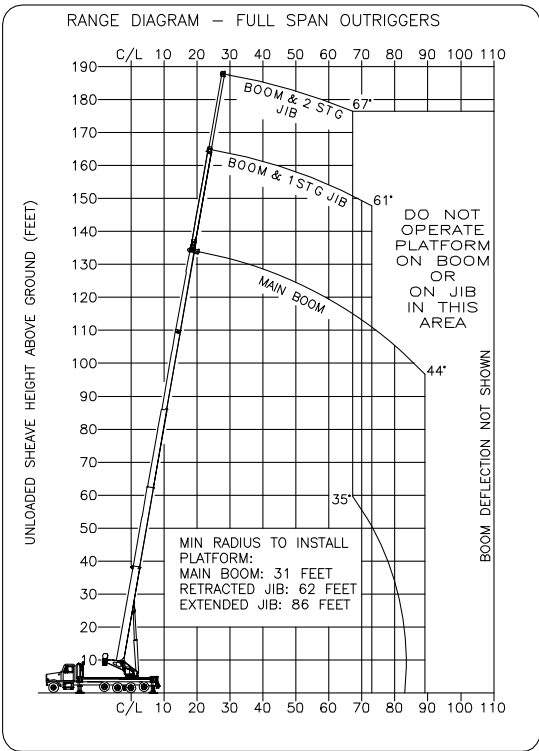
ALTEC INDUSTRIES
325 SOUTH CENTER DRIVE
DALEVILLE, VA 24083

MFG. DATE __mo/20__yr
970438640 A



PLATFORM OPERATION—BOOM & JIB
CRANE MODEL ACXX—XXXS

NON—INSULATED
PLATFORM
ASSEMBLY



FOR USE WITH ALTEC PLATFORM ASSEMBLY PART NUMBER 970268044 OR 970369795 ONLY.

ONLY FOR USE ON ALTEC ACXX—XXXS.

DO NOT OPERATE THE PLATFORM IN WINDS IN EXCESS OF 20 MPH AT PLATFORM WORKING HEIGHT.

PLATFORM ASSEMBLY WEIGHT = XXX LBS.

PLATFORM LOAD CAPACITY = XXX LBS.

LOAD LINE MUST BE STOWED AT WINCH WHEN PLATFORM IS INSTALLED ON BOOM TRUCK CRANE.

ASME B30.23 COMPLIANT

ALTEC INDUSTRIES
325 SOUTH CENTER DRIVE
DALEVILLE, VA 24083

MFG. DATE __mo/20__yr
970340920 C

Figure 3.3 — Platform Operation Sample Range Diagram and Capacity Placards

- Winch line rated working load multiplied by the number of parts of winch line.
- Rated capacity shown in rated capacity chart for material handling jib (if jib is in use).
- If the actual load radius is not shown in the chart, use the load capacity at the next longer radius shown.
- When lifting with the jib, use loaded boom angle to determine jib capacity regardless of boom length.
- When jib is erected boom must be fully retracted before lowering below minimum boom with jib angles. Retracted boom with jib has no lifting capacity below a 50 degree angle with full span outriggers and below a 65 degree angle with mid span outriggers. Jib operation is not allowed with short span outriggers.
- If a boom is extended to a length not shown in the chart, use the load capacity at the next longer length of extension shown for that boom.
- The multiple part winch line must be used when the load being lifted exceeds the winch line rated working load. Line pull (obtained by dividing load weight by number of parts of line) must not exceed winch line rated working load.
- Load capacities in the chart do not exceed 85 percent of actual tipping loads on a level surface, based on the unloaded vehicle weight. If the unit is remounted or if the vehicle is modified in any way affecting stability, contact Altec to determine if a new load capacity chart is required.

Considerations when using the platform. All personnel platform use must be in compliance with the requirements of OSHA 1926.1431 (g) and either ASME B30.23 or ANSI A92.2 compliant units plus the following.

- The rated capacity chart for occupied personnel platform is in use by selecting platform mode on the LMAP display.
- The unit is properly set on outriggers.
- Platform controls have been tested for proper operation.
- The lift has been preplanned including identifying hazards such as power lines and other obstructions.

- A platform should not be attached at any time material handling is being done.
- Platforms may be attached to the personnel jib.
- The load in platform must not exceed either of the following values.
 - The rated platform capacity.
 - The rated capacity shown in the rated capacity chart for personnel jib (if jib is in use).
- If the actual boom angle is not shown in the chart, use the load capacity at the next lower boom angle.
- When between listed boom lengths or radii, always use the smallest of the values shown.

Cold Weather Capacity

Operation of this unit in subzero temperatures will affect the operating functions and structural capacities.



WARNING

Death or serious injury can result from overloading the unit in subzero temperatures.

Do not operate this unit when the temperature is less than -40 degrees Fahrenheit (-40 degrees Celsius).

When operating in subzero temperatures above -40 degrees Fahrenheit (-4 degrees Celsius), reduce the capacity values by the following percentages.

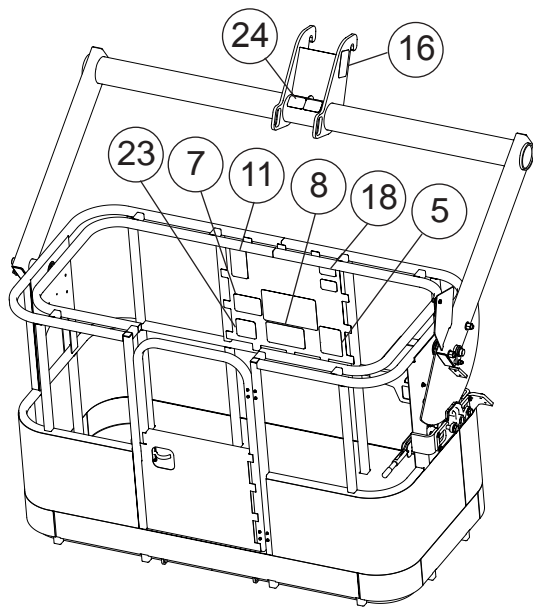
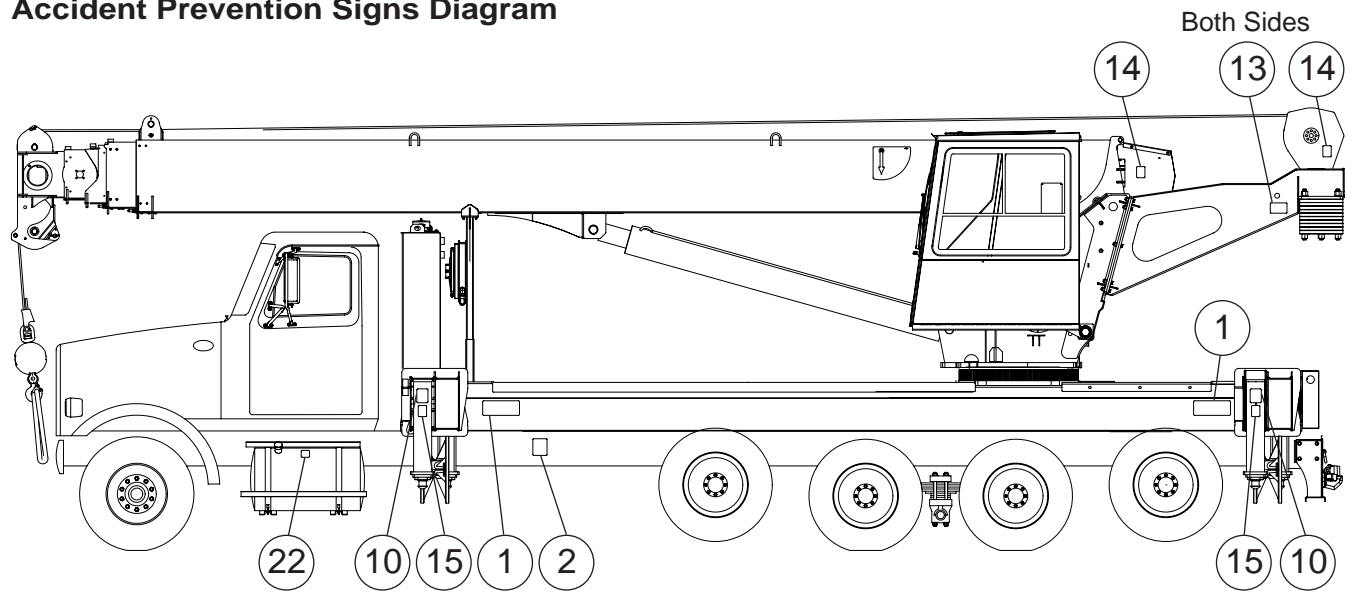
- Reduce the capacity value by 15 percent if the temperature is -10 to -20 degrees Fahrenheit (-23 to -29 degrees Celsius).
- Reduce the capacity value by 40 percent if the temperature is -20 to -40 degrees Fahrenheit (-29 to -40 degrees Celsius).

Accident Prevention Signs

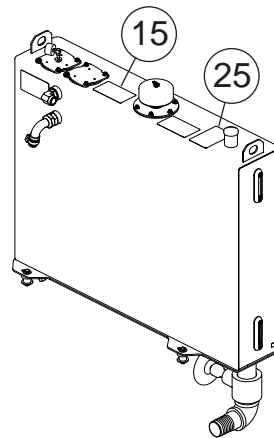
This unit was equipped with accident prevention signs at the time of manufacture. If any of these are lost or become illegible, obtain replacements from your Altec representative.

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.

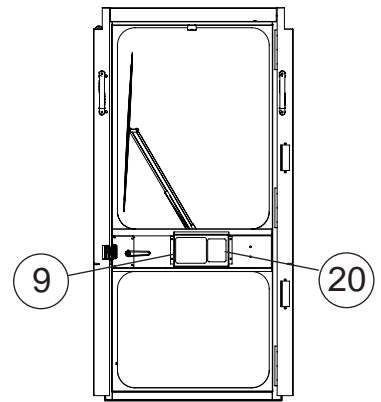
Accident Prevention Signs Diagram



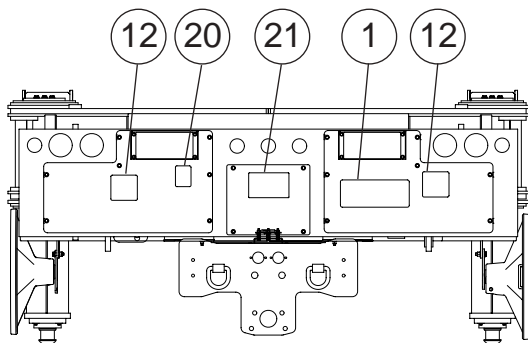
Platform



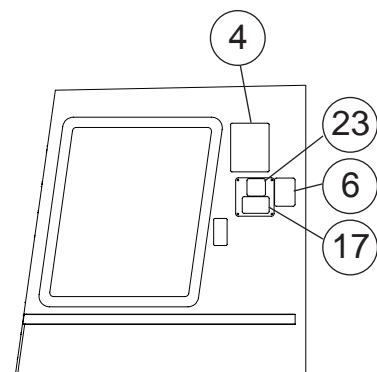
Reservoir



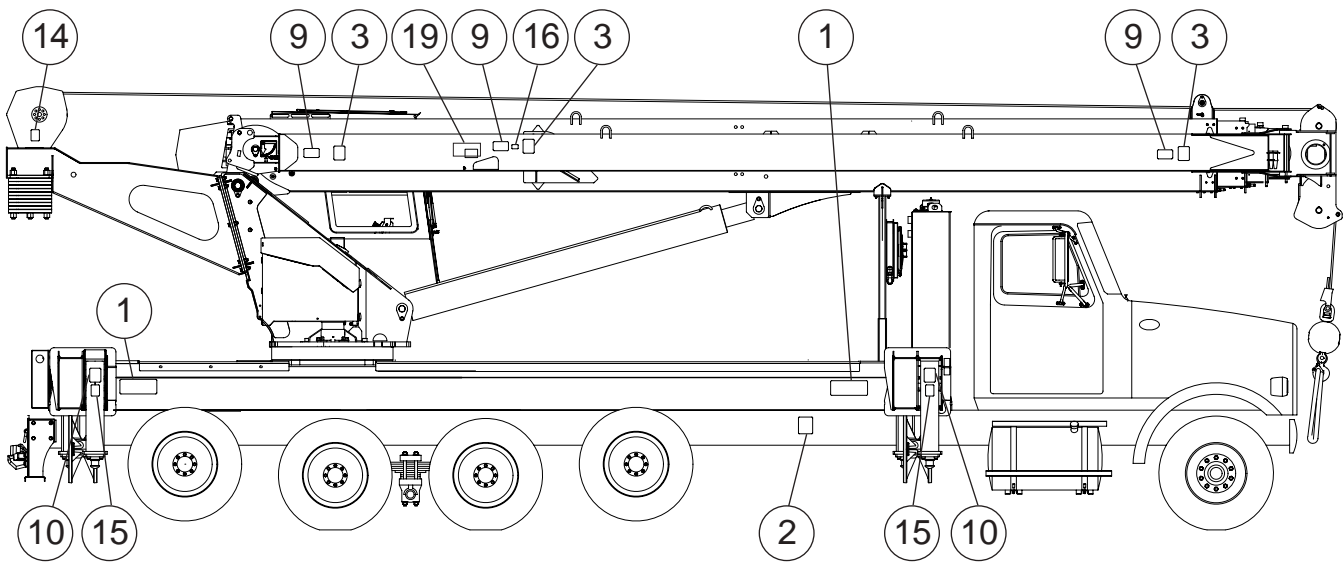
Back of Door, Inside Cab


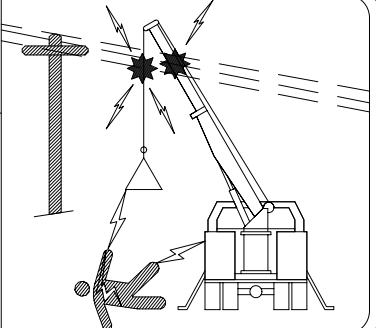


Tailshelf




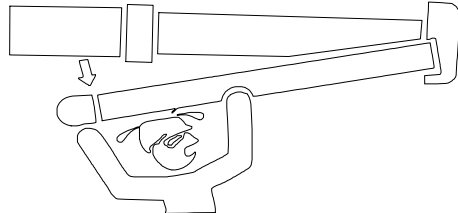
Inside of Cab



	<h1>DANGER</h1>	
<p>DEATH OR SERIOUS INJURY WILL RESULT FROM CONTACT WITH OR INADEQUATE CLEARANCE TO ELECTRICAL POWER LINES AND APPARATUS</p> <p>670-40203 B</p>	<p>ELECTROCUTION HAZARD THIS MACHINE IS NOT INSULATED</p> <ul style="list-style-type: none"> • Maintain safe clearance from electrical power lines in accordance with applicable government regulations. Allow for boom, electrical line and loadline sway. • This machine does not provide protection from contact with or proximity to an electrically charged power line. 	

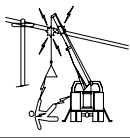
 <h1>DANGER</h1>

<p>CONTACT WITH A ROTATING DRIVELINE WILL CAUSE SERIOUS INJURY OR DEATH</p> <h2>KEEP AWAY</h2> <ul style="list-style-type: none"> * KEEP CLEAR OF ROTATING DRIVE SHAFT. * NEVER WORK ON AN INSTALLED POWER TAKE-OFF WITH THE ENGINE RUNNING. <p style="text-align: right; font-size: small;">970013530 A</p>

 <h1>DANGER</h1>

<p>A FREE FALLING JIB WILL RESULT IN DEATH OR SERIOUS INJURY</p> <p>Always check that jib is properly secured. Follow proper jib erection and storage procedures. See crane manufacturer's manual.</p> <p style="text-align: right; font-size: small;">970013536 A</p>


! DANGER

ELECTRICAL HAZARDS!



Death or serious injury will result from contact with load, unit, vehicle or vehicle attachments if the boom or load line should become electrically charged. Maintain safe clearance (at least 10 feet) between machine and electrical power lines in accordance with applicable government regulations. Allow for boom, electrical line and load line sway. This machine is NOT INSULATED and does not provide protection from contact with or proximity to unprotected electrically charged power lines.


TWO BLOCKING HAZARDS!



The winch can break the load line if the unit is two-blocked. Two blocking may cause the load line to fail and load/hook block to fall. Do not allow hook block to contact boom tip by hoisting up, extending or lowering the boom.


OVERLOAD HAZARDS!

Overloading will result in instability and/or structural damage. Never overload the unit by exceeding the values shown in the chart. Load capacity chart values are for freely suspended loads only, never lift an unknown load, or loads that are still attached or stuck to the ground or structures. Never handle material on load line with personnel platform occupied. Never side load the boom.



INSTABILITY HAZARDS!

Improper outrigger setup will result in instability. Deploy all outriggers to level the unit prior to operating. All outriggers must be properly set on firm level surfaces able to support load.



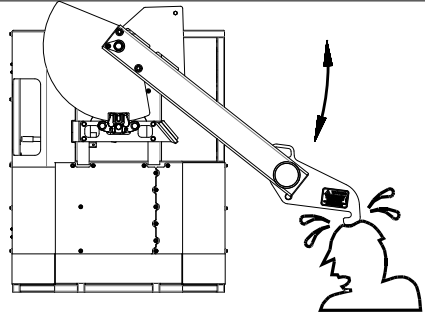
This unit is equipped with operator aids (see manual), before use, inspect these systems for proper operation.

FAILURE TO COMPLY TO ANY OF THE ABOVE WILL RESULT IN DEATH OR SERIOUS INJURY.

970014543 A

4

! DANGER



CRUSH HAZARD

RELEASING THE BRAKE ON AN UNSECURED PLATFORM WILL RESULT IN DEATH OR SERIOUS INJURY

*Do not leave platform with hanger positioned or elevated above platform when platform is not attached to the boom or jib.
*Do not release platform brake without firmly supporting hanger.

970023002 D

5

! DANGER

OPERATION BY QUALIFIED PERSONNEL ONLY

Operating this unit without proper training will result in death or serious injury to yourself and others

Do not operate this equipment unless:

- *You have been qualified/certified by your employer to other.
- *You follow your employers work rules, Government regulations and the operating instructions found in the manufacturer's manuals, unit decals and other material provided with this unit.
- *You are sure the unit is operating properly and has been inspected, maintained and tested in accordance with the manufacturer's and government's requirements.
- *You are sure that all decals, covers, and guards are properly installed.
- *You are sure that platform occupants(s) are wearing personal fall protection equipment.

670-40172 F

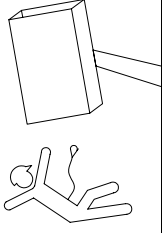
6

! DANGER

FALL HAZARD

Death or serious injury will result from falling from platform.

- All platform occupants must use an OSHA approved fall protection system, attached to the anchor provided.
- Platform door, if provided, must be securely latched. Inspect latch daily.
- Secondary platform door restraint must be latched on platforms equipped with doors.
- Do not sit/stand on platform edge or other devices for a work position.



670-40207 E

7

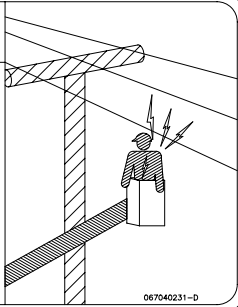
! DANGER

ELECTRICAL HAZARDS

THIS UNIT IS NON INSULATING

Death or serious injury will result if operator or unit contacts or is too close to electrical power lines, equipment, or other electrically charged objects.

Maintain safe clearances from electrical power lines in accordance with applicable government regulations. Allow for boom, platform, electric line, and winch line sway.



067040231-D

8

DANGER

**RIDING ON BOOM OR LOADLINE
WILL RESULT IN
DEATH OR SERIOUS INJURY**

Never ride on boom, hook, load or any device attached to loadline.

970013535 A

9

DANGER

**MOVING OUTRIGGER
HAZARD**

Contact with moving outrigger will cause death or serious injury.

STAND CLEAR

670-40170 B

10

DANGER

OVERLOAD HAZARD

**DEATH OR SERIOUS INJURY
WILL RESULT FROM
OVERLOADING THE CRANE
WHEN THE PLATFORM IS
OCCUPIED.**

The combined weight of the platform structures, personnel, tools and other equipment must not exceed 50% of the overall lifting capacity of the crane configuration.

Set LMAP for and use platform capacity chart to determine the lifting capacity.

Perform platform proof test and trial lifts as required by your employer, state and or federal regulations.

970024923-G

11

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

12

WARNING

**MOVING PARTS
STAY CLEAR**

Death or serious injury can result from contact with moving counterweight.

970178284 A

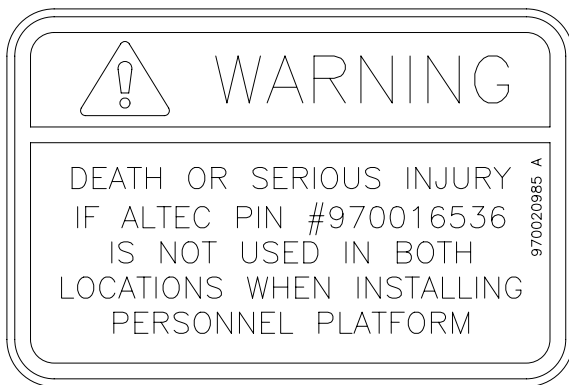
13



14



15



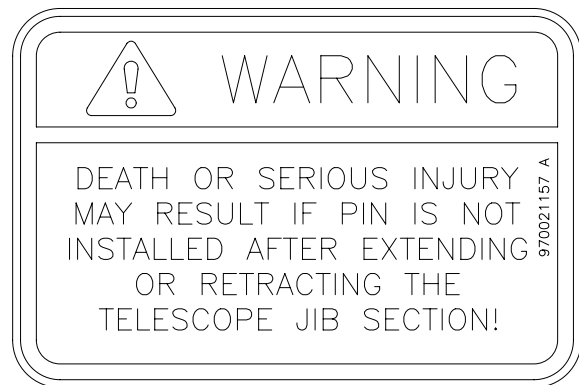
16



17



18



19


 **WARNING**



RIDING/FALL HAZARD
 Death or serious injury could result from riding in this area. Riders could fall or be crushed under the tires.
 When vehicle is in motion, all riders must be in cab with safety belts fastened.




NO RIDERS 670-40294 C

20

 **WARNING**


OVERLOAD & TIPPING HAZARD
 Death or serious injury could result from failure to correctly deploy the outriggers

•Outriggers must be deployed as indicated in the diagrams below to safely operate in selected mode
 •The entire outrigger placard (FULL or MID) must be visible on each outrigger to operate in the indicated mode. If the placard is not visible or only partially visible, unit must be operated according to the next shorter outrigger configuration. LMAP must be set accordingly.

<p>FULL SPAN FRONT: FULL SPAN PLACARD COMPLETELY VISIBLE</p>  <p>REAR: FULL SPAN PLACARD COMPLETELY VISIBLE</p>	<p>MID SPAN FRONT: MID SPAN PLACARD COMPLETELY VISIBLE</p>  <p>REAR: MID SPAN PLACARD COMPLETELY VISIBLE</p>	<p>SHORT SPAN FRONT: EXTENDED TO CLEAR OUTRIGGER INTERLOCK</p>  <p>REAR: EXTENDED TO CLEAR OUTRIGGER INTERLOCK</p>
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970368168-B


21

 **CAUTION**

DIESEL FUEL ONLY

670-40383

22

 **CAUTION**

EXCESSIVE SIDE LOADING HAZARD
 This unit is not equipped with a side load protection system. Side loading can damage the rotation system, and other unit components. The unit may also tip over.

- Never apply side loads.
- Always center the boom tip over the load when winching or raising boom.

970013532 A

23

NOTICE

HYDRAULIC FLUID ONLY

Use of improper fluid will damage system. Never use brake fluid.

Use proper hydraulic fluid as recommended in maintenance manual.

670-40138 D

25

 **CAUTION**

MAXIMUM 2 PERSONS
 REFER TO PLATFORM RANGE DIAGRAM FOR ALLOWABLE CAPACITY

970023004 C

24

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 6.

Capacity and Stability

A chart showing the load capacities of the particular model is located on the turntable. This chart is used when lifting a load without personnel in the platform. A range diagram is also located on the chart. If the unit is specified for platform use it will be equipped with a special rated capacity chart (also on unit) and a boom angle indicator visible from the platform. This chart is used when the personnel platform is installed. The load capacity charts found on the unit are the only charts valid for determining the capacity of each particular unit.

The values on the load capacity charts reflect vehicle stability and structural competence. The rated working load of the winch line may also limit the loads lifted by the unit. The load capacity values on the chart near the riding seat controls show the maximum loads that may be lifted by the unit at regular intervals of load radius, through the full range of boom elevation, extension, and rotation, and still maintain vehicle stability. The operator may use the capacity chart to determine whether or not a load may be lifted.

Stability will be maintained if the values listed in the chart are not exceeded and the outriggers are properly positioned to level the unit as described in Section 6 under Outriggers. Also refer to other considerations listed in Section 3 when using the capacity charts.

WARNING

Death or serious injury can result if the unit becomes unstable. Determine the weight of the load before lifting.

Death or serious injury can result from overloading the unit. Do not exceed the rated capacity values.

Determine the weight of the material before moving it. Use the placards on the unit and in the Operator's Manual to determine the available rated lifting capacities. Do not exceed rated lift capacities.

WARNING

Death or serious injury can result if the unit becomes unstable. Properly set the outriggers to level the unit before moving the booms from the rest.

CAUTION

Injury and property damage can result from abrupt reversals in direction, starts, or stops. Operate the controls smoothly.

NOTICE

Refer to the platform use capacity chart for limitations when personnel are in the platform.

Avoid side loading of the booms. Side loading can result in damage to the structures or rotation system and can adversely affect vehicle stability.

The unit is equipped with outriggers to help stabilize the unit while it is in use.

Understand the stability characteristics of this unit before using it. As delivered, this unit will meet or exceed the requirements for stability as set forth in ASME B30.5 at the time of manufacture.

Using the unit in an unsafe manner or overloading the unit can cause structural failure or instability.

The stability characteristics of a vehicle vary as the boom is rotated to different positions around the vehicle. Therefore, any load being rotated should be kept as close to the ground as possible. This will allow the load to settle to the ground, rather than tip the unit over, if the vehicle becomes unstable.

Lowering or extending the boom increases the load radius. Use caution when lowering the boom with a load on the winch line. The unit's capacity and stability decrease as the boom is lowered.

WARNING

Death or serious injury can result if the unit becomes unstable. Park on a firm surface before operating the unit. Set the parking brakes and extend the outriggers as instructed under Outriggers. Take into consideration pad loads on all surfaces.

It is impossible to foresee all situations and combinations for set up of the unit. Establish criteria for stable operation of the unit based on actual conditions, work procedures, and experience. The owner and operator bear ultimate responsibility for ensuring that the unit is properly set up.

Operation Near Energized Conductors

This machine is not insulated.



DANGER

ELECTRICAL HAZARDS

Death or serious injury will result from contact with load, unit, vehicle or vehicle attachments if the boom or load line should become electrically charged. This machine is **NOT INSULATED** and does not provide protection from contact with or proximity to unprotected electrically charged power lines. Maintain safe clearance between machine and electrical power lines of at least 22' (6.10 m) for voltages up to 350 kV and 50' (15.24 m) for voltages over 350 kV up to 1,000 kV, and a distance determined by the electrical power line utility owner in accordance with applicable government regulations. Allow for boom, electrical line and load line sway.

Death or serious injury will result from contact with or inadequate clearance from electrical power lines. This unit will not provide protection from contact with or proximity to an electrically charged power line.

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



WARNING

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

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 or 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.



DANGER

Death or serious injury will result from contact with or proximity to an energized conductor.

- Contact by the conductive components, including but not limited to hydraulic hoses and winch lines with an energized conductor will energize the entire vehicle. If the vehicle becomes energized, it is an extreme hazard to anyone who might touch the vehicle or unit. All personnel must remain clear of the vehicle or unit any time the boom is elevated in the vicinity of energized wires.



DANGER

Death or serious injury will result from hydraulic oil burning or exploding in the event of electrical contact. Maintain minimum clearances from energized electrical equipment.

In addition to these hazards, other 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.

Shift Preoperational Inspection

Material Handling

Inspect the unit at the beginning of each work shift to detect potential service and safety problems. Refer to the Shift/Monthly Inspection and the Wire Rope Inspection checklists in the Appendix and to the Inspection Diagram in this section for inspection guidelines. Check the following items, as equipped, during the shift preoperational inspection. Components may be installed on your unit that require additional inspection. Refer to those component manuals for more information. If any problem is found, stop and have the problem corrected as directed in Section 3 under Crane Inspection before placing the unit in service.



WARNING

Death or serious injury can result from operating a unit which has not successfully completed the daily preoperational inspection. Make sure any malfunctions are corrected by a qualified person before placing the unit in service.

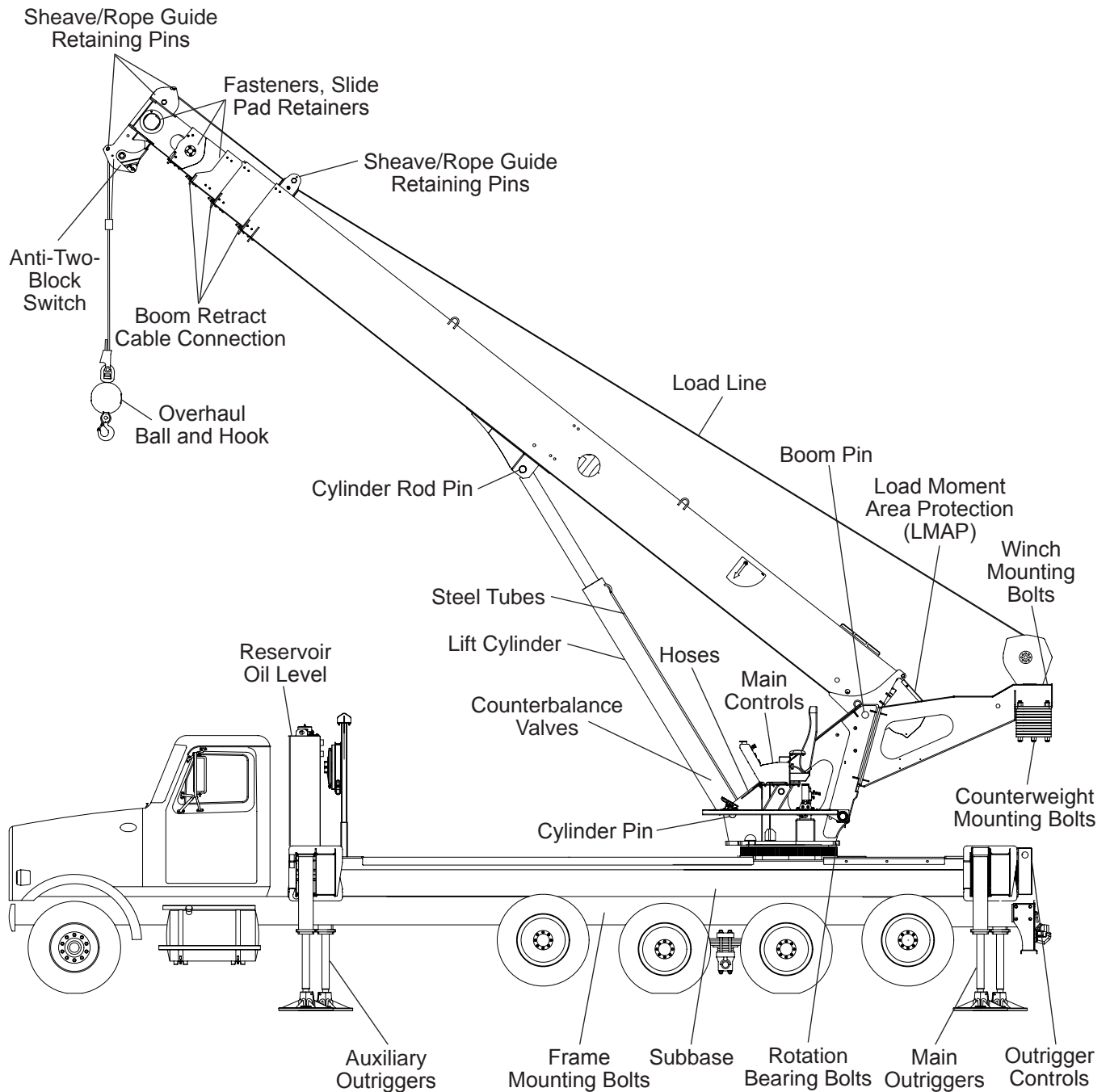
1. Position the unit on a level surface. Apply the parking brake, and chock the wheels.
2. Make sure the vehicle tires are in good condition and properly inflated to the pressure posted on the driver's side door placard.
3. With the booms and outriggers stowed, check the oil level in the hydraulic reservoir. The oil level must be visible through the sight gauge on the side of the reservoir. If necessary, add oil as described in the Maintenance Manual. The need to add oil regularly indicates a leak in the hydraulic system that should be corrected.



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.

Inspection Diagram



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

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

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

4. Visually inspect the unit for hydraulic leaks. Continue to look for hydraulic leaks while performing the inspection.
5. Throughout the inspection, pay particular attention when inspecting the components included on the Shift/Monthly Inspection Checklist (refer to the Appendix).
6. Inspect all covers to make sure they are in place, secure, and in good condition.
7. Inspect booms for debris or foreign objects.

NOTICE

Safety devices and operational aids must not be used as a substitute for the exercise of professional judgment by the operator.

8. Check visual and audible safety devices and operational aids for proper operation. Replace missing and/or illegible placards.
9. Start the engine, and engage the PTO.

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.

10. If the temperature outside is below 32 degrees Fahrenheit (0 degrees Celsius), warm the hydraulic oil before operating the unit. The procedure for warming the oil is described in this section under Cold Weather Start-Up. Do not operate the pump or engine at more than a fast idle until the hydraulic oil has warmed up.
11. Test the outrigger interlock system for units with full pressure outrigger controls. For units with electro-hydraulic controls, proceed to step 12.

- a. Without engaging the outrigger selector and with all outriggers fully stowed, place the lower boom control in the Raise position.
 - b. If movement occurs, the outrigger interlock system is not functioning properly. Proceed to step 13.
12. Test the outrigger interlock system for units with electro-hydraulic controls.
 - a. Move the outrigger/crane functions selector to the Crane position.
 - b. With all outriggers fully stowed, place the lower boom control in the Raise position.
 - c. If movement occurs, the outrigger interlock system is not functioning properly. Proceed to step 14.
 13. Test the outriggers for units with full pressure controls.
 - a. Hold the outriggers selector in the Outriggers position.
 - b. Properly set the outriggers. Confirm proper operation and audible alarm function (refer to Section 6 under Outriggers).
 - c. Without moving the outrigger selector, hold one outrigger control in the Raise position while watching that outrigger for movement.
 - d. If the outrigger retracts, the cylinder, holding valve, or crane/outriggers functions selector is not functioning properly.
 - e. Hold the outrigger control in the Lower position. If the outrigger extends, the crane/outriggers functions selector is not functioning properly.
 - f. Repeat this test for each outrigger.
 - g. Verify the outriggers are properly set and note how far each outrigger is extended. Proceed to step 15.
 14. Test the outriggers for units with electro-hydraulic controls.
 - a. Move the crane/outriggers functions selector to the Outriggers position.
 - b. Properly set the outriggers. Confirm proper operation and audible alarm function (refer to Section 6 under Outriggers).

- c. Turn the engine off. Turn the ignition switch to the On position to provide electrical power to the unit.
- d. Move the crane/outriggers functions selector to the Crane position.
- e. Hold one outrigger control in the Raise position while watching that outrigger for movement.
- f. If the outrigger retracts, the cylinder, holding valve, or crane/outriggers functions selector is not functioning properly.
- g. Hold the outrigger control in the Lower position. If the outrigger extends, the crane/outriggers functions selector is not functioning properly.
- h. Repeat this test for each outrigger.
- i. Verify the outriggers are properly set and note how far each outrigger is extended.



DANGER

Death or serious injury will result from unprotected contact with energized conductors. The platform carries no dielectric rating.



CAUTION

Injury and property damage can result from contact of the booms or platform with fixed objects. Make sure there is sufficient clearance before operating the unit.

Injury and property damage can result from abrupt reversals in direction, starts, or stops. Operate the controls smoothly.

- 15. Throughout the preoperational test of all unit controls, confirm the following items.
 - a. When controls are released, they must return to neutral without sticking and all motion for that function should stop. If movement continues, a control valve may not be functioning properly.
 - b. While cylinders are extended and under load, no movement should occur while controls are in neutral. Any movement indicates a cylinder or holding valve malfunction.
- 16. Test the lower controls emergency stop.
 - a. Engage the emergency stop.
 - b. Confirm the engine has shut down and all lower controls do not function. If engine does not shut
 - down or if movement occurs, the emergency stop is not functioning properly.
- c. Disengage the emergency stop, and restart the engine.



WARNING

Death or serious injury can result from two-blocking the unit. The winch can break the load line if two-blocked. Two-blocking may cause the load line to fail and load/hook block to fall. Do not allow hook block to contact boom tip by hoisting up, extending or lowering boom.

Do not operate the winch function with the anti-two-block switch disabled or the weight chain shortened. The weight must be 30" (76.20 cm) from the boom tip sheave.

NOTICE

When testing the operation of the interlock system, position the platform and booms to prevent damage from unexpected movement.

- 17. Test the lower controls and LMAP system.
 - a. Operate each control through its full range of motion, and observe for proper function.
 - b. As boom angle and extension limits are reached, verify the LMAP system display matches the values depicted on unit load chart and mechanical boom angle indicator.
 - c. Gently raise the winch until the anti-two-block weight is lifted. Verify the LMAP anti-two-block alarm activates. The following control functions should not function.
 - Winch raise
 - Boom lower
 - Boom extend

The following control functions should still function.

 - Boom raise
 - Boom retract
 - Winch lower
 - d. Lower the winch to silence anti-two-block alarm. Verify normal winch and boom functions are restored.
- 18. Test the emergency stop and transmitter tilt sensor at the radio remote controls.

- a. Move the radio remote switch on the lower control console to the On position. This will stop the engine.
- b. Perform the transmitter Start-Up Procedure as described in Section 6. Start the engine using the radio controls.
- c. Engage the emergency stop.
- d. Confirm engine has shut down and all radio controls do not function. If the engine does not shut down or if movement occurs, the emergency stop is not functioning properly.
- e. Reset the transmitter (refer to Section 6 under Start-Up Procedure), and start the engine.
- f. Tilt the transmitter more than 45 degrees for 5 seconds. No function should operate.
- g. Return the transmitter to an upright position, and reset the transmitter.
- h. If both the emergency stop and tilting the transmitter do not stop operation of unit functions, do not operate the remote control system until the problem is corrected.
- i. Disengage the emergency stop.

- 19. Test the operation of the radio remote controls. Operate each function of the unit with the radio controls from the ground with no personnel in the platform.



WARNING

Death or serious injury can result if the winch line breaks. Replace a worn or damaged winch line.

- 20. Inspect the winch line (refer to the Wire Rope Inspection Checklist in the Appendix). Ensure proper reeving of the winch line onto the drum. Use a genuine Altec replacement part to ensure that the proper rope and design is used. Refer to the Maintenance Manual for requirements and procedures for replacement.
- 21. Inspect the modular jib system. Inspect the fiberglass personnel adapter for nicks or scratches in the surface. Inspect the pins and pin retainers for condition and operation.



WARNING

Death or serious injury can result if the unit becomes unstable. Properly stow the booms before raising the outriggers.

- 22. Verify that each outrigger is still extended to the position noted in either step 13 or 14. If any retraction has occurred, the outrigger cylinder or its holding valve is not functioning properly.
- 23. Make sure the booms are properly stowed, raise the outriggers, disengage the PTO, and turn off the engine.

Personnel Handling

Inspect the unit at the beginning of each work shift to detect potential service and safety problems. Refer to the Shift/Monthly Inspection and the Wire Rope Inspection checklists in the Appendix and to the Inspection Diagram in this section for inspection guidelines. Check the following items, as equipped, during the shift pre-operational inspection. Components may be installed on your unit that require additional inspection. Refer to those component manuals for more information. If any problem is found, stop and have the problem corrected as directed in Section 3 under Crane Inspection before placing the unit in service.



WARNING

Death or serious injury can result from operating a unit which has not successfully completed the daily preoperational inspection. Make sure any malfunctions are corrected by a qualified person before placing the unit in service.

- 1. Position the unit on a level surface. Apply the parking brake, and chock the wheels.
- 2. Make sure the vehicle tires are in good condition and properly inflated to the pressure posted on the driver's side door placard.
- 3. With the booms and outriggers stowed, check the oil level in the hydraulic reservoir. The oil level must be visible through the sight gauge on the side of the reservoir. If necessary, add oil as described in the Maintenance Manual. The need to add oil regularly indicates a leak in the hydraulic system that should be corrected.



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

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

4. Visually inspect the unit for hydraulic leaks. Continue to look for hydraulic leaks while performing the inspection.
5. Throughout the inspection, pay particular attention when inspecting the components included on the Shift/Monthly Inspection Checklist (refer to the Appendix).
6. Inspect all covers to make sure they are in place, secure, and in good condition.
7. Inspect booms for debris or foreign objects.

NOTICE

Safety devices and operational aids must not be used as a substitute for the exercise of professional judgment by the operator.

8. Check visual and audible safety devices and operational aids for proper operation. Replace missing and/or illegible placards.
9. Start the engine, and engage the PTO.

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.

10. If the temperature outside is below 32 degrees Fahrenheit (0 degrees Celsius), warm the hydraulic oil before operating the unit. The procedure for warming the oil is described in this section under Cold Weather Start-Up. Do not operate the pump or engine at more than a fast idle until the hydraulic oil has warmed up.
11. Test the outrigger interlock system for units with full pressure outrigger controls. For units with electro-hydraulic controls, proceed to step 12.
 - a. Without engaging the outrigger selector and with all outriggers fully stowed, place the lower boom control in the Raise position.

- b. If movement occurs, the outrigger interlock system is not functioning properly. Proceed to step 13.

12. Test the outrigger interlock system for units with electro-hydraulic controls.

- a. Move the outrigger/crane functions selector to the Crane position.
 - b. With all outriggers fully stowed, place the lower boom control in the Raise position.
 - c. If movement occurs, the outrigger interlock system is not functioning properly. Proceed to step 14.

13. Test the outriggers for units with full pressure controls.

- a. Hold the outriggers selector in the Outriggers position.
 - b. Properly set the outriggers. Confirm proper operation and audible alarm function (refer to Section 6 under Outriggers).

- c. Without moving the outrigger selector, hold one outrigger control in the Raise position while watching that outrigger for movement.

- d. If the outrigger retracts, the cylinder, holding valve, or crane/outriggers functions selector is not functioning properly.

- e. Hold the outrigger control in the Lower position. If the outrigger extends, the crane/outriggers functions selector is not functioning properly.

- f. Repeat this test for each outrigger.

- g. Verify the outriggers are properly set and note how far each outrigger is extended. Proceed to step 15.

14. Test the outriggers for units with electro-hydraulic controls.

- a. Move the crane/outriggers functions selector to the Outriggers position.
 - b. Properly set the outriggers. Confirm proper operation and audible alarm function (refer to Section 6 under Outriggers).

- c. Turn the engine off. Turn the ignition switch to the On position to provide electrical power to the unit.

- d. Move the crane/outriggers functions selector to the Crane position.
- e. Hold one outrigger control in the Raise position while watching that outrigger for movement.
- f. If the outrigger retracts, the cylinder, holding valve, or crane/outriggers functions selector is not functioning properly.
- g. Hold the outrigger control in the Lower position. If the outrigger extends, the crane/outriggers functions selector is not functioning properly.
- h. Repeat this test for each outrigger.
- i. Verify the outriggers are properly set and note how far each outrigger is extended.



DANGER

Death or serious injury will result from unprotected contact with energized conductors. The platform carries no dielectric rating.



CAUTION

Injury and property damage can result from contact of the booms or platform with fixed objects. Make sure there is sufficient clearance before operating the unit.

Injury and property damage can result from abrupt reversals in direction, starts, or stops. Operate the controls smoothly.

- 15. Throughout the preoperational test of all unit controls, confirm the following items.
 - a. When controls are released, they must return to neutral without sticking and all motion for that function should stop. If movement continues, a control valve may not be functioning properly.
 - b. While cylinders are extended and under load, no movement should occur while controls are in neutral. Any movement indicates a cylinder or holding valve malfunction.
- 16. Test the lower controls emergency stop.
 - a. Engage the emergency stop.
 - b. Confirm engine has shut down and all lower controls do not function. If engine does not shut down or if movement occurs, the emergency stop is not functioning properly.

- c. Disengage the emergency stop, and restart the engine.



WARNING

Death or serious injury can result from two-blocking the unit. The winch can break the load line if two-blocked. Two-blocking may cause the load line to fail and load/hook block to fall. Do not allow hook block to contact boom tip by hoisting up, extending or lowering boom.

Do not operate the winch function with the anti-two-block switch disabled or the weight chain shortened. The weight must be 30" (76.20 cm) from the boom tip sheave.

NOTICE

When testing the operation of the interlock system, position the platform and booms to prevent damage from unexpected movement.

- 17. Test the lower controls and LMAP system.
 - a. Operate each control through its full range of motion, and observe for proper function.
 - b. As boom angle and extension limits are reached, verify the LMAP system display matches the values depicted on unit load chart and mechanical boom angle indicator.
 - c. Gently raise the winch until the anti-two-block weight is lifted. Verify the LMAP anti-two-block alarm activates. The following control functions should not function.
 - Winch raise
 - Boom lower
 - Boom extend

The following control functions should still function.

 - Boom raise
 - Boom retract
 - Winch lower
 - d. Lower the winch to silence anti-two-block alarm. Verify normal winch and boom functions are restored.



DANGER

Death or serious injury will result if the unit becomes unstable while the personnel platform is occupied. Only handle personnel in approved platforms with

properly functioning upper controls and LMAP system set to the personnel handling chart.

18. Test the emergency stop and transmitter tilt sensor at the radio remote controls.
 - a. Move the radio remote switch on the lower control console to the On position. This will stop the engine.
 - b. Perform the transmitter Start-Up Procedure as described in Section 6. Start the engine using the radio controls.
 - c. Engage the emergency stop.
 - d. Confirm engine has shut down and all radio controls do not function. If the engine does not shut down or if movement occurs, the emergency stop is not functioning properly.
 - e. Reset the transmitter (refer to Section 6 under Start-Up Procedure), and start the engine.
 - f. Tilt the transmitter more than 45 degrees for 5 seconds. No function should operate.
 - g. Return the transmitter to an upright position, and reset the transmitter.
 - h. If both the emergency stop and tilting the transmitter do not stop operation of unit functions, do not operate the remote control system until the problem is corrected.
 - i. Disengage the emergency stop.
19. Test the operation of the radio remote controls. Operate each function of the unit with the radio controls from the ground with no personnel in the platform.
20. Test the LMAP system in man-basket operation mode.
 - a. Press the basket operation button on the LMAP and select man-basket operation mode.
 - b. Verify the maximum speeds for boom and rotation functions are reduced, and the indicator light at the base of the boom is illuminated.
 - c. Verify the winch functions do not operate.
 - d. The LMAP system is programmed to limit the maximum radius that the platform can reach. The allowable radius is dependent on whether the

platform is installed on the main boom or the jib. Refer to the personnel handling range diagram. Set the boom at an appropriate angle so that when extended the platform will cross the maximum allowable radius. This angle will depend on whether the platform is mounted to an erected jib or the main boom. Extend the boom into a clear area.

- e. The telescope function should deactivate at the boom length shown on the personnel handling range diagram. If it does not, the LMAP is not functioning properly.
- f. Lower the boom slowly.
- g. The boom lower function should deactivate at the angle shown on the personnel handling range diagram. If it does not, the LMAP is not functioning properly.



WARNING

Death or serious injury can result if the winch line breaks. Replace a worn or damaged winch line.

21. Complete additional testing according to whether the unit will be used in compliance to only ASME B30.23 or ANSI A92.2 standards (refer to the serial number placard on the unit).
 - a. In accordance with ASME B30.23, at each new job site, prior to hoisting people in the personnel platform, the platform and rigging must be proof tested to 125 percent of the platform's capacity rating. Perform a trial lift prior to hoisting personnel with at least the weight expected during the actual lift. An optional platform test weight is available to facilitate these requirements.
 - b. For units equipped with the optional ANSI A92.2 compliance package, cycle each boom function through its complete range of motion and verify operation of emergency controls. The 125 percent proof test lift is not required.



WARNING

Death or serious injury can result if the unit becomes unstable. Properly stow the booms before raising the outriggers.

22. Verify that each outrigger is still extended to the position noted in either step 13 or 14. If any retraction has occurred, the outrigger cylinder or its holding valve is not functioning properly.

23. Make sure the booms are properly stowed, raise the outriggers, disengage the PTO, and turn off the engine.

Preparing for Operation

Before using this unit each day, the shift preoperational inspection must have been performed. 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 and apply the parking brake. Apply the supplemental holding brake, if equipped.



WARNING

Park on a firm surface before operating the unit. Set parking brakes, outriggers must be extended as instructed under Outriggers. Take into consideration pad loads on all surfaces.

It is impossible to foresee all situations and combinations for set up of the unit. Establish criteria for stable operation of the unit 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.
3. If equipped, move the truck/machine selector switch in the vehicle cab to the Machine position.



CAUTION

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

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.

4. If the temperature is below 32 degrees Fahrenheit (0 degrees Celsius), warm the hydraulic oil before operating the unit. The procedure for warming the oil is described under Cold Weather Start-Up in this

section. Do not operate the pump or engine at more than a fast idle until the hydraulic oil has warmed up.

5. The unit has outrigger controls on the tailshelf. These controls are only functional when the crane/outrigger switch is in the Outrigger position. Properly set the outriggers to level the unit as described in Section 6 under Outriggers.
6. 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 Start-Up

When operating the unit in temperatures of 32 degrees Fahrenheit (0 degrees Celsius) or below, follow the cold weather start-up procedure. Refer to the Maintenance Manual for cold weather oil recommendations.

NOTICE

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

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 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 movement, as well as cavitation and consequent pump damage.

Use the following procedure to warm up the hydraulic oil.

1. Start the vehicle engine and engage the PTO.
2. Operate the boom retract function, allowing the oil to bypass over a relief valve for a few minutes.
3. With the machine properly set-up, extend the boom fully, retract, and repeat step 2 above.

Section 5 — Protection Systems

The unit is equipped with operator aids that are intended to assist the operator in the safe use of this unit. However, even with these systems, the unit can be damaged if the operator overrides the system or disregards the recommended methods and procedures described in this manual.

Load Moment and Area Protection System (LMAP)

The LMAP system monitors load on the unit and the working area. This system is an important feature that may help prevent accidents and damage to the unit. All operators should understand the system and its importance (LMAP Operator's Manual found in the Appendix).

The load moment part of the LMAP system is built into the unit's hydraulic and electrical systems. Pressure transducers in the LMAP computer unit sense the amount of pressure in the lift cylinder. When the unit is loaded to 90 percent of its rated capacity, an audible alarm is activated. When the unit is loaded to 100 percent of its rated capacity, the LMAP system is activated. The LMAP system temporarily shuts off the following functions that can cause further overloading.

- Winch raise
- Boom extend
- Boom lower

While these functions are temporarily shut off, the following functions remain operational to relieve the overload.

- Winch lower
- Boom retract
- Boom raise

When the operator eliminates the overload from the unit, the system automatically restores operation to the functions that were temporarily shut off.

Do not use the LMAP system as a way of determining the load the unit will lift. Use the load capacity chart to determine if a load is within the capacity of the unit.



WARNING

Death or serious injury can result from overloading the unit. Do not exceed the rated capacity values.

You should not operate the unit with a disabled or improperly functioning LMAP system.

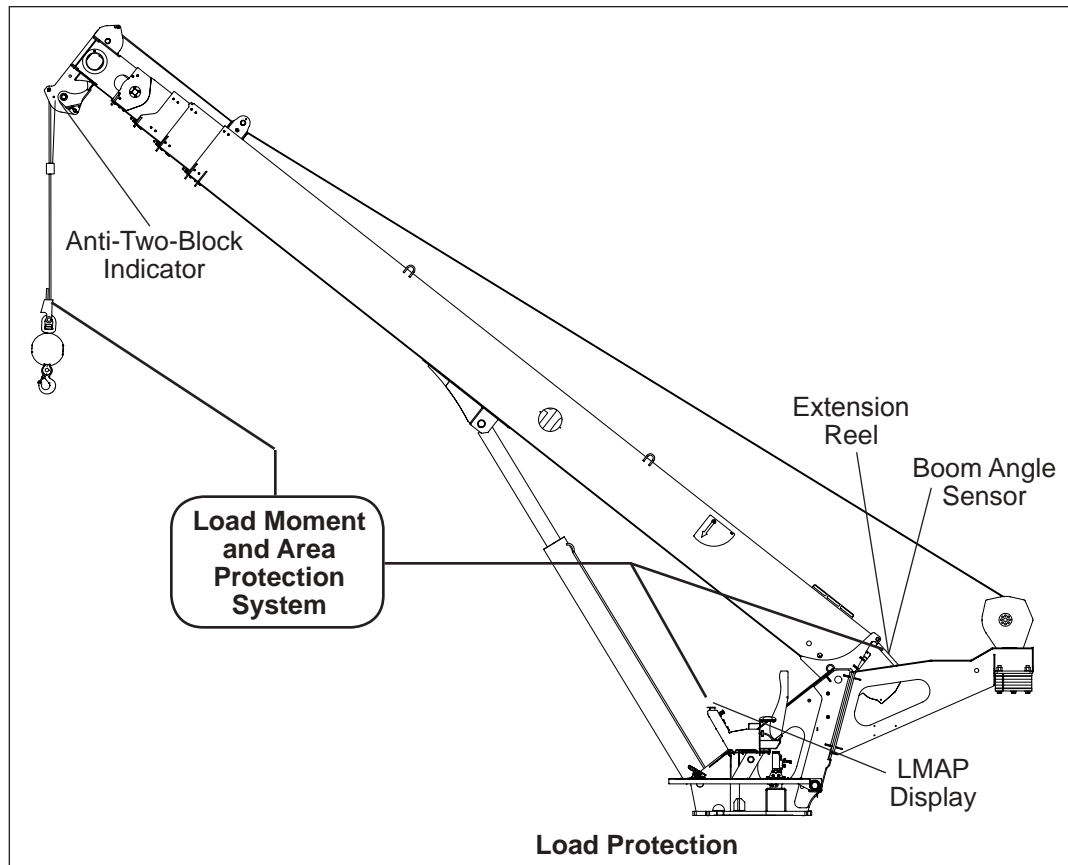


Figure 5.1 — Protection Systems

The LMAP system is intended to help the operator prevent overloading of the unit when lifting a load. Repeated operation at load levels that activate the LMAP system can damage the unit.

The area protection feature of the LMAP enables the operator to set audible alarm set-points for the following functions.

- Boom angle
- Boom length
- Boom rotational position

Move the boom to any one of these functional positions and press the set button. This setting assists the operator by sounding an alarm when the boom exceeds the previously established limit (refer to LMAP in the Appendix).

Do not disable the LMAP system in an attempt to allow the unit to perform a task prevented by this protection system.

Section 6 — Operation



CAUTION

Injury and property damage can result from abrupt reversals in direction, starts, or stops. Operate the controls smoothly.

Outriggers help stabilize and level the unit while it is in use. Before operating the unit, follow the procedure in Section 4 under Preparing for Operation. Properly set the outriggers as described in the following section.



WARNING

Park on a firm surface before operating the unit. Set parking brakes, outriggers must be extended as instructed under Outriggers. Take into consideration pad loads on all surfaces.

It is impossible to foresee all situations and combinations for set up of the unit. Establish criteria for stable operation of the unit based on actual conditions, work procedures, and experience. The owner and operator bear ultimate responsibility for ensuring that the unit is properly set up.

Outriggers

The AC45 multipurpose boom truck crane is designed for use with a subbase and requires two sets of out and down outriggers: one set of main out and down outriggers at the rear of the truck, and one set of auxiliary out and down outriggers at the front of the subbase. Each of these outrigger cylinders is equipped with double-acting, pilot operated check valves to prevent movement of the outrigger cylinder in the event of hydraulic line failure.

The controls for the primary and auxiliary outriggers are located at the tailshelf (refer to Figure 6.1) where each outrigger can be viewed. The area around the control handles is guarded to protect against unintentional movement of the handles.



WARNING

Death or serious injury can result if the unit becomes unstable. Properly set the outriggers to level the unit before moving the booms from the rest.

Death or serious injury can result from contact with a moving outrigger. Clear the area around the outriggers before operating the unit.

Death or serious injury can result if the unit becomes unstable. Properly stow the booms before raising the outriggers.



CAUTION

Injury and property damage can result from the unit becoming unstable. Do not operate the horizontal outrigger function while the vertical outrigger is deployed.

The surface that the outrigger shoe will rest on must be firm and capable of supporting a substantial load in a concentrated area. If necessary, place cribbing or supports beneath each outrigger shoe to increase the support area and load holding capability.



WARNING

Death or serious injury can result from contact with a moving outrigger. Clear the area around the outriggers before operating the unit.

If the outriggers are not visible while being deployed, a signal person must be used to be sure the outriggers are set safely to avoid crushing injury.

An audible warning signal alerts the operator when the outriggers are in motion.

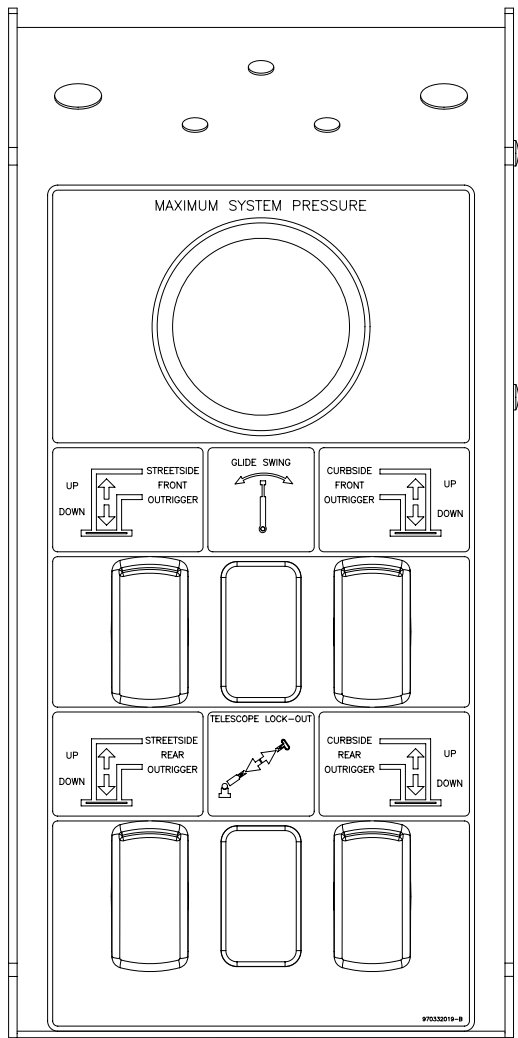
The outriggers have full, mid-span, and short-span capabilities, with placards installed on the outrigger beams to aid the operator in mid-span and short-span setups (refer to Figure 6.2).

Tailshelf Outrigger Controls

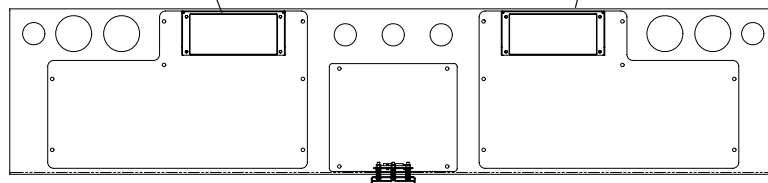
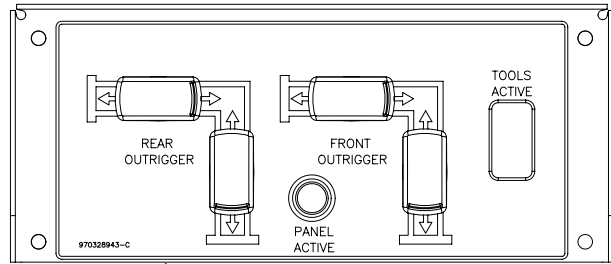
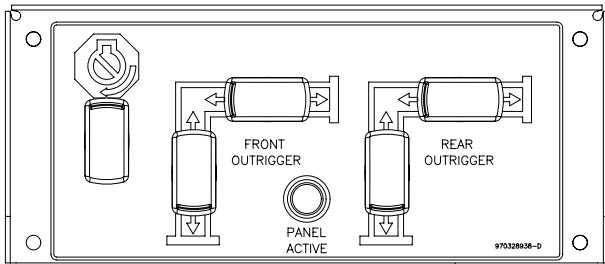
The main controls for outrigger setup are located at the tailshelf (refer to Figure 6.1). These controls are active only when the unit is in Outrigger mode. The unit will default to Outrigger mode when the PTO is first engaged. Horizontal and vertical functions will operate each outrigger as labeled. When the outrigger controls are released, the spool in the valve will return to neutral. In order to operate the crane after setting the outriggers, the outrigger/crane functions switch (located at the riding seat) must be placed in the Crane position.

Riding Seat Outrigger Controls

When equipped with riding seat outrigger controls, the outrigger/crane functions switch must be placed in the Outrigger position to operate the outriggers. Only vertical outrigger control is available from the riding seat.



**Riding Seat Outrigger Controls
Left Hand Control Pod**



Tailshelf Electric Outrigger Controls

Figure 6.1 — Outrigger Controls

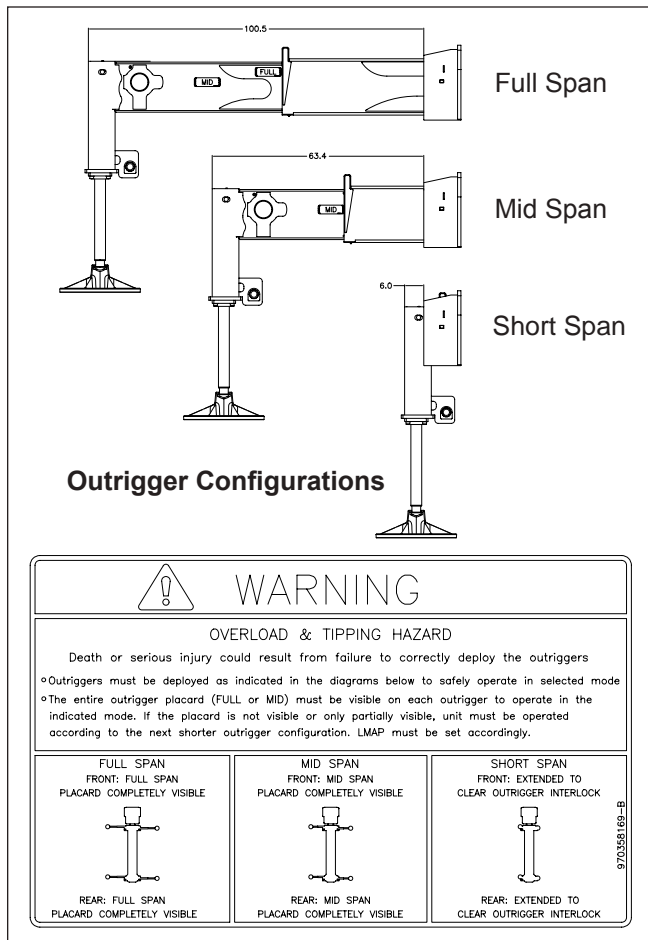


Figure 6.2 — Outrigger Span

WARNING

Death or serious injury can result if the unit becomes unstable. Properly set the outriggers to level the unit before moving the booms from the rest.

Properly Setting the Outriggers

With the boom stowed, deploy the outrigger beams to the desired outrigger configuration. Main (rear) and auxiliary (front) outriggers have mid and full span placards to aid the operator in setting outrigger configuration. Figure 6.2 illustrates short, mid, and full span outrigger setups. Once all beams are properly deployed, lower the outriggers to a firm footing. Lower the outriggers to level the unit and remove all tire contact with the ground surface. Level the unit using the bulls eye level near the outrigger controls.

After setting the front and rear outriggers, verify the unit is level within one degree by checking the master level

located at the top of the subbase, beside the rotation bearing (refer to Figure 6.3). Levels provided at the tailshef and turntable are for reference only, and must be checked periodically against the master for accuracy.

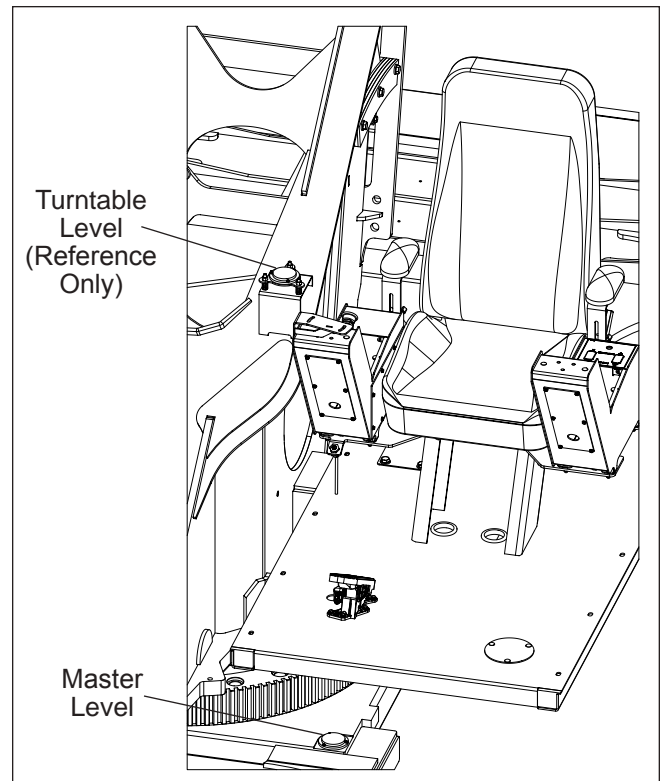


Figure 6.3 — Level Indicators

Control Station

This unit has a hydraulic pilot operated, low pressure control system. The controls are located adjacent to the riding seat. Figures 6.4 and 6.5 illustrate the operator's control panels.

Left Hand Control Console

The left hand control is a single joystick type control, or a dual lever type, which activates four separate pressure reducing valves utilizing the pilot pressure to activate the main control valves. When a function is operated, the function's speed is proportional to the distance the hand control is shifted. For example, if the boom hand control is shifted in the boom extend direction at maximum hand control travel, the boom extends at maximum speed. The boom will continue to rise until the handle is shifted to neutral or the boom reaches its maximum travel for the boom extend function.

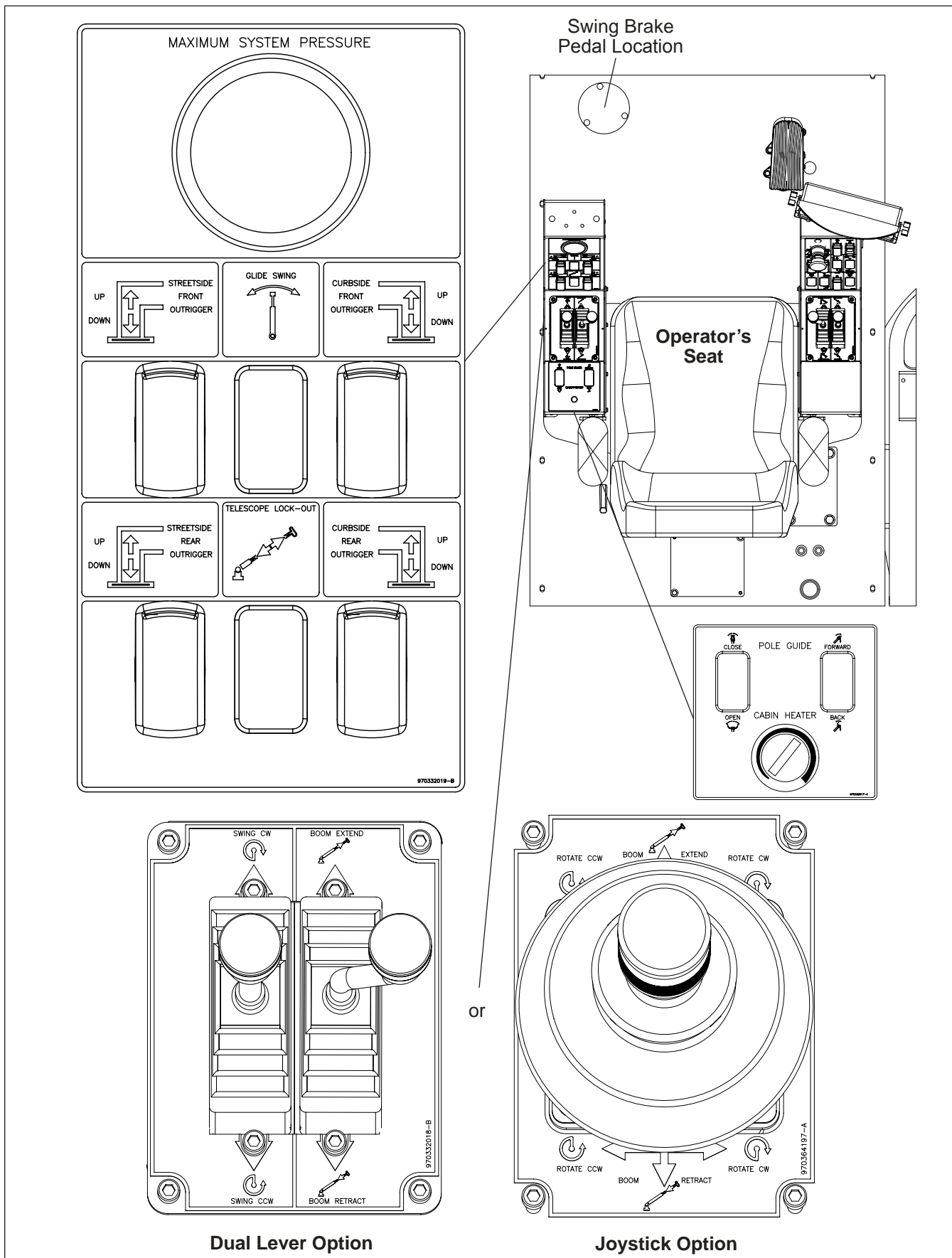


Figure 6.4 — Control Station (Left Hand)

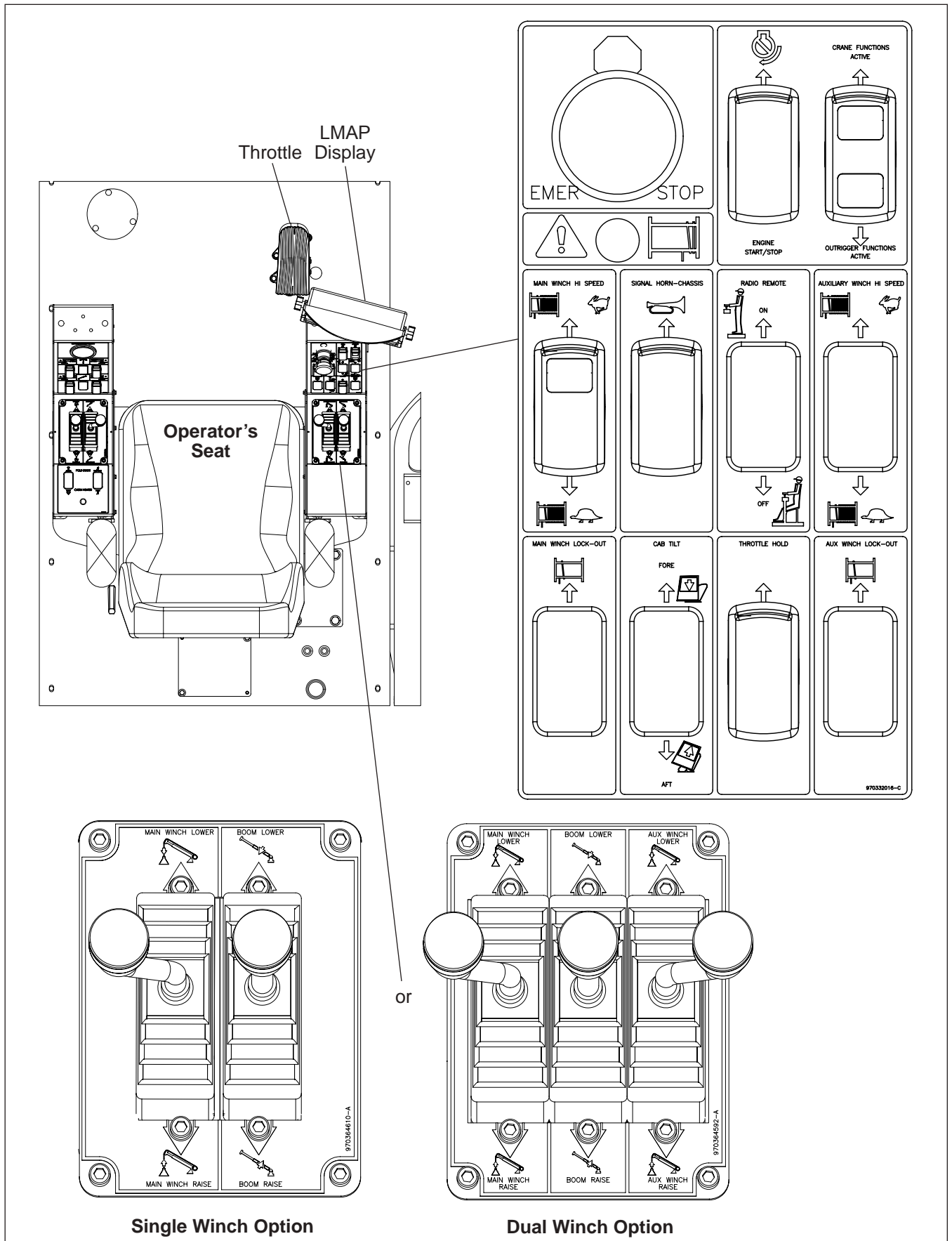


Figure 6.5 — Control Station (Right Hand)

The joystick or lever controls on the left hand control pod provide for turntable rotation and boom extend/retract.

 **WARNING**

Death or serious injury can result from two-blocking the unit. The winch can break the load line if two-blocked. Two-blocking may cause the load line to fail and load/hook block to fall. Do not allow hook block to contact boom tip by hoisting up, extending or lowering boom.

Do not operate the winch function with the anti-two-block switch disabled or the weight chain shortened. The weight must be 30" (76.20 cm) from the boom tip sheave.

 **CAUTION**

Injury and property damage can result from abrupt reversals in direction, starts, or stops. Operate the controls smoothly.

On units equipped with the joystick control, pushing forward on the joystick extends the boom and pulling back on the joystick retracts the boom. Tilting the joystick to the right rotates the turntable clockwise, and tilting the joystick to the left rotates the turntable counterclockwise as indicated on the joystick placard shown in Figure 6.4.

On units equipped with the two lever left hand control, pushing forward on the right side lever extends the boom and pulling back on the right side lever retracts the boom. Pushing forward on the left side lever rotates the turntable clockwise, and pulling back on the left-side lever rotates the turntable counterclockwise as indicated on the two-lever placard shown in Figure 6.4.

As the hand control is moved further from neutral, the speed of the function is proportional to the distance the hand control is shifted. The foot throttle or engine speed switch may also be used to increase the speed of a function when operating the boom and winch functions.

Outrigger Up/Down Controls

When equipped with riding seat outrigger controls, the outrigger/crane functions switch must be placed in the Outrigger position to operate the outriggers. Only vertical outrigger control is available from the riding seat.

Glide Swing

This control enables the glide swing if equipped.

Telescope Lockout

This control if equipped disables boom extend and retract function when actuated.

Pole Guide

The pole guide if equipped may be opened or closed and tilted forward or back with these controls.

Cabin Heater

When equipped with a cabin heater this control may be used to adjust the cabin temperature.

Gauge

There is one gauge located on the control panel. This gauge indicates the pressure in the hydraulic system.

The gauge for the hydraulic system can be used to give the operator an idea of how hard the unit is working. To do this, note the reading on the gauge when the load begins to move. Compare this reading with the maximum system pressure [3,300 psi (227.53 bar)]. Some troubleshooting techniques, as described in the Maintenance Manual, also use this gauge.

Right Hand Control Console

Two individual spring centered levers are located on the right hand side of the control station.

 **WARNING**

Death or serious injury can result from two-blocking the unit. The winch can break the load line if two-blocked. Two-blocking may cause the load line to fail and load/hook block to fall. Do not allow hook block to contact boom tip by hoisting up, extending or lowering boom.

Do not operate the winch function with the anti-two-block switch disabled or the weight chain shortened. The weight must be 30" (76.20 cm) from the boom tip sheave.

Each lever activates a pair of pressure reducing valves using pilot pressure to activate the main control valves. The handles may be operated individually or in combination.

 **CAUTION**

Injury and property damage can result from abrupt reversals in direction, starts, or stops. Operate the controls smoothly.

Boom Lift Lever

The lever to the far right controls boom lift, except on units equipped with dual winches, in which case boom lift is controlled by the center lever. To operate the boom lift function, move the handle from neutral. Pushing the lever forward lowers the boom and pulling back on the lever raises the boom. As the hand control is moved further from neutral, the function speed is proportional to

the distance the hand control is shifted. The foot throttle or engine speed switch may also be used to increase function speed when operating the boom function. When released, the lever should return to neutral and the boom motion should stop.

WARNING

Death or serious injury can result from two-blocking the unit. The winch can break the load line if two-blocked. Two-blocking may cause the load line to fail and load/hook block to fall. Do not allow hook block to contact boom tip by hoisting up, extending or lowering boom.

Do not operate the winch function with the anti-two-block switch disabled or the weight chain shortened. The weight must be 30" (76.20 cm) from the boom tip sheave.

Winch Control Lever

The lever on the near right controls the winch line. To operate the winch function, move the handle from neutral. Pushing the lever forward lowers the winch line hook and pulling back on the lever raises the hook. As the control is moved further from neutral, the function speed is proportional to the distance the hand control is shifted. The foot throttle or engine speed switch may also be used to increase function speed when operating the boom function. When released, the lever should return to neutral and the winch line should stop.

On units equipped with dual winches, the right hand control will have three levers instead of two. The lever on the far right controls the auxiliary winch.

Winch Speed Selector Switch

The winch speed selector is located directly in front of the right hand controls. This switch can be positioned to select either low speed or high speed for the hydraulic winch motor.

Drum Rotation Indicator

This crane is equipped with a drum rotation indicator, which is located in the top of the winch control lever. It provides a pulsating movement which can be felt by the operator's thumb, to indicate if the winch is turning and how fast.

Radio Remote Switch

The radio remote switch transfers control of unit functions between the seat control console and the radio remote controls. By placing the switch in the On position, only the radio remote can control unit operation. Placing the switch in the Off position disables the radio remote and returns control to the seat control console.

Signal Horn

The signal horn switch is located directly in front of the right hand controls. When pressed, this momentary switch sounds an audible signal.

Emergency Stop

The emergency hydraulic stop control stops the operation of all functions. Press the control down to engage the emergency stop. Pull the control out to disengage the emergency stop.

CAUTION

Injury and property damage can result from vehicle movement if the transmission is not in neutral or park when the engine is started. Make sure the transmission is in neutral or park before remotely starting the engine.

Engine Start/Stop

The engine start/stop switch (refer to Figure 6.4) may be used to start and stop the vehicle engine from the control panel. To start the engine, push the switch until the engine is running and then release. If the engine does not start, push the switch and release. Then repeat the procedure. To turn off the engine, push the switch and release. The switch is operational only when the cab ignition switch is on and the emergency stop is not engaged.

Crane/Outrigger Functions Selector

Place the selector in the Crane Functions position to operate the crane. Place the selector in the Outrigger Functions position to operate the vertical outrigger controls from the riding seat.

Winch Lockout

This control if equipped disables the winch function when actuated.

Cab Tilt

This control if equipped tilts the operator's cabin fore and aft up to a maximum tilt angle of 20 degrees.

Throttle Hold

This control if equipped is a momentary switch which holds a throttle setting similar to a cruise control. Using the foot throttle, set the desired engine throttle setting, and press and release the throttle hold switch. The foot throttle may now be released and the engine rpm will remain at the preset setting. To release the throttle hold setting, press the throttle hold switch and release. The engine will return to its idle setting.

Foot Throttle

The foot throttle is located below the control panel. Using the foot throttle when operating certain functions or multiple functions will increase the speed of the function.

NOTICE

Excessive engine speeds can result in rapid heat generation and damage to the hydraulic system.

When operating the winch function, or a boom function, use the foot throttle to obtain full function speed. When the foot throttle is used, the hydraulic pump responds by increasing the amount of oil flow. This increases the function speed. Do not use the foot throttle more than needed for maximum function speed. This may overheat the hydraulic system and damage the pump. Consult your Altec representative for the maximum recommended engine speeds for the vehicle's particular engine, transmission, PTO, and pump combination.

Cold Oil/Change Filter Indicator

This indicator, located at the filter, alerts the operator when the return line filter needs changing or when the hydraulic oil is cold.

The indicator will come on when the hydraulic system oil is cold and the engine is at operating speeds. In this situation, the indicator should go out when the oil has warmed up. Section 4 under Cold Weather Start-Up fully describes how to properly warm the hydraulic system oil. If the indicator continues to come on when the oil is warm, the filter needs to be changed. Changing the return line filter is described in the Maintenance Manual.

Radio Controls

The radio control system allows remote operation of unit functions when the control panel switch is placed in the Radio On position. Check all functions before working with the remote control system. Refer to Section 4 under Shift Preoperational Inspection.



WARNING

Death or serious injury can result from two-blocking the unit. The winch can break the load line if two-blocked. Two-blocking may cause the load line to fail and load/hook block to fail. Do not allow the hook block to contact boom tip by hoisting up, extending or lowering boom.

Do not operate the winch function with the anti-two-block switch disabled or the weight chain shortened. The weight must be 30" (76.20 cm) from the boom tip sheave.



WARNING

Park on a firm surface before operating the unit. Set parking brakes, outriggers must be extended as instructed under Outriggers. Take into consideration pad loads on all surfaces.

It is impossible to foresee all situations and combinations for set up of the unit. Establish criteria for stable operation of the unit based on actual conditions, work procedures, and experience. The owner and operator bear ultimate responsibility for ensuring that the unit is properly set up.

Docking Station

When using the radio controls from the platform, stow the load line, and place the transmitter in the docking station. Radio control winch functions are disabled when the transmitter is in the docking station. Set the LMAP to platform mode to ensure the proper load chart is selected before operating the unit.

Start-Up Procedure

Make sure no commands are active on the transmitter. The transmitter is started with the stop button and the on/horn control (refer to Figure 6.6). They can be actuated in any order. After one control is actuated, the operator has five seconds to actuate the other control. The remote will sound two times. The radio controls are now activated and are ready for use.

If radio communication is interrupted due to interference or distance between the transmitter and the receiver, the remote control receiver stops sending signals to all unit functions. The remote control system will stop operation and must be reset by performing the start-up procedure.

Frequency

To change the frequency, press and hold the On/horn control and the frequency change control (located to the right of the AUX 2/AUX 3 switch) until the horn sounds. This indicates a new frequency has been selected and the unit is ready for operation.

Emergency Stop

Push the emergency stop control on the transmitter control panel to immediately stop operation of all functions from the receiver. Restart by performing the start-up procedure.

Engine Start/Stop

The engine start/stop may be used to start and stop the vehicle engine from the transmitter control panel. Push the on/off switch forward until the engine starts. Push the switch down to stop the engine.

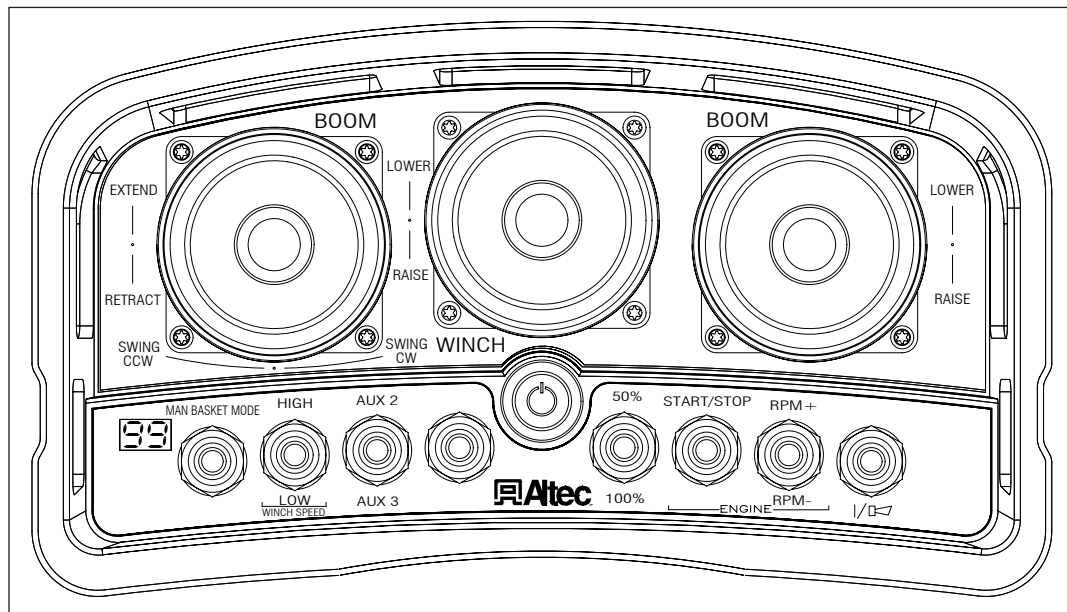


Figure 6.6 — Radio Controls

RPM +/-

The engine speed may be selected to one of three settings. The three available settings are high, idle, and low. The center switch position selects idle. Moving the switch down selects low rpm. Moving the switch up selects high rpm.

50% - 100%

Push the 50% - 100% toggle switch forward to the 50% position and the boom functions and turntable rotation functions will operate at one-half speed. Move the toggle to the 100% position and the same functions operate at full speed.

Man Basket Mode

Move this switch to the man basket mode when using the platform and all functions will be at 25 percent of normal operating speeds.

Boom Extend/Rotate Joystick

The joystick on the operator's left controls the boom extend and retract function as well as the boom rotate function. To operate a function, grasp the control handle and move it in the desired direction. The functions will operate at a speed proportional to the distance the control handle is moved. Pushing forward on this joystick extends the boom and pulling back retracts the boom. Tilting the joystick to the operator's left causes the turntable to rotate counter-clockwise and tilting the joystick to the right causes the clockwise rotation. When the joystick is released it returns to the center position and movement stops.

Units equipped with optional A92.2 rating in platform mode will have interlock buttons on each joystick. One of the interlocks must be engaged before function will operate.

Boom Lift Joystick

The joystick located on the operator's right raises and lowers the boom. To operate a function, grasp the control handle and move it in the desired direction. The functions will operate at a speed proportional to the distance the control handle is moved. When the joystick is pushed forward the boom is lowered and when it is pulled back, the boom raises. When the joystick is released it returns to the center position and movement stops.

Units equipped with optional A92.2 rating in platform mode will have interlock buttons on each joystick. One of the interlocks must be engaged before function will operate.

Winch Joystick

The joystick located in the center operates the winch. To operate a function, move the control handle in the desired direction. The functions will operate at a speed proportional to the distance the joystick is moved. When the joystick is pushed forward the hook is lowered, and when it is pulled back the hook is raised. The winch cannot be operated from the platform with the transmitter in the platform docking station.

Units equipped with optional A92.2 rating in platform mode will have interlock buttons on each joystick. One of the interlocks must be engaged before function will operate.

Winch Speed

Moving the winch speed toggle from low to high controls the two-speed motor that powers the winch. Low speed provides more meterability of the functions allowing precise positioning of the hook.

Tilt Switch

The transmitter is equipped with a tilt switch that will cause the transmitter to stop sending signals when it is tilted more than 45 degrees in any direction for 4 to 5 seconds. The vehicle engine will continue to run, but the unit's functions will not respond to movement of the transmitter controls.

To make the transmitter operational, return it to a level position and reset it by performing the start-up procedure.

Sleep Mode

The transmitter is equipped with a sleep circuit that will shut down the transmitter and vehicle engine automatically. Shut down occurs when the engine rpm switch is in the idle position and the transmitter is not used for approximately 10 minutes.

To reset the transmitter after it has entered the sleep mode, turn it off and perform the start-up procedure.

Battery Charger

The battery charger will restore the electrical charge to the rechargeable transmitter batteries. The battery charger automatically stops when the charging process is complete. This allows the charged battery to be stored safely in the charger until it is needed. A continuously on charger LED indicate that the battery is charging. When the charging is complete, the LED will flash.

Booms

The boom may be operated using the control panel or the radio remote transmitter. When operating the boom function, it may be necessary to use the foot throttle or engine speed switch to increase engine speed.

When operating more than one boom function, it may be necessary to use the foot throttle or engine speed switch to operate the functions at full speed. Use only sufficient foot throttle for maximum function speeds.

When starting and stopping any boom movement, meter the hand control to avoid shock loads. This is very important when handling heavy loads.

The lift cylinder is held in position at all angles by a pilot operated counterbalance holding valve located in the base end of the lift cylinder. This valve prevents loss of oil from the cylinder if hydraulic line failure occurs, thus preventing free fall of the booms. Due to the counterbalance valve's load holding capability, it is necessary to power the booms down, rather than allowing them to lower by gravity.

DANGER

Death or serious injury will result from unprotected contact with energized conductors. Maintain safe clearance from electrical power lines and apparatus. Allow for platform or line sway, rock, or sag.

Consult the load capacity chart to determine if repositioning the vehicle or boom will allow the load to be lifted.

If the LMAP is inoperative or malfunctioning, the designated persons responsible for supervising the lifting operations shall establish procedures to conduct the lifting operation.

Use caution when lowering the boom. The unit's capacity and stability decrease as the boom is lowered. While lowering the boom, refer to the load capacity chart and use the personnel handling chart on the LMAP to make sure that the load capacity of the unit is not exceeded. Be aware of the stability limits of the particular unit. Read and understand Section 4 under Capacity and Stability.

DANGER

Death or serious injury will result from unprotected contact with energized conductors. Read and understand the contents of Section 4 before operating the unit near energized conductors.

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

CAUTION

Injury and property damage can result from abrupt reversals in direction, starts, or stops. Operate the controls smoothly.

Avoid sudden starts, stops, or direction reversals of the boom controls.

WARNING

Death or serious injury can result from two-blocking the unit. The winch can break the load line if two-blocked. Two-blocking may cause the load line to fail and load/hook block to fall. Do not allow hook block to contact boom tip by hoisting up, extending or lowering boom.

Do not operate the winch function with the anti-two-block switch disabled or the weight chain shortened. The weight must be 30" (76.20 cm) from the boom tip sheave.

As the boom extends, pay out the winch line to compensate for the increased rope length required between the winch drum and the boom tip sheave. If the winch line is not payed out sufficiently during boom extension, damage to the unit or breaking of the winch line could result.

Use caution when extending the boom with a load on the winch line. Unit capacity decreases as the load moves farther away from the centerline of rotation. Determine whether the load is within the load capacity of the unit by referring to the capacity chart. Following the values in the capacity chart should ensure that the stability limit of the unit is not exceeded as the load moves outward.

 **CAUTION**

Damage to the unit can result from side loading. Operate the unit in a manner that avoids developing a side load on the boom.

The boom tip should always be centered over the load. Side loading can result in damage to the structures or rotation system and can adversely affect vehicle stability.

 **CAUTION**

Injury and property damage can result from improper use of the unit. The load must be freely suspended before moving it in any direction.

Always be sure to position the boom tip and winch line directly over the load before lifting. Lift slowly to avoid swinging loads. Never drag a load with the boom or winch. Do not lift a load if wind creates a hazard. Note that even light winds can blow a load out of control or tip the unit.

Boom Storage

 **WARNING**

Death or serious injury can result if the unit becomes unstable. Properly stow the boom before raising the outriggers.

When stowing the boom for transportation, first be sure the jib is properly stowed on the boom, then fully retract the boom. If the unit is equipped with a personnel platform, properly detach the platform and secure it on to the flatbed. Then position the boom carefully in the boom rest.

NOTICE

Meter the lower boom control using slow speed to avoid shock loads as the boom contacts the rest.

Damage to the unit can result if the boom bounces during road travel. Stow the boom firmly in its rest.

Secure the Hook

Before travel it is necessary to stow the hook. Attach the lanyard through the eye located on the driver side of the front bumper outrigger and attach the other end to the hook. In the case of mounting on a long nose truck, it may be necessary to extend the boom slightly to avoid the ball hitting the hood of the truck.

NOTICE

Do not overtighten the winch line while securing the hook, as this can result in damage to the crane.

Use the winch in low speed and winch up to take the slack out of the line. When the alarm sounds, it will be necessary to hold down the cancel alarm button on the LMAP, and then finish taking the slack out of the wire rope. The winch stow switch located near the front bumper outrigger may also be used to stow the winch.

Rotation

The unit can be rotated through 360 degrees continuously after the booms are elevated out of the boom rest. There is no restriction in either direction.

Tilting the joystick to the right rotates the turntable clockwise and tilting the joystick to the left rotates the turntable counterclockwise as indicated on the joystick placard shown in Figure 6.4. Avoid rapid starts, stops, and reversal of directions to minimize shock loads to the unit.

The rotation gearbox is equipped with a spring-applied, hydraulically released brake. This means the brake is engaged until it is released by hydraulic pressure. When the joystick is tilted, pressure begins to build up in the rotation motor. This pressure releases the brake and allows the motor to rotate the turntable. When the hand control is returned to neutral, the hydraulic pressure in the motor decreases to zero. As the pressure in the motor decreases, the brake is applied and rotation motion is stopped.

 **WARNING**

Death or serious injury can result if the unit becomes unstable. Make sure the load is within the capacities shown on the chart and the outriggers are properly set.

 **CAUTION**

Damage to the unit can result from side loading. Operate the unit in a manner that avoids developing a side load on the boom.

The boom tip should always be centered over the load. Side loading can result in damage to the structures or rotation system and can adversely affect vehicle stability.

 **CAUTION**

Damage to the unit can result from side loading. Operate the unit in a manner that avoids developing a side load on the boom.

The boom tip should always be centered over the load. Side loading can result in damage to the structures or rotation system and can adversely affect vehicle stability.

Winch

Never allow anyone to ride the load line. Use only Altec approved personnel platform attached to the boom or jib for personnel lifting.

 **WARNING**

Death or serious injury can result from falling loads. Winch cable anchors are not designed to hold rated capacity. Keep a minimum of three wraps on the drum at all times.

The winch raise circuit is equipped with a holding valve to hold the load in position after the control is returned to neutral.

 **WARNING**

Death or serious injury can result from overloading the unit. Do not exceed the rated capacity values.

Never lift an unknown load. Determine the weight of the material before moving it. Use the placards, and charts provided on the unit and in the Operator's Manual to determine the available load capacities.

 **WARNING**

Death or serious injury can result from unsafe work practices. Stay clear of a load that is being moved or lifted. Never lift loads over personnel.

Death or serious injury can result if the winch line breaks. Stay clear of a load that is being moved or lifted.

 **CAUTION**

Injury and property damage can result from loss of load control. Use tools specifically designed for and

properly attached to the lifting device when lifting materials.

NOTICE

Plan work procedures and mentally “walk through” them before moving or lifting any load.

Before using the winch to lift a load, use the capacity chart to determine if the load is within the load capacity of the unit. In some boom positions, the rated capacity of the winch will be greater than the load capacity of the unit. The capacity of the winch is stated on the capacity placard near the controls.

When raising the winch line with a load, do not use the LMAP system to determine the load the unit will lift. The LMAP is intended to help the operator prevent overloading of the unit when lifting a load. Repeated operation at load levels that activate the LMAP system can damage the unit. Section 5 under Load Moment and Area Protection system (LMAP) describes the LMAP system.

 **WARNING**

Death or serious injury can result if the winch line breaks. Do not use the winch to pull an object that is firmly set in the ground.

Death or serious injury can result from improper use of the jib or winch. Never use a material handling jib or winch to lift personnel.

Death or serious injury can result from contact with a moving winch hook. Maintain a safe distance from the winch hook after removing it from a load.

Before removing the load hook from a load, always relieve all of the tension on the winch line. Releasing the load hook before all of the tension on the line is relieved may cause uncontrolled movement of the load hook.

 **WARNING**

Death or serious injury can result from using a winch hook that is overloaded. Make sure that the hook is marked with the rated load.

Death or serious injury can result from an improperly secured load.

Death or serious injury can result from an improperly secured load. Never wrap the winch line around the load or use it as a sling to secure the load.

Winch Line



WARNING

Death or serious injury can result if the winch line contacts an energized conductor and a ground. Do not allow the winch line to contact an energized conductor.

The winch drum is designed to accommodate wire rope. The rated working load of the winch line may limit the loads lifted by the unit.

The winch line rated working load is stated on the capacity placard near the control station. Winch line rated working load is the minimum breaking strength of the winch line (as specified by the line manufacturer) divided by the appropriate design factor. The design factor for rotation-resistant-type steel ropes shall not be less than 5 to 1. The design factor for standard-type steel ropes shall not be less than 3¹/₂ to 1. The rated working load of the line will vary depending on the type and size of the line. If the winch line was provided by Altec Industries, contact your Altec representative for information concerning the rated working load of the winch line. If the winch line was provided by an alternate source, contact the winch line manufacturer concerning the rated working load of the winch line.

Depending on the rated working load of the winch line, a multiple part load line may be required to fully utilize the load capacity of the unit.

ANSI requires the use of a multiple part winch line for loads that exceed the winch line rated working load. The winch line rated working load must be greater than or equal to the load weight divided by the number of parts of winch line.

The unit is equipped with a multiple part winch line sheaves at the end of the boom. Figure 6.7 illustrates multiple part winch lines.



WARNING

Death or serious injury can result if the hook block breaks loose and load control is lost. Use a hook block with a rated working load greater than or equal to the load being lifted.

Hook blocks of various capacities are available from your Altec representative.



CAUTION

Injury can result from handling wire rope. Wear appropriate safety equipment.

Be careful when handling wire rope. Wire rope can be dangerous if not handled properly.



WARNING

Death or serious injury can result from contact with a moving winch hook. Maintain a safe distance from the winch hook after removing it from a load.

Death or serious injury can result if the winch line breaks. Replace a worn or damaged winch line.

Inspect the winch line daily as described in Section 4 under Shift Preoperational Inspection. If the line shows any sign of wear, a thorough inspection of the entire winch line (as described in the Maintenance Manual) is required. Winch line replacement criteria must be consistent with the winch line manufacturer's recommendations.

Personnel Platform

The unit may be equipped with a steel two-man personnel platform mounted at the upper boom tip for use in aerial operations. The platform is gravity leveled. The platform can be mounted to the jib or boom tip.

Platform capacity of the unit [800 pounds (363 kg)] is the total weight of the personnel, tools, and material.



WARNING

Death or serious injury can result from improper use of the platform. Do not use the platform surface to push or support objects such as poles, conductors, etc.

Installation

Prior to mounting the platform to the crane or jib tip, the crane must be set up and leveled (refer to Properly Setting the Outriggers in this section).

1. Place platform assembly on level ground at an appropriate distance from the crane.
2. Remove and store the load ball, and stow the load line. The load line may be run back and secured to the winch. Alternatively, the load line may be secured around the sheaves at the top of the base boom as shown in Figure 6.8. Note that the distance between the winch and the sheaves increases slightly as the boom is lowered. The line must be installed with enough slack to remain loose when the boom is lowered to its lowest angle. Secure the beckett with the beckett pin as shown, and re-install the cotter pin to keep the pin in place.

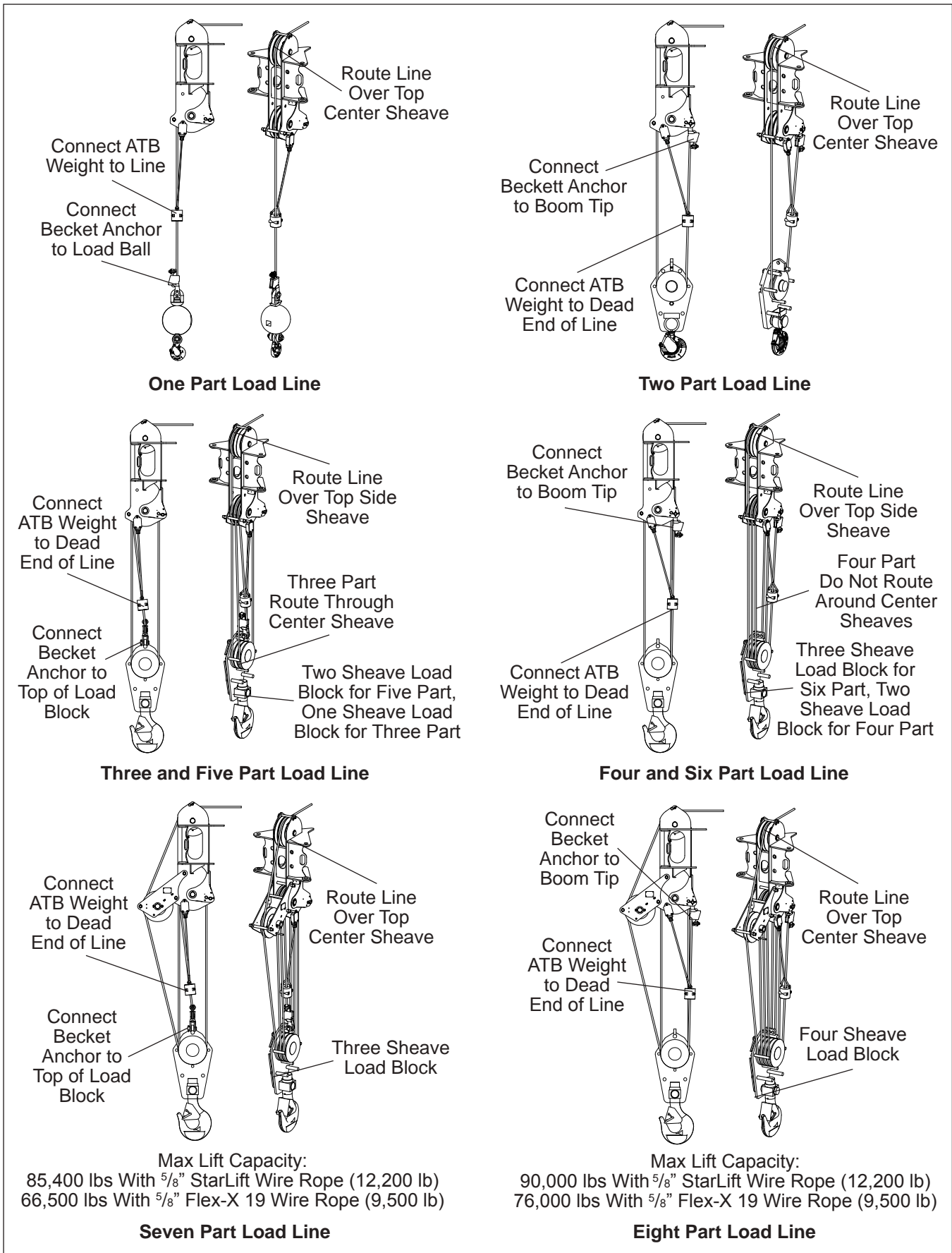
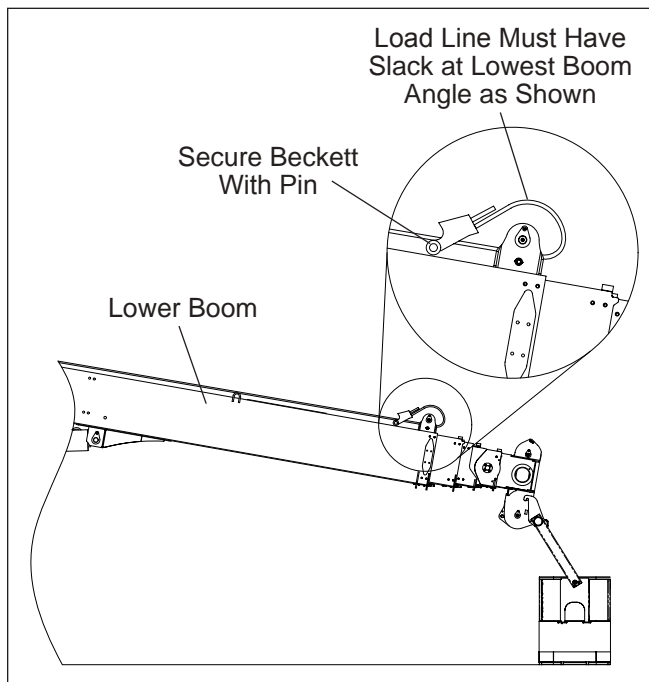


Figure 6.7 — Multiple Part Winch Lines



**Figure 6.8 —
Load Line Secured at Top of Lower Boom**

! WARNING

Death or serious injury can result from improperly stowing the load line. If the line is installed with insufficient slack, it will tighten and potentially fail as the boom is lowered.

3. Disable the winch using the winch disable switch located in the operator's cab. Verify the winch is disabled by actuating both the winch control in the cab and the winch control on the radio remote (if equipped). Do not lift personnel in the platform unless the winch is disabled.
4. Position the crane or jib tip under the platform assembly mounting pins.
5. Raise or lower the platform hanger so that the angle of the mounting pins matches the angle of the tip. Use the platform brake to maintain this angle.
6. Slowly lift the crane boom to engage the tip onto the top platform assembly mounting pin.

! WARNING

Death or serious injury can result from failure to install the platform properly. Ensure platform mounting pins and pin retainers are properly installed before using the platform.

! CAUTION

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

7. Once the top platform mounting pin is fully engaged into the tip mounting ears, align the holes for the bottom mounting pin. Install the pin and install pin retainers in both pins.

Inspection

Prior to operating the unit with the platform, the operator must:

1. Complete the appropriate shift preoperational inspection of the unit.
2. Inspect the platform assembly, door latch, mounting pins, pivot pins and leveling cylinder.
3. Visually inspect all welds on the platform assembly to be free of cracks or separations.
4. Make sure the platform pin keepers are in place and secure.
5. Verify that the lifting capacity of the platform is not being exceeded.
6. Confirm the Load Moment Indicator system is properly calibrated for the addition and capacity of the platform assembly.

Testing LMAP System in Personnel Handling Mode

Test the LMAP system in the personnel handling mode. Boom and rotation functions speeds will be reduced in this mode, and the indicator light at the base of the boom will be illuminated.

1. Select the personnel handling chart on the LMAP.
2. The LMAP system is programmed to limit the maximum radius that the platform can reach. The allowable radius is dependent on whether the platform is installed on the main boom or the jib. Refer to the personnel handling range diagram.
3. Set the boom at an appropriate angle so when extended the platform will cross the maximum allowable radius. The angle will be depend on whether the platform is mounted to an erected jib or the main boom.
4. Telescope the boom into a clear area, and verify the telescope function disables at the appropriate radius based on the personnel handling range diagram. Boom lower should also be disabled at this point.

 **DANGER**

ELECTRICAL HAZARDS

Death or serious injury will result from contact with load, unit, vehicle or vehicle attachments if the boom or load line should become electrically charged. This machine is **NOT INSULATED** and does not provide protection from contact with or proximity to unprotected electrically charged power lines. Maintain safe clearance between machine and electrical power lines of at least 22' (6.10 m) for voltages up to 350 kV and 50' (15.24 m) for voltages over 350 kV up to 1,000 kV, and a distance determined by the electrical power line utility owner in accordance with applicable government regulations. Allow for boom, electrical line and load line sway.

Death or serious injury will result from unprotected contact with energized conductors. The platform carries no dielectric rating.

Death or serious injury will result from unprotected contact with energized conductors. Operators must read and understand Section 4 before operating the unit near energized conductors.

 **DANGER**

Death or serious injury will result if the unit becomes unstable while the personnel platform is occupied. Only handle personnel in approved platforms with properly functioning LMAP system set to the personnel handling chart.

Do not exceed $\frac{1}{2}$ the rated capacity values as shown on the load capacity chart.

 **WARNING**

Death or serious injury can result from improper use of the platform. Do not use the platform surfaces to push or support objects such as poles, conductors, etc.

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

Death or serious injury can result from falling from the platform. Do not use a ladder or other means to extend reach from the platform.

Death or serious injury can result from falling from the platform. Do not sit or stand on platform guardrails.

Death or serious injury can result from improper use of the unit. Do not operate the unit or occupy the platform while the vehicle is in motion.

Death or serious injury can result from falling from the platform. All platform occupants must properly use an appropriate OSHA approved personal fall protection system.

Keep the lanyard used with the OSHA approved personal fall protection system in place and in good condition.

 **CAUTION**

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

For operator safety, follow OSHA and company rules about platform operation and minimum clearances.

Operation

1. Before using the controls, the operator must be familiar with the warnings and safety instructions of the platform, unit and company work practices.
2. Check the entire operating environment (including overhead) for hazards or obstructions prior to operating crane.
3. Personnel in the platform must strictly adhere to the instructions, warnings, cautions and dangers described on the placards located on the crane and platform assembly.
4. Crane and platform assemblies are non-insulated. Minimum approach distances to electrical lines and electrically charged devices must be maintained.
5. Each platform occupant must properly use OSHA approved fall protection devices.
6. Each fall protection lanyard must be individually attached to a designated anchor point. Attach only one lanyard per anchor point.
7. The radio controls must be used from the platform docking station while in personnel handling mode. When the platform is occupied, only use the control station to position the platform in an emergency or when the platform occupant is guiding the lower controls operator.
8. All boom movements must be performed slowly and deliberately. Abrupt control operation will result in erratic movements.
9. When bringing the platform back to the ground, use light down pressure only. Overpowering the platform into the ground may result in irreparable structural damage to the platform assembly and/or the crane.

10. Complete additional testing according to whether the unit will be used in compliance to only ASME B30.23 or ANSI A92.2 standards (refer to the serial number placard on the unit).
 - a. In accordance with ASME B30.23, at each new job site, prior to hoisting people in the personnel platform, the platform and rigging must be proof tested to 125 percent of the platform's capacity rating. Perform a trial lift prior to hoisting personnel with at least the weight expected during the actual lift. An optional platform test weight is available to facilitate these requirements.
 - b. For units equipped with the optional ANSI A92.2 compliance package, cycle each boom function through its complete range of motion and verify operation of emergency controls. The 125 percent proof test lift is not required.

NOTICE

The platform must be removed from the boom and securely fastened to the deck while the unit is in transit.

Lanyard Anchor

The lanyard anchor (refer to Figure 6.9), is part of the personal fall protection system. The operator's harness and lanyard must be properly attached to the anchor.

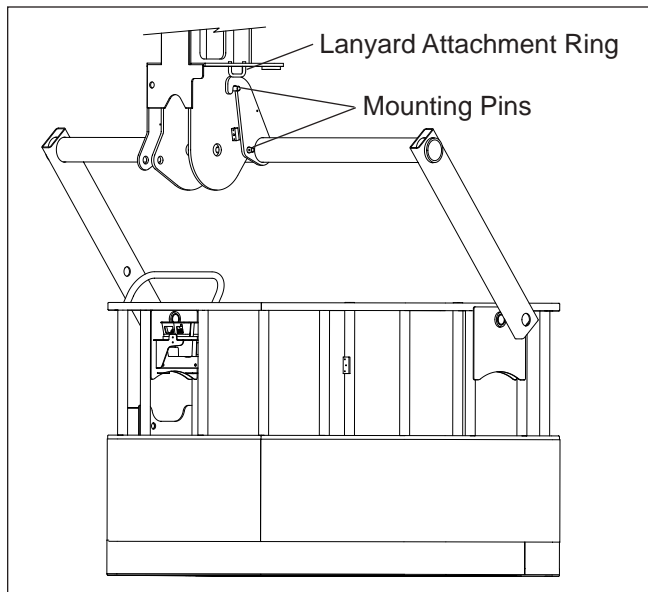


Figure 6.9 — Personnel Platform

Platform Brake

A caliper brake is used to lock the platform into a level position. Lift the brake release lever to release the brake. When the platform is in its working position, push the brake lever back down to lock the brake.

WARNING

Death or serious injury can result from falling from the platform. Secure the platform brake after arriving at the work position.

Death or serious injury can result from uncontrolled movement. Do not leave the platform with the hanger positioned or elevated above the platform when the platform is not attached to the boom tip or release the platform brake lever without firmly supporting the platform hanger.

Platform Test Weight

The personnel platform is available with an optional platform test weight package for the purposes of testing compliance with applicable portions of ASME B30.23 (Personnel Lifting Systems). A trial lift shall be completed with at least the weight expected during the actual lift and a proof load test lift shall be completed with a minimum of 125 percent of the platform capacity. It is the responsibility of the operator to comply with all testing requirements governing his or her work practice.

The platform test weight is designed to be stored underneath the personnel platform on the deck of the unit while it is in transit between job sites. Figure 6.10 shows the platform in its travel position.

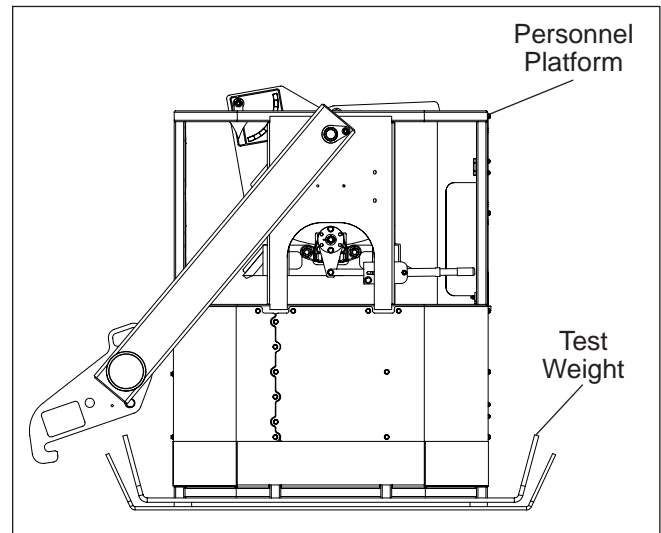


Figure 6.10 — Personnel Platform and Test Weight Positioned for Road Travel

Before performing a test lift, inspect slings, shackles, and other mounting hardware for damage. Replace any faulty components with genuine Altec replacement parts prior to performing a test lift.

To perform the lift, the test weight is attached to the boom or jib mounted platform by the slings and shackles provided with the test weight (refer to Figure 6.11). Lifting the load

clear of the ground, the test weight hangs suspended from the bottom of the platform for a specified period. The test weight is then removed from the platform and the lift may begin.

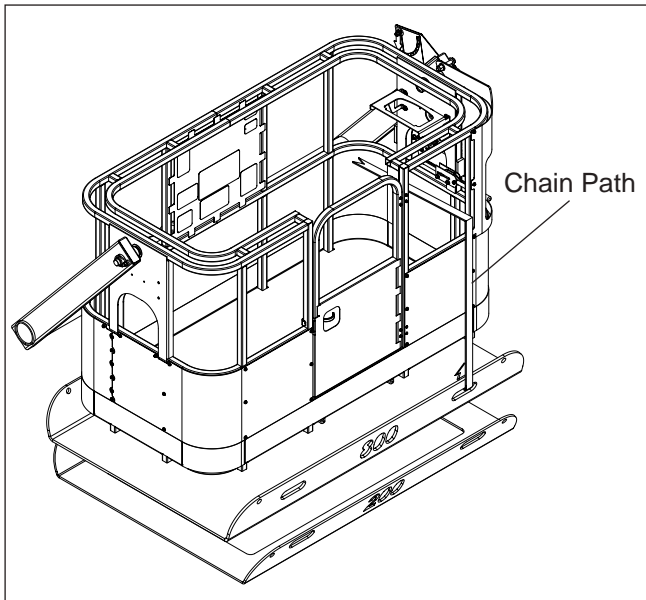


Figure 6.11 — Test Weight and Platform Mounted

It is permissible to lift the platform and test weight as one from the deck. When the lift is complete, the platform may be returned to the center of the test weight. With the slings and shackles secure, the platform and test weight may be lifted as one onto the deck of the machine and secured for transport.

Jibs

All jibs will have a rated jib capacity placard mounted on the jib bracket or jib boom. In some material handling jib positions, the rated capacity of the winch will be greater than the rated capacity of the jib.

Inspect the jib, jib mounting brackets, and pins prior to installing the jib. Do not install the jib if any components are damaged or missing.

WARNING

Death or serious injury can result from overloading the jib. Do not exceed the values on the jib capacity chart.

Death or serious injury can result from damaging the jib. Refer to the capacity placards before using a jib.

Before lifting a load with the jib, refer to Section 3 under Capacity.

Installation and Stowing Procedure

The jib installation and stowing procedures are described here and also on a placard on the unit.

To Install the Jib in the Working Position

1. Engage the PTO and properly set the outriggers.
2. Fully retract the boom and lower the boom tip until it can be reached from the ground.
3. Remove the load block and auxiliary sheave from the boom tip. Remove the anti-two-block switch and chain clevis from the anti-two-block switch.
4. Remove the load line from the boom tip sheave (refer to Figure 6.12). Replace the load line retaining pin.
5. Install the two pins from the pin stow bracket (pins are stowed in brackets on each side of the jib) to fasten the jib in place on the right side of the boom tip. Install hairpin retainers in the pins.
6. Raise the boom to a horizontal position.
7. Fasten a tag line, approximately 15' (4.57 m) long, to the end of the jib.

DANGER

Death or serious injury will occur from uncontrolled movement of the jib. Do not remove the jib stow pin until the two pins have been installed on the right side of the boom tip.

8. Remove the jib stow pin from the jib stow bracket.
9. Extend the boom approximately 15" (38.10 cm) so the jib stow bar is clear of the front jib stow bracket (refer to Figure 6.12).

WARNING

Death or serious injury can occur from uncontrolled movement of the jib. Maintain control of the jib when swinging it into position.

10. Swing the jib into inline position with the tag line.
11. Install two pins from the pin stow bracket to fasten the jib in place on the left side of the boom tip (refer to Figure 6.12). Install hairpin retainers in these pins.

WARNING

Death or serious injury will result from a free falling jib. Ensure that the jib pins and retaining pins are properly installed.

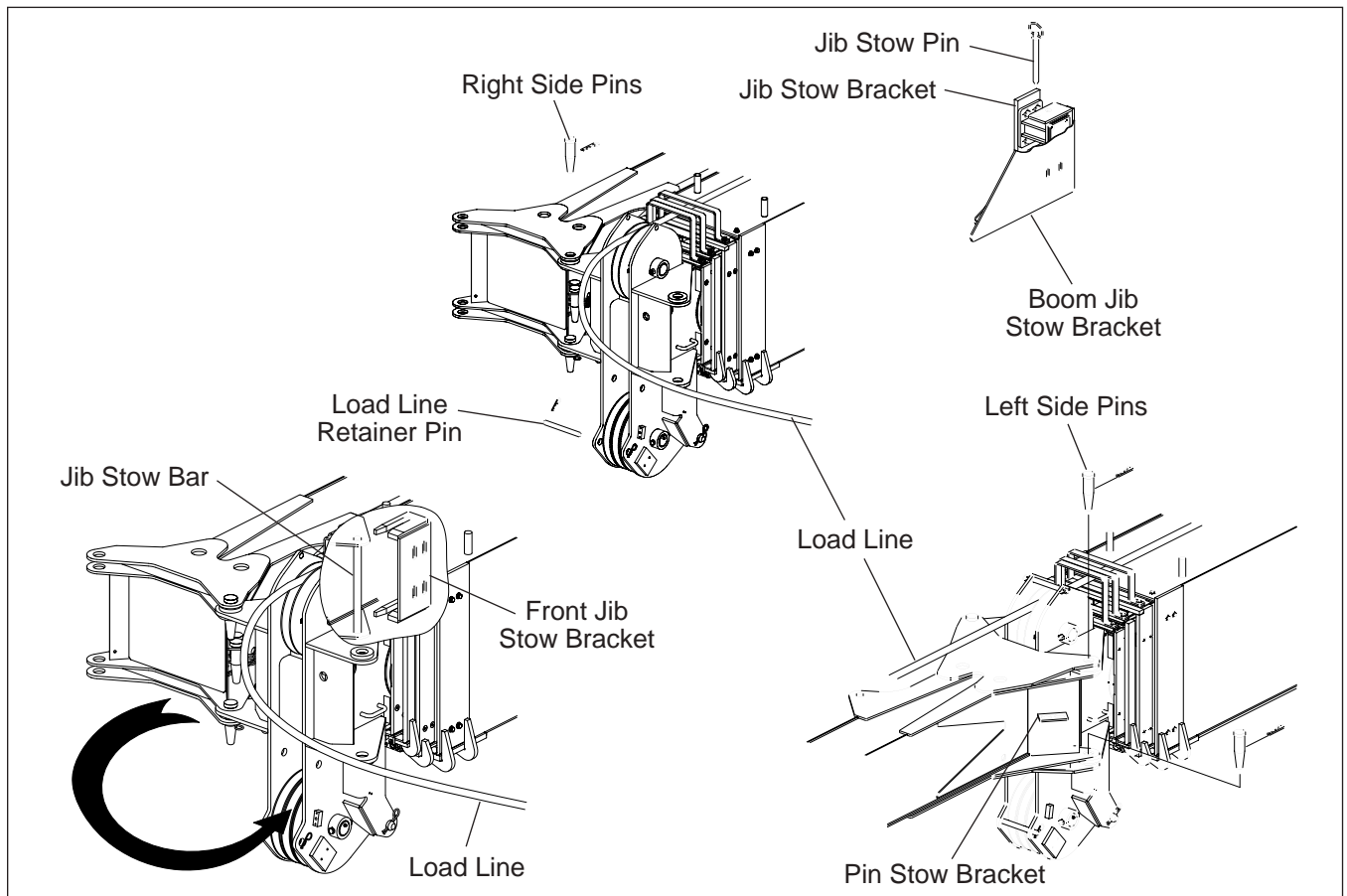


Figure 6.12 — Jib Installation and Stowing

12. Install the load line over the jib tip and boom tip sheave. Reinstall the load line retainer pins.
13. Pin chain clevis for anti-two-block weight to anti-two-block limit switch lever on the jib tip.

To Stow the Jib

1. Fully retract the boom and lower it to the ground until the tip can be reached from the ground.
2. Remove the load line from the jib tip, reinstall the load line retaining pin.
3. Fasten a tag line, approximately 15' (4.57 m) long, to the end of the jib.
4. Remove two pins from the holes on the left side of the boom tip and place in the pin stow bracket. Install hairpin retainers in these pins.
5. Raise the boom to a horizontal position.
6. Extend the boom approximately 15" (38.10 cm).

WARNING

Death or serious injury can occur from uncontrolled movement of the jib. Maintain control of the jib when swinging it into position.

7. Swing the jib to the stored position with the tagline.
8. Remove the jib stow pin from the jib stow bracket. Retract the boom so the jib stow bar, on the jib, engages the front jib stow bracket.

WARNING

Death or serious injury will result from a free falling jib. Ensure that the jib pins and retaining pins are properly installed.

9. Install the jib stow pin in the jib stow bracket. Install the hairpin retainer in this pin.

DANGER

Death or serious injury will occur from uncontrolled movement of the jib. Do not remove the two pins from

the holes on the right side of the boom tip until the jib stow pin is installed in the jib stow bracket.

10. Remove the two pins from the holes on the right side of the boom tip and place in the pin stow bracket. Install hairpin retainers in these pins.

CAUTION

Injury and property damage can result from extending the boom before the jib is properly stowed. Do not extend the boom until the two pins have been removed from the right side of the boom tip.

11. Install the load line over the boom tip sheave. Reinstall the load line retainer pin. Reattach the anti-two-block weight and chain clevis to the anti-two-block switch.

Manual Extend Jib

On units with one of the manually extending jibs shown in Figure 6.13, it may be extended in the following manner after the jib is properly installed on the boom tip.

1. Lower the boom until the jib tip can be reached from the ground.
2. Remove the telescopic locking pin. The pin is located at position 1 for a two point jib extension.
3. Pull the jib out until it is fully extended. Raise the boom if necessary.

WARNING

Death or serious injury can result from uncontrolled movement of the jib. Make sure the jib extension pin and retaining pin are properly installed.

4. Install the jib extension pin and retaining pin. The pin must be moved from position 1 to 2 for a two point jib extension.

Glide Swing Operation (If Equipped)

WARNING

Death or serious injury can result from uncontrolled movement. When the glide swing control and the indicator light are on, maintain foot brake pressure if rotation is not desired.

Do not leave the control station when the glide swing control and indicator light are on. The boom is free to rotate unpowered due to wind or out-of-level set up.

The glide swing control switch (refer to Figure 6.14) is a two-position, rocker switch, located on the left hand control pod. It is used to control a hydraulic solenoid valve that directs a regulated flow of pressure to the swing brake. The switch has two positions. In the on position, the solenoid is shifted to release the parking brake. The indicator light will illuminate and the boom and turntable structure are free to rotate. When the switch is in the off position, normal swing function will resume. The indicator light is no longer illuminated.

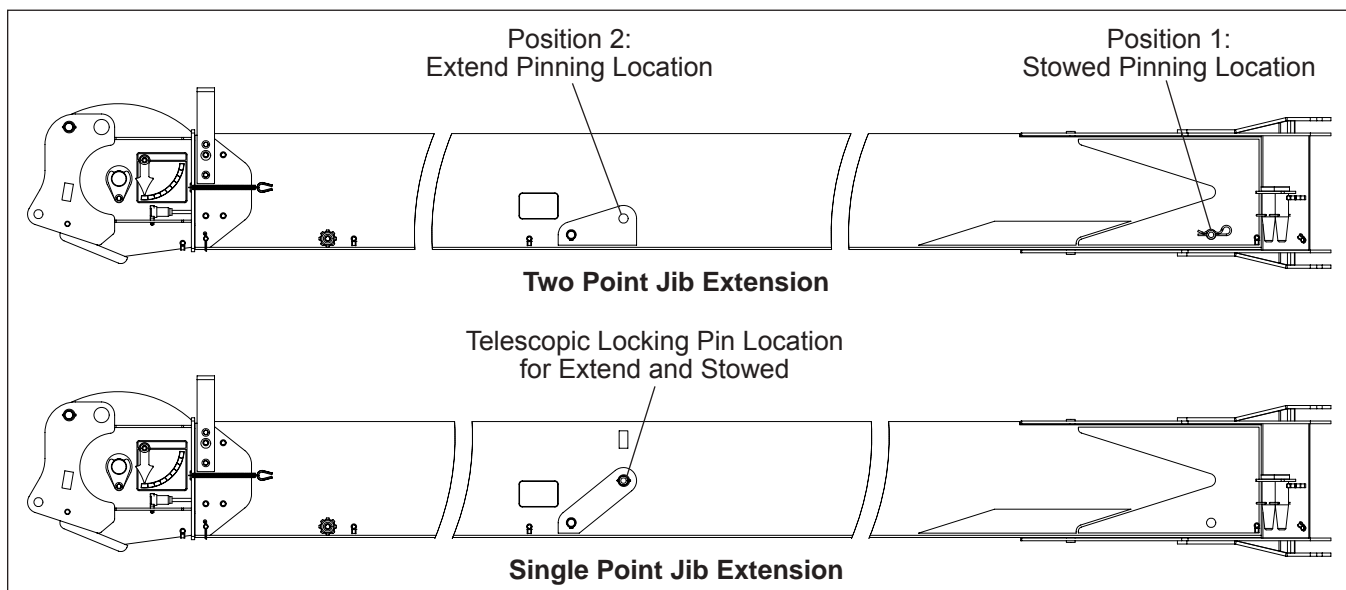


Figure 6.13 — Extensible Jib

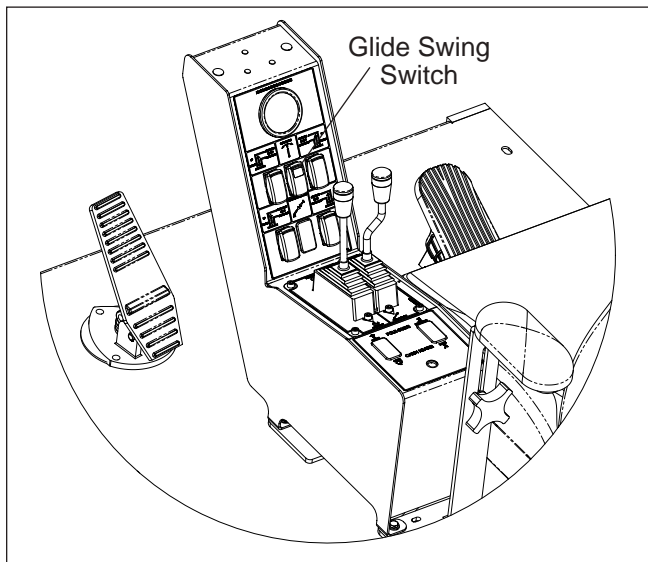


Figure 6.14 — Left Hand Control Pod

A glide swing out of seat horn (refer to Figure 6.15) will sound if the operator is not on the seat when the glide swing is in the On mode. Never leave the operator's control station without deactivating the glide swing.

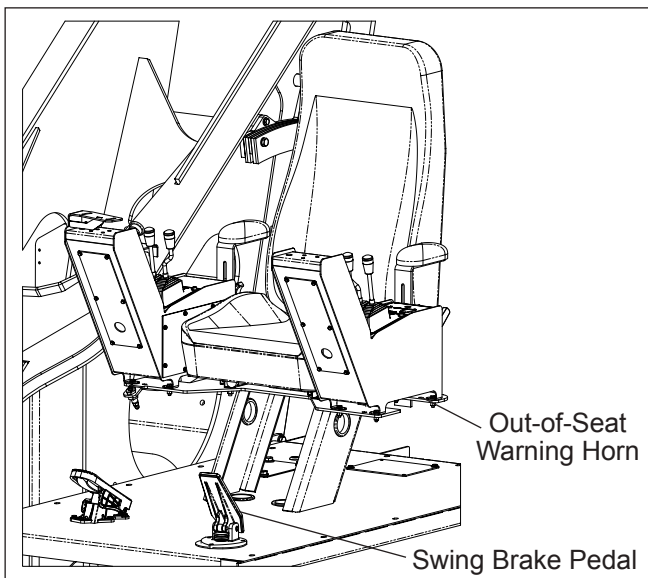


Figure 6.15 — Warning Horn Location

The glide swing hydraulic brake pedal (refer to Figure 6.16) is located on the left side of the operator's control station floor. The brake pedal is used to slow or stop rotation motion. Braking is proportional to pedal engagement. When the glide swing is on, but the brake pedal is not engaged, hydraulic pressure is applied to the brake release. Engaging the brake pedal actuates a control valve to apply pressure to the swing brake override section of the brake. This pressure applies the dynamic braking required to stop unpowered rotation of the boom and turntable structure.

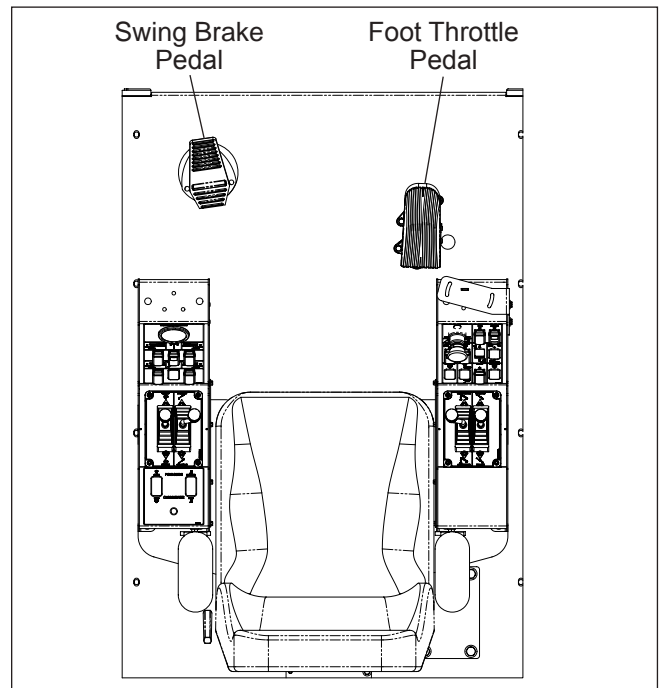


Figure 6.16 — Control Station Floor

Other Methods of Lowering/Stowing the Unit

Use the operator control station controls to lower the platform if the radio remote controls are not operational.

DANGER

Death or serious injury will result from contact with equipment that has become electrically charged. Determine that the unit is not energized before making contact with the unit.

Death or serious injury will result from contact with or proximity to equipment that has become electrically energized. Maintain safe clearances from all energized conductors.

CAUTION

Injury and property damage can result from contact of the boom or platform with fixed objects. Make sure there is sufficient clearance before operating the unit.

After determining that it is safe to touch the vehicle, use the operator control station for boom and platform movement. Then use the controls to carefully lower the platform to the ground.

Section 7 — Care of the Unit

An alert operator can contribute to the proper care of the unit. The observation and correction of minor maintenance problems, as they occur, may prevent costly repairs, 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, oil level and oil 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 putting the unit in service. Section 4 under Cold Weather Start-Up describes this procedure.

The maximum temperature that the hydraulic system can operate at depends upon the hydraulic oil used. Cold weather oil should not exceed 160 degrees Fahrenheit (71 degrees Celsius) and warm weather oil should not exceed 200 degrees Fahrenheit (93 degrees Celsius).

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

NOTICE

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

Check the oil level in the hydraulic reservoir daily. When checking the oil level, the vehicle should be on level ground, booms and outriggers stowed. The oil level must be visible through the sight gauge on the side of

the reservoir. If oil must be added, use the proper type as described in the Maintenance Manual.

A cold oil/change filter indicator is located at the oil filter. This indicator alerts the operator when the return line filter cartridge needs to be replaced or when the hydraulic oil is cold. If the oil is warm and the indicator continues to show, the return line filter cartridge needs to be replaced. Replacing the return line filter is described in the Maintenance Manual.

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

If the unit is equipped with a platform, do not allow it to contact fixed objects such as poles and trees. Keep the platform clean by periodically washing it with mild detergent in warm water.

Structures and Mechanical Systems

Report any loose fasteners, lockwires, pins, pin retainers, etc. so the cause can be determined and corrected.



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

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 the gearbox so the cause can be determined and corrected.

Avoid shock loads and overloading. These conditions can present hazards to the unit and personnel. Start and stop all operations as smoothly as possible. Do not allow debris, tools, etc. to accumulate on the unit. The unit must be free to extend and retract without obstruction.

When cleaning with high pressure washers or steam cleaning equipment, do not directly spray the hydraulic or electrical components or control panels. All hydraulic and electrical connections are sealed and designed for outside use. However, high pressure fluids can sometimes 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 centipoise 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.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 lower leveling cylinder actuated by movement of the lower boom and an upper leveling 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 an 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.

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

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

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

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

meter — to regulate the amount of fluid flow.

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

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

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

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

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

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

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

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

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

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

moly — see molybdenum disulfide.

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

molydisulfide — see molybdenum disulfide.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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 lead is applied to a unit or component.

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

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

oxidation — the reaction of a substance with oxygen.

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

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

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

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

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

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

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

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

penetration — the distance the vehicle frame is lifted 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.

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

pintle hook — the “jaw” portion of a pintle hitch which attaches to the tow vehicle.

piston — a cylindrically shaped part that fits within a cylinder or cylindrical bore and transmits or receives linear motion by means of a connecting rod or other component.

piston pump — a pump in which motion and force are applied to fluid by a reciprocating piston(s) in cylindrical bore(s).

pivot weldment — the structure located above the slide frame on a pressure digger which supports the mast.

placard — **1:** a thin sheet of rigid material which is attached to another surface by adhesive and/or mechanical fasteners, and is used to convey instructions, information and warnings. **2:** May also refer to a decal.

planetary gear set — an assembly of meshed gears consisting of a central gear (sun gear), a coaxial internal tooth ring gear and several intermediate pinions (planet gears) supported on a revolving carrier.

planetary gearbox — a gearbox containing one or more planetary gear sets.

platform — the personnel-carrying component of a unit, mounted at the upper boom tip.

platform elevator — a mechanism, at the boom tip, to which the platform is mounted, allowing vertical motion of the platform with respect to the rest of the boom tip.

platform heater — an electrically powered device mounted in a splicer platform which is used to warm the occupant.

platform leveling system — a system which keeps the bottom of a platform parallel to or at a fixed angle to the base plate of the turntable, or parallel to level ground, as the boom is raised or lowered. The system may be mechanically, hydraulically, or gravity operated.

platform liner — a component made of material having a high dielectric strength which is designed to be inserted into a platform to cover the walls and bottom of the platform.

platform pin — the horizontal pin that is used to fasten a platform mounting bracket to the upper boom tip. The mounting bracket pivots about this pin for platform leveling or positioning.

platform rest — the structural member attached to the chassis or body to support and cushion the platform in the travel or rest position.

platform ring — a metal band around the lip of a splicer platform which supports and guides the platform as it is rotated about its vertical centerline.

platform rotation override system — a system which allows the zone of platform rotation to extend beyond a predetermined limit when actuated by the operator.

platform rotator — a system which allows the operator to rotate the platform about a vertical axis. This permits the position of the platform to be changed with respect to the boom tip.

platform tilt system — a system which allows the operator to adjust the orientation of the platform about a horizontal axis. Some systems allow the operator to adjust the working position of the platform floor and tilt the platform for cleaning. Other systems allow tilting of the platform for cleaning but do not provide for operator adjustment of the working position.

platform use — the stability criteria for a digger derrick mobile unit which indicates that the load capacity chart and stability requirements

apply to the use of the derrick with the platform occupied, with no lifting of loads with the winch line.

plunger — a cylindrically shaped part that is used to transmit thrust; a ram.

pole — a long cylindrical piece of material such as wood, metal, or concrete which is installed in a vertical position for use as a support structure for power and communication lines.

pole guide — a mechanism at the tip of a boom used for guiding and stabilizing a utility pole while using the winch line to raise or lower the pole.

pole guide tilt cylinder — the hydraulic cylinder which is used to tilt (raise or lower) the pole guide.

pole guide tong cylinder — the hydraulic cylinder which opens and closes the pole guide tongs.

pole guide tongs — 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.

primary control panel — the 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 primary control panel is used in conjunction with a secondary panel to provide dual station lower controls.

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 over-running 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 control panel — a derrick lower control panel that is configured as a remote terminal of the primary panel. The secondary panel is used in conjunction with a primary panel to provide dual station lower controls.

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.

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.

splice 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 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.

Shift/Monthly Inspection Checklist

Vehicle No. _____ Location _____ Date _____

Service Request # _____ Model # _____ Serial # _____

Odometer _____ Hours Meter _____ Inspector _____

All items must be checked prior to use each shift and monthly. The monthly inspection must be documented and maintained for a minimum of three months. Begin the inspection by checking that the equipment is in a level position both before each shift and after each move and that ground conditions are adequate for proper support.

Symbols

✓/O = Okay or completed
U = Unsafe to operate

C = Corrected by inspector
N/A = Not applicable

R = Repair or replacement required

General Items		General Operation	
	Hydraulic oil reservoir (proper fluid level, condition)		Outrigger motion alarms and interlocks
	Covers and guards (in place, condition)		Control mechanisms for incorrect adjustments
	Platform mounting pins and fasteners (condition)		Electrical apparatus (malfunctioning, excessive deterioration, dirt, moisture accumulation)
	Winch motor (condition)		
	Jib mounting pin and jib mounting bracket fasteners (condition)	Safety Devices	
	Lift cylinder mounting pins (condition)		Crane level indicator(s) (if built-in and not working properly, must be tagged out or removed)
	Boom pivot pin (condition)		A removable crane level indicator (remove if not working properly)
	Tires (proper inflation, condition)		Rotation brake release pedal on units with optional glide swing feature (operation)
	Rotation bearing and gearbox (condition)		Outrigger holding valves (operation)
	Sheaves and drums (cracked or worn, condition)		Horn (if built-in and not working properly, must be tagged out or removed)
	Fasteners (missing, loose, condition)		Removable horn (remove if not working properly)
	Control and drive mechanisms (excessive wear; contamination by lubricants, water or other foreign matter, condition)	Operational Aids	
	Pressurized lines, and fittings (deterioration, blistering, leakage, condition)		Anti-two-blocking (operation)
	Hooks and latches (deformation, cracks, excessive wear, damage, condition)		Boom angle or radius indicator (LMAP) (operation)
	Operator cab windows (significant cracks, breaks, other deficiencies, condition)		Boom length indicator (LMAP) (operation)
			Load weighing device (LMAP) (operation)
	Hydraulic and other leaks		Outrigger/boom interlocks (operation)
	Misaligned inspection marks		Hoist drum rotation indicator (operation)

Comments _____

Name (printed) _____ Signature _____

Wire Rope Inspection Checklist

Vehicle No. _____ Location _____ Date _____

Service Request # _____ Model # _____ Serial # _____

Odometer _____ Hours Meter _____ Inspector _____

The shift/monthly inspection must be conducted prior to use each shift the equipment is in service and monthly. When conducting a monthly inspection, the inspection must be documented and maintained for three months. When conducting an annual/comprehensive inspection, the inspection must be documented and maintained for 12 months.

Symbols

✓/O = Okay or completed
U = Unsafe to operate

C = Corrected by inspector
N/A = Not applicable

R = Repair or replacement required

Shift/Monthly		
Critical Review Items	Category 2	
Rotation resistant wire rope in use	Visible broken wires in running wire ropes. Six randomly distributed broken wires in one rope lay or three broken wires in one strand in one rope lay where a rope lay is the length along the rope in which one strand makes a complete revolution around the rope.	
Wire rope being used for boom hoists and luffing hoists, particularly at reverse bends		
Wire rope at flange points, crossover points, and repetitive pickup points on drums		
Wire rope at or near terminal ends	Visible broken wires in rotation resistant ropes. Two randomly distributed broken wires in six rope diameters or four randomly distributed broken wires in 30 rope diameters.	
Wire rope in contact with saddles, equalizer sheaves or other sheaves where rope travel is limited		
Category 1		
Significant distortion of the wire rope structure such as kinking, crushing, unstranding, birdcaging, signs of core failure, or steel core protrusion between the outer strands	Visible broken wires in pendants or standing wire ropes. More than two broken wires in one rope lay located in rope beyond end connections and/or more than one broken wire in a rope lay located at an end connection.	
Significant corrosion		
Electric arc damage (from a source other than power lines) or heat damage	A diameter reduction of more than five percent from nominal diameter	
Category 3		
Improperly applied end connections		In rotation resistant wire rope, core protrusion or other distortion indicating core failure
Significantly corroded, cracked, bent, or worn end connections (such as from severe operation)		
	Prior electrical contact with a power line	
	A broken strand	
Annual/Comprehensive		
Complete shift/monthly inspection	Wire rope subject to reverse bends	
Check sections that are normally hidden during shift and monthly inspections	Wire rope passing over sheaves	

Comments _____

Name (printed) _____ Signature _____

Annual Inspection Checklist

Vehicle No. _____ Location _____ Date _____

Service Request # _____ Model # _____ Serial # _____

Odometer _____ Hours Meter _____ Inspector _____

This inspection must be documented and maintained for a minimum of 12 months. Begin the inspection by completing the monthly inspection.

Symbols

✓/O = Okay or completed

U = Unsafe to operate

C = Corrected by inspector

N/A = Not applicable

R = Repair or replacement required

Pumps and Motors		Significant inaccuracies
	Unusual noises or vibration	Gasoline, Diesel, Electric, or Other Power Plants
	Low operating speed	Safety related problems
	Excessive heating of the fluid	Condition
	Low pressure	Leaking exhaust
	Loose fasteners	Emergency shut-down feature
	Shaft seals and joints between pump sections for leaks	Proper operation
Valves		Travel Steering, Brakes, and Locking Devices
	Spools that stick, have improper return to neutral, and leaks	Proper operation
	Valve housing cracks	Sheaves and Drums Cracks
	Relief valves with failure to reach correct pressure (if there is a manufacturer procedure for checking pressure, it must be followed)	Significant wear Components Such as Pins, Bearings, Shafts, Gears, Rollers, and Locking Devices
Cylinders		Distortion
	Drifting caused by internal leakage	Cracks
	Rod seals and welded joints for leaks	Significant wear
	Cylinder rods for scores, nicks, or dents	Brake and Clutch System parts, Linings, Pawls, and Ratchets
	Barrel for significant dents	Excessive wear
	Loose or deformed rod eyes and connecting joints	Chains and Chain Drive Sprockets
Hydraulic or Pneumatic Lines, Fittings, and Connections		Excessive wear of sprockets
	Leakage	Excessive chain stretch
	Outer covering of the hose for blistering, abnormal deformation or other signs of failure/impending failure	Tires Damage
	Outer surface of a hose, rigid tube, or fitting for indications of excessive abrasion or scrubbing	Excessive wear Outrigger or Stabilizer Pads/Floats
Equipment Structure, Including the Boom and Jib (if equipped)		Excessive wear
	Structural member (deformity, cracks, significant corrosion)	Cracks Slide Pads
	Bolts, rivets and other fasteners (loose, have failed, significantly corroded)	Excessive wear Cracks
	Welds (cracks)	Electrical Components and Wiring
Safety Devices/Operational Aids		Cracked or split insulation
	Proper operation	Loose or corroded terminations

Labels and Decals Originally Supplied by the Manufacturer or Otherwise Required		Originally Equipped Operator Seat, Steps, Ladders, Handrails, and Guards	
	Missing		Missing
	Unreadable		Unusable
			Unsafe condition

Comments _____

Name (printed) _____ Signature _____

Standard Hand Signals for Controlling Crane Operations



SWING: Arm extended, point with finger in direction of swing of boom.



STOP: Arm extended, palm down, move arm back and forth horizontally.



EMERGENCY STOP: Both arms extended, palms down, move back and forth horizontally.



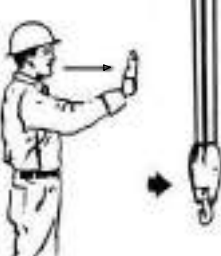
HOIST: With forearm vertical, forefinger pointing up, move hand in small horizontal circle.



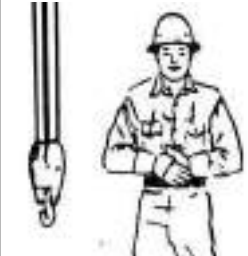
LOWER: With arm extended downward, forefinger pointing down, move hand in small horizontal circle.



USE MAIN HOIST: Tap fist on head; then use regular signals.



TRAVEL: Arm extended forward, hand open and slightly raised, making pushing motion in direction of travel.



DOG EVERYTHING: Clasp hands in front of body.



TRAVEL (Both Tracks): Use Both fists in front of body, making a circular motion about each other, indicating direction of travel, forward or backward. (For land cranes only.)



USE WHIP LINE (Auxiliary Hoist): Tap elbow with one hand; then use regular signals.



RAISE BOOM: Arm extended, fingers closed, thumb pointing upward.



LOWER BOOM: Arm extended, fingers closed, thumb pointing downward.



TRAVEL (One Track): Lock the track on side indicated by raised fist. Travel opposite track in direction indicated by circular motion of other fist, rotated vertically in front of body. (For land cranes only.)



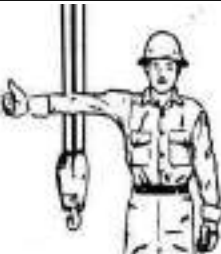
RETRACT BOOM: (Telescoping Booms). Both fists in front of body with thumbs pointing toward each other.



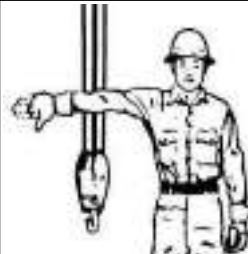
EXTEND BOOM: (Telescoping Booms). Both fists in front of body with thumbs pointing outward.



MOVE SLOWLY: Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist slowly shown as example.)



RAISE THE BOOM AND LOWER THE LOAD: With arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.



LOWER THE BOOM AND RAISE THE LOAD: With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.

Extracted From ANSI Standard
ASME B30.5 - 2000
This Complies With OSHA Standards

9700-13539



Altec LMAP

(Load Moment and Area Protection)
Telescopic Boom Cranes

Operation

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Introduction

System Components

- LMAP Display Unit
- LMAP Computer Unit
- Pressure Transducers
- Extension Reel with length and angle sensors
- Anti Two-Block (ATB) switches
- Cables

The Load Moment Area Protection (LMAP) system is intended to aid the crane operator by continuously monitoring the load and warning of an approach to an overload or two-block condition. Crane functions are monitored by means of high accuracy sensors. The system continuously compares the load suspended below the boom head with the crane capacity chart stored in the computer memory. At approach to overload, the system warns by means of audible and visual alarms. The system can be configured to cause function kick-out by sending a signal to function disconnect solenoids.

Anti Two Block (ATB)

A switch monitors the approach of the hookblock or overhaul ball to the boom head. The switch is held in the normal position until the hookblock or overhaul ball raises a weight that is mounted around the hoist rope. When the weight is raised, it causes the switch to operate. The resultant signal is sent to the computer via the extension reel causing the ATB alarm to operate and function kick-out to occur.

Area Alarm

When set, this alarm permits the operator to define the operating zone by only two set points. The use of this method of setting results in a greatly enhanced working area, and also clearly defines the operating zone.

Boom Angle Sensor

Boom angle is measured by means of a high accuracy potentiometer, a magnetically dampened pendulum to prevent erratic voltage changes. It provides a voltage proportional to boom angle. The boom angle sensor is mounted inside the cable extension reel assembly.

Display

The operator is provided with a continuous display of:

- Rated Load
- Actual Load
- Bar Graph showing Percentage of Rated Load
- Radius of the Load
- Boom Angle
- Main Boom Length
- Working Area
- Crane Configuration

On-screen messages provide the operator with visual warnings of conditions that occur during operation of the system.

Extension Sensor

The extension sensor provides an increasing voltage proportional to the extension of the boom. A cable attached to the boom head provides a low current electrical path for the ATB signal.

Function Kick-Out

Electrically operated solenoids disconnect the control lever functions for boom hoist lower, telescope out, and winch up whenever an overload or an ATB condition occurs.

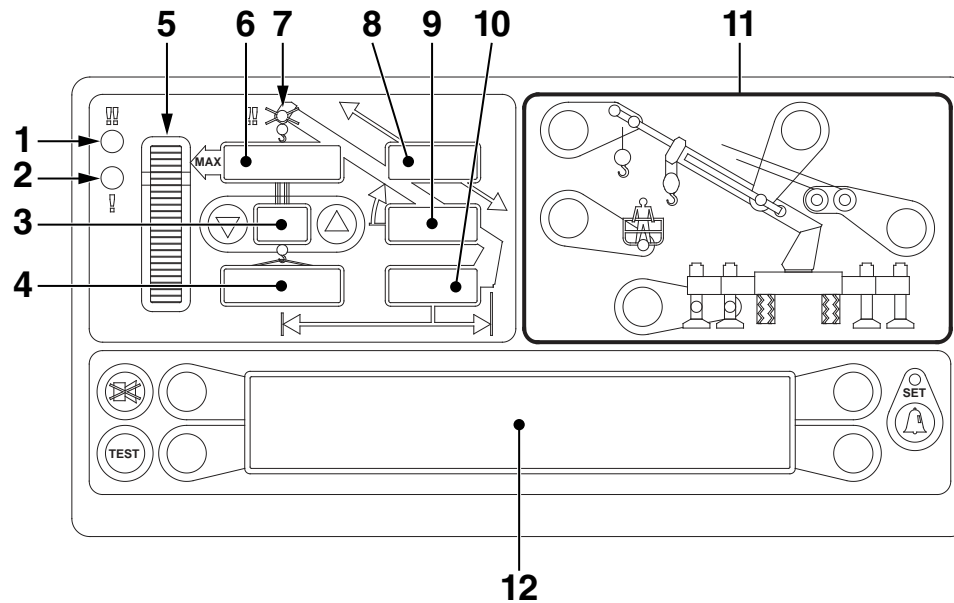
Pressure Transducers

Two pressure transducers measure the pressure in the boom hoist cylinder. The resultant Total Moment signal is processed to provide a continuous display of the load suspended below the point of lift.

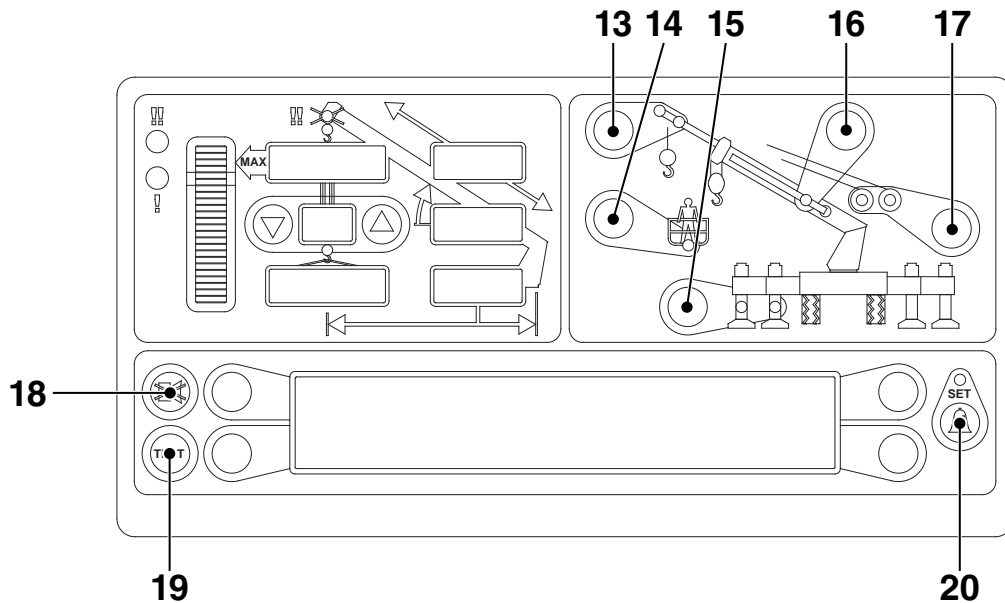
Operator Alarms

These alarms, when properly set by the operator, define the operating range. This is achieved by means of minimum and maximum angle, maximum height, and/or maximum length. These alarms can be programmed for each job site and allow the operator to work in a defined area.

LMAP Display



1. Overload Warning – This red LED illuminates when you reach or exceed 100% of rated capacity. It is accompanied by solid tone alarm and when maximum rated capacity is exceeded will result in boom function lockout.
2. Approaching Overload Warning – This amber LED illuminates when you reach or exceed 90% Rated Capacity. It will be accompanied by a beeping alarm.
3. Parts of Line – Displays current number of parts of line in use.
4. Load on Hook – Displays the entire hook load weight under the head of the boom, including cable, load block, load handling equipment, and weight of load hanging on hook.
5. Percent of Rated Capacity Meter - Shows the load as a percentage of rated capacity. As the load increases, the meter level increases to represent the percentage of the rated capacity of the crane.
6. Rated Capacity – Displays the rated capacity in the current configuration based on the crane load capacity chart.
7. ATB Warning – Warns of a potential two-block condition with flashing LED and audible alarm.
8. Boom Length – Displays the current boom length in feet and tenths of a foot.
9. Boom Angle – Displays the current boom angle in degrees and tenths of a degree.
10. Load Radius – Displays the load radius from centerline of rotation.
11. Crane Setup – These keys are used in the setup process to configure the LMAP system to match the current configuration of the crane.
12. Information Window – Displays crane setup and calibration information as well as warning messages.



- 13. Erected Jib – Enables the selection of the jib to be used on the boom. Selects extended or retracted jib when crane is equipped with two stage jib.
- 14. Basket Operation – Enables the selection of the platform for man basket operation.
- 15. Outrigger Configuration – Enables the selection between full and mid span outriggers.
- 16. Stowed Jib – Enables the selection of the jib stowed on the boom. Also used to stow the erected jib.
- 17. Winch Selection – Enables the selection of the winch if the crane is equipped with an optional second winch (for models equipped with auxiliary winch only).
- 18. Alarm Cancel – Disables audible alarm. Holding down this key overrides function kick-out.
- 19. Test Button – Press and hold the test button to initiate a system self test and run diagnostics.
- 20. Operator Alarm/Set – Enables operator alarms. When an alarm has been set, the LED above this button will illuminate yellow.

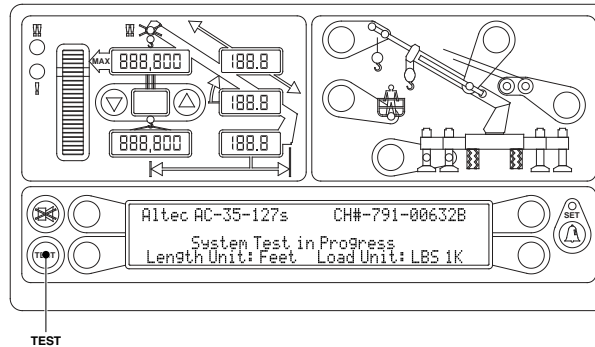
⚠ WARNING

YOU MUST USE THE CRANE SETUP MODE TO CORRECTLY SET THE LMAP SYSTEM FOR PROPER OPERATION. THE LMAP SYSTEM SETUP MUST MATCH THE ACTUAL CONFIGURATION OF THE CRANE SO THAT IT WILL INDICATE THE CORRECT HOOK LOAD AND LIFTING CAPACITY OF THE CRANE.

Operation

Power Up Self-Test

Immediately following electrical power up, or by manually pressing the **TEST** key, the system will execute a self-test lasting for approximately eight seconds.

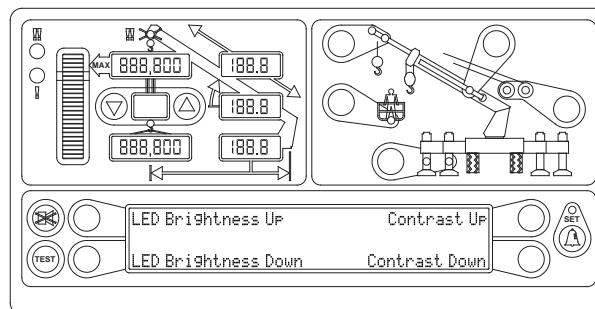


During this time, the numerical display segments and bar graph segments are all turned on, the audible alarm will sound, and alarm indicator lights and all other LED's are illuminated. The information window will display the crane model, rating chart number, and units of measure for length and load.

NOTE At the end of the self-test, the information window will display “CHECK CONFIGURATION BEFORE YOU CONTINUE”. Press any key to continue, and then verify the setup of the system to the current configuration of the crane.

Adjusting Brightness & Contrast

Immediately following self-test and the start up screen, the information window will display the brightness and contrast control functions for two seconds.

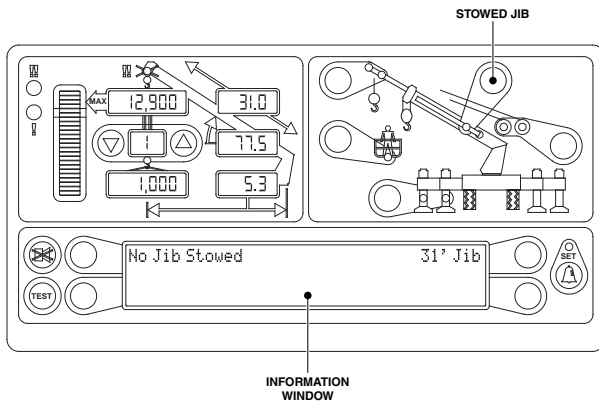


Press the key adjacent to either “LED Brightness Up” or “LED Brightness Down” to increase or decrease the brightness of the LEDs on the display.

Press the key adjacent to either “Contrast Up” or “Contrast Down” to increase or decrease the contrast level of the information window.

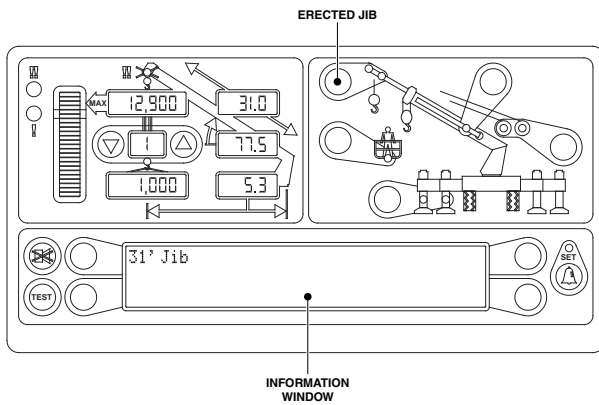
NOTE Brightness and contrast can be adjusted at any time during normal operation except while operator alarms are being set.

Stowing the Jib



The **STOWED JIB** key will select between stowed jib or no stowed jib. The **STOWED JIB** key is also used to stow the erected jib. For cranes that do not have jib options, the message “No Other Stowed Jib Options” will appear in the information window.

Erecting the Jib

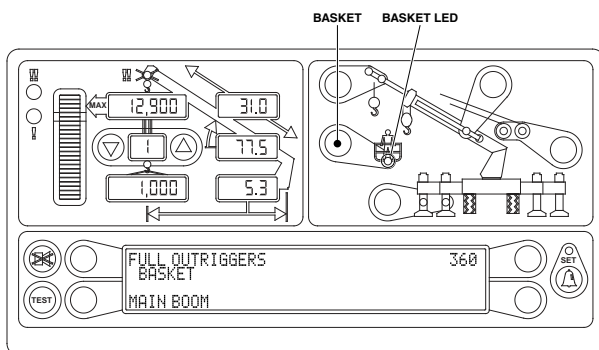


The **ERECTED JIB** key will select the erected jib when the stowed jib is selected. The available erected jib options will be displayed in the information window.

NOTE

If the **ERECTED JIB** key is pressed when the LMAP System does not have a stowed jib selected, the message “There Is No Stowed Jib To Erect” will appear in the information window.

Selecting the Platform



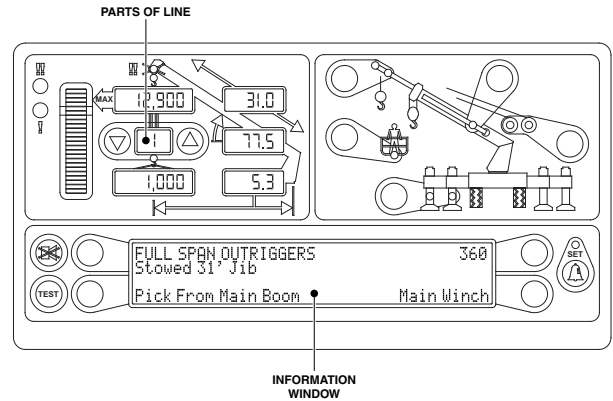
Pressing the platform key selects the platform for man-basket operation and will illuminate the LED that is under the platform graphic.

NOTE

When the platform for man-basket operation is selected, winch functions are disabled.

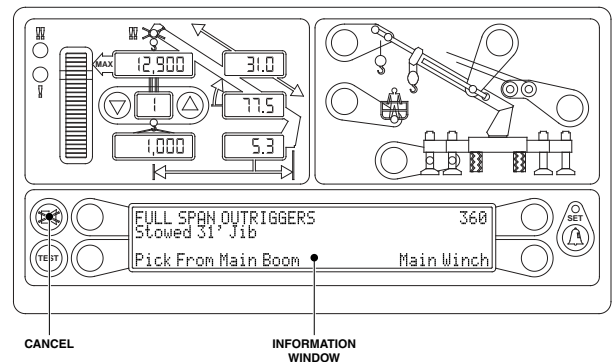
Setting the Parts of Line

Parts of line are set by pressing the up or down arrow. The number of parts of line will appear in the display next to the arrow. When an alternate winch is selected, it is necessary to reset the parts of line for the alternate winch.



Cancel Alarm Key

When an alarm condition occurs, the warning horn can be silenced by pressing the **CANCEL** key. The system will reactivate the warning horn when another alarm condition occurs.



Reset Function Kick-Out

If the function kick-out is engaged due to an overload condition, press and hold the **CANCEL** key to override. An audible beep will sound confirming the override. The override will remain active as long as the **CANCEL** key is held down, once the **CANCEL** key is released the function kick-out will re-engage. **While in override for an overload condition, two-block protection WILL remain active.**

If the function kick-out is engaged due to a two-block condition, press and hold the cancel key to override. An audible beep will sound confirming the override. The override will remain active as long as the **CANCEL** key is held down, once the **CANCEL** key is released the function kick-out will re-engage. **While in override for an two-block condition, overload protection WILL NOT be active.**

⚠️ WARNING

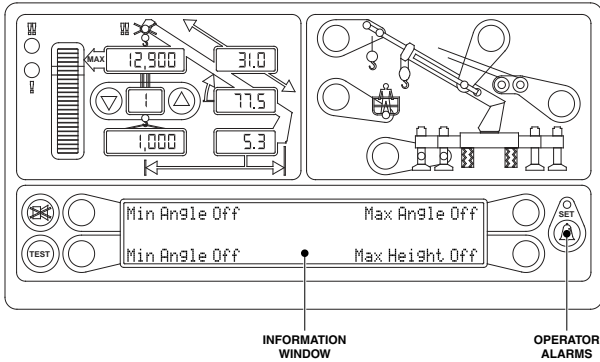
WHEN THE RESET FUNCTION KICK-OUT OVERRIDE FUNCTION IS USED, THERE IS NO PROTECTION FROM OVERLOAD OR TWO-BLOCK CONDITION.

Operator Alarms

⚠ WARNING

ALL OPERATOR DEFINED ALARMS ARE WARNING DEVICES. ALL CRANE FUNCTIONS REMAIN OPERATIONAL WHEN AN OPERATOR ALARM IS ACTIVE.

Accessing the Operator Alarms

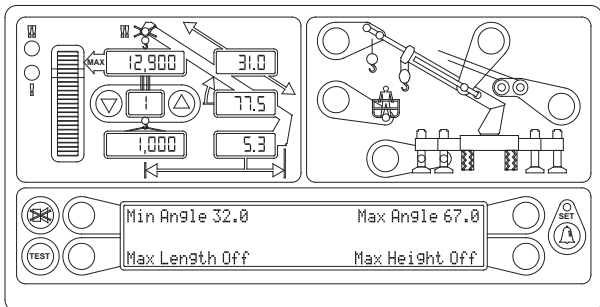


Press the **OPERATOR ALARM** key to access the operator alarms. The information window will show the current status of the alarms. The following operator alarms are available:

- Minimum Boom Angle
- Maximum Boom Angle
- Maximum Boom Length
- Maximum Tip Height

Each key acts as a toggle switch turning the alarm on or off if the alarm is off, press the appropriate key to turn the alarm on. If the alarm is on, press the appropriate key to turn the alarm off.

Setting Minimum Boom Angle Alarm



Move the boom to the desired minimum angle. Press the **OPERATOR ALARM** key to access the operator alarm screen. Press the key adjacent to “Min Angle” to set to the current position.

If the angle of the boom falls below the minimum angle set, the red warning light will flash and the audible alarm will sound.

Press the key adjacent to “Min Angle” again to turn off

the minimum boom angle alarm.

Setting Maximum Boom Angle Alarm

Move the boom to the desired maximum angle. Press the **OPERATOR ALARM** key to access the operator alarm screen. Press the key adjacent to “Max Angle” to set the current position.

If the angle of the boom rises above the maximum angle set, the red warning light will flash and the audible alarm will sound.

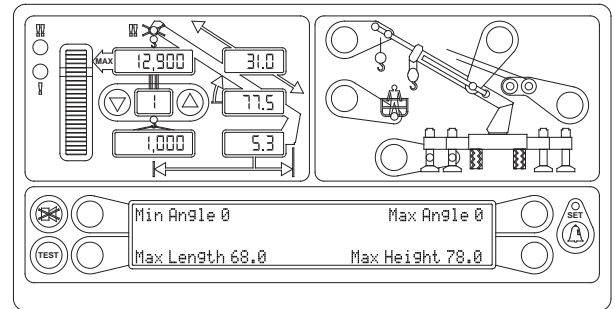
Press the key adjacent to “Max Angle” to turn off the maximum boom angle alarm.

Setting Maximum Boom Length Alarm

Extend the boom to the desired maximum length. Press the **OPERATOR ALARM** key to access the operator alarm screen. Press the key adjacent to “Max Length” to set to the current position.

If the length of the boom increases beyond the maximum length set, the red warning light will flash and the audible alarm will sound.

Press the key adjacent to “Max Length” again to turn of the minimum boom angle alarm.



Setting Maximum Tip Height Alarm

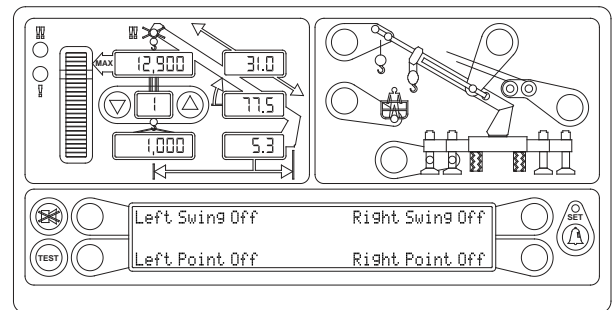
Raise the boom to the desired maximum height. Press the **OPERATOR ALARM** key to access the operator alarm screen. Press the key adjacent to “Max Height” to set to the current position.

If the tip of the boom goes beyond the maximum height set, the red warning light will flash and the audible alarm will sound.

Press the key adjacent to “Max Height” again to turn of the minimum boom angle alarm.

Accessing Swing and Work Area Alarms

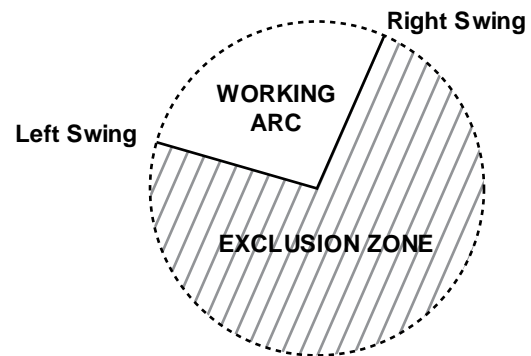
To access the swing and work area alarms from the main working screen, press the **OPERATOR ALARM** key twice. The information window will show the current status of the swing and work area alarms. Each of the four operator alarms are controlled by keys adjacent to the text in the information window. Each key operates as a toggle switch. If the alarm to be set is off, pressing the corresponding key will turn the alarm on. If the alarm to be set is on pressing the corresponding key will turn the alarm off. When operator alarms are set, the light above the key will be illuminated. Return to the main screen by pressing the **OPERATOR ALARM** key.



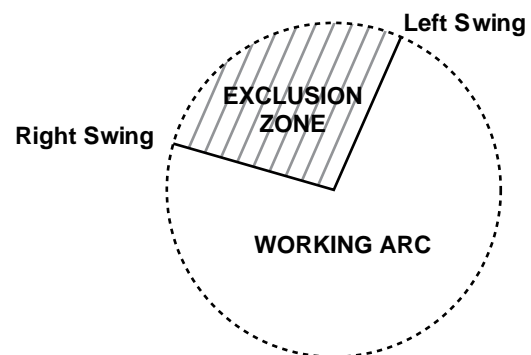
Swing Alarms

Swing alarms define a working arc and an exclusion zone by two set points. The following diagram illustrates the working arc and exclusion zone.

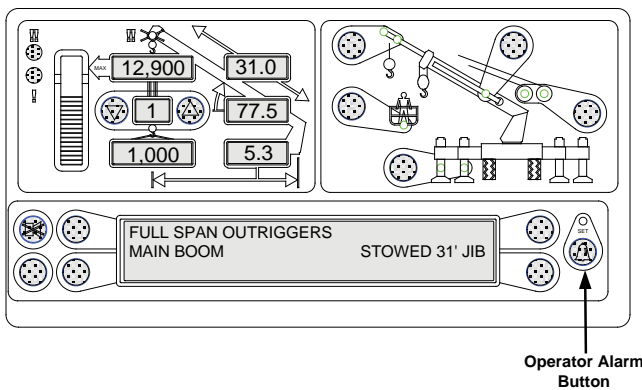
- A left swing alarm is activated when swinging to the left.
- A right swing alarm is activated when swinging to the right
- In this example, the working arc is the smaller piece of the pie



- A left swing alarm is activated when swinging to the left.
- A right swing alarm is activated when swinging to the right
- In this example, the working arc is the larger piece of the pie.

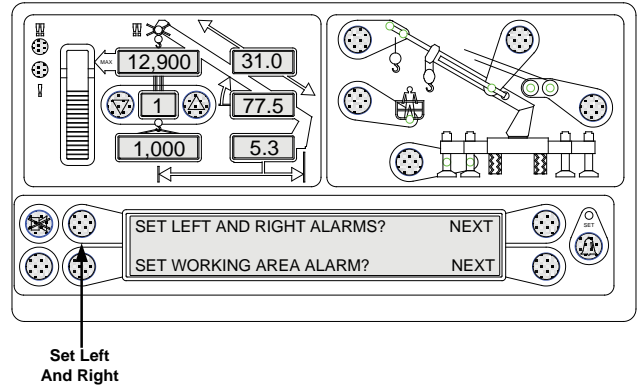


Setting the Swing Left and Swing Right Alarms (Normal Outriggers)

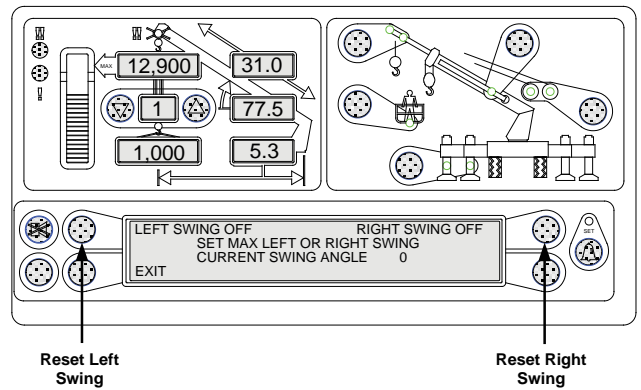


From the main working screen, press the **OPERATOR ALARM** key twice.

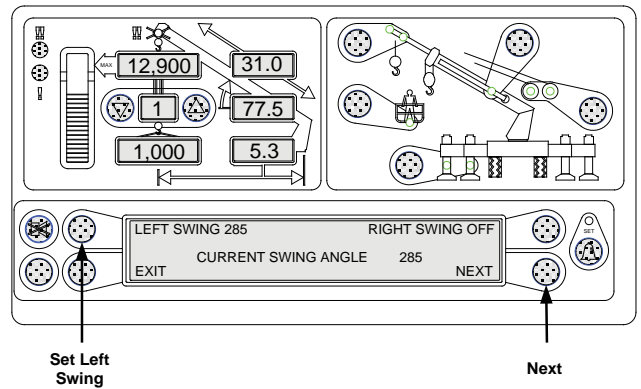
Press the key adjacent to “Set Left and Right Alarms?”.



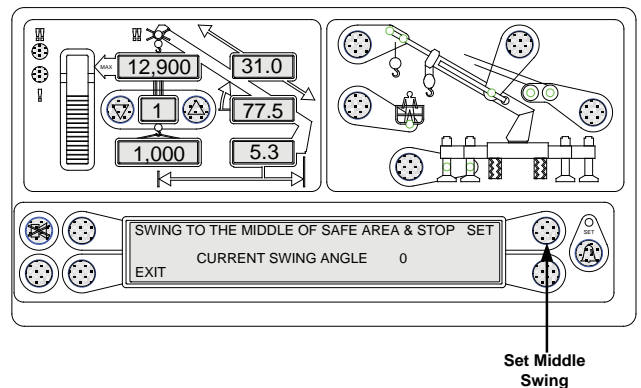
To set a new swing area, you must first reset the left and right points. Press the keys adjacent to “Left Swing” and Right Swing” so they show “off”.

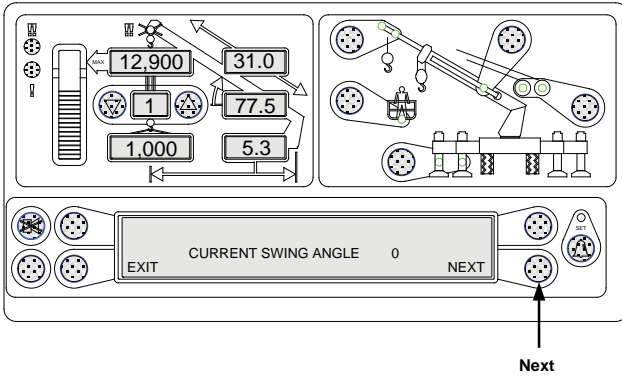


Rotate the boom to the left swing point and press the key adjacent to “Left Swing”, then press the key adjacent to “Next” to proceed.

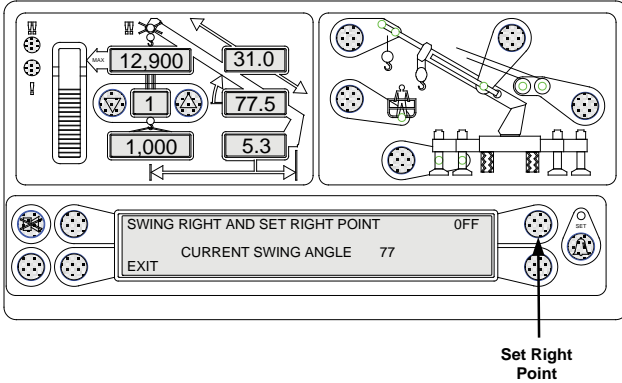


Move the boom to the middle of the swing area and press the key adjacent to “Set”.

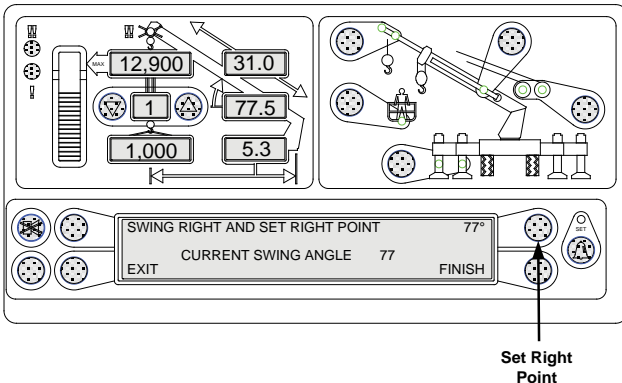




Press the key adjacent to "Next" to proceed.

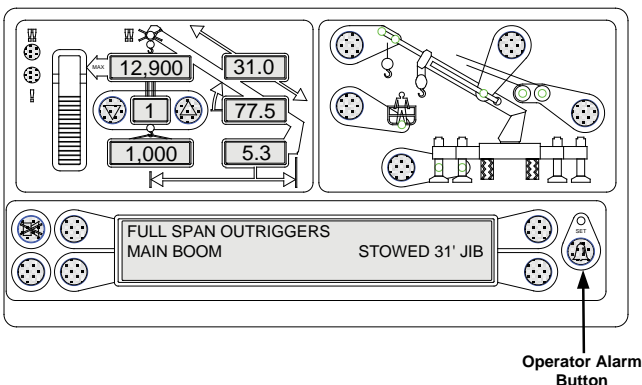


Rotate the boom to the right swing point and press the key adjacent to "Off".



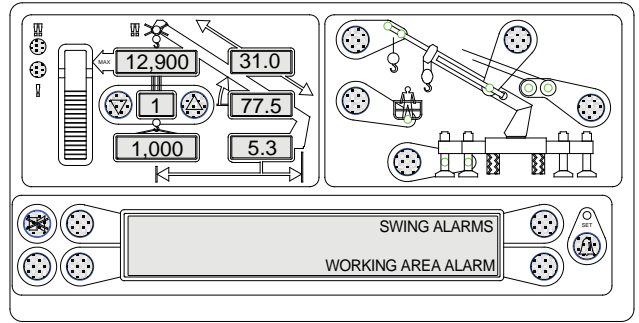
Press the key adjacent to "Finish" to complete the routine.

Enabling the Preset Exclusion Zones (Models Equipped with Short-Span Outriggers)

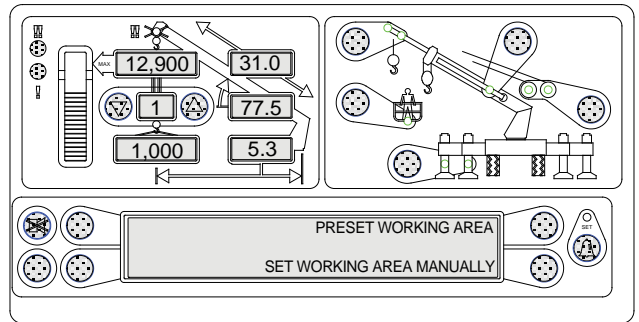


From the main working screen, press the **OPERATOR ALARM** key twice.

Press the key adjacent to "Swing Alarms".

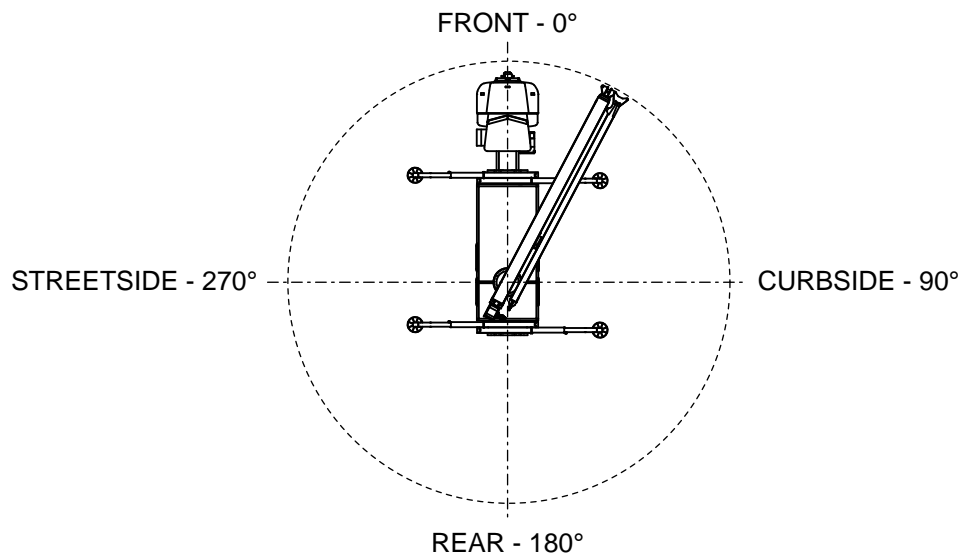
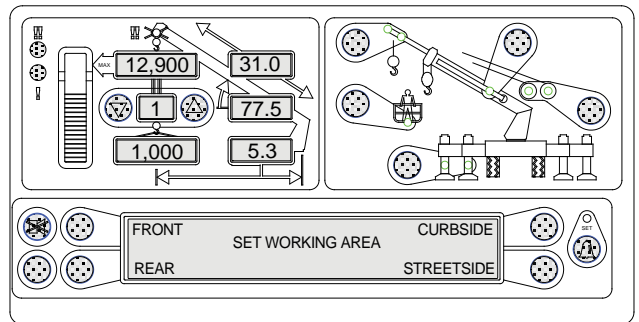


Press the key adjacent to "Preset Working Area".

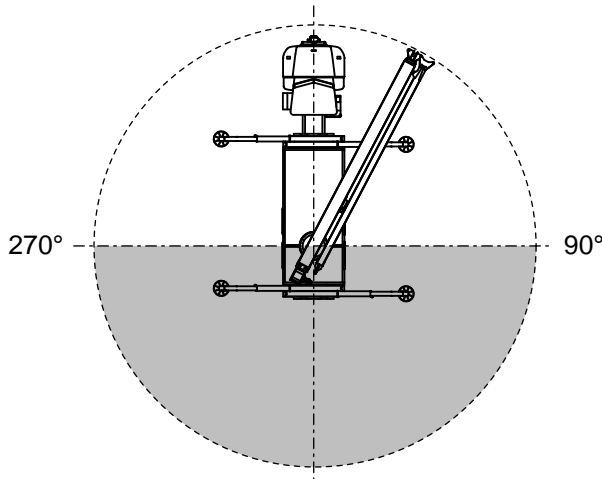


Press the key adjacent to one of the four predefined exclusion zones: Front, Rear, Curbside, or Streetside.

SELECTION	EXCLUSION ZONE
Front	270° - 90°
Rear	90° - 270°
Curbside	0° - 180°
Streetside	180° - 0°

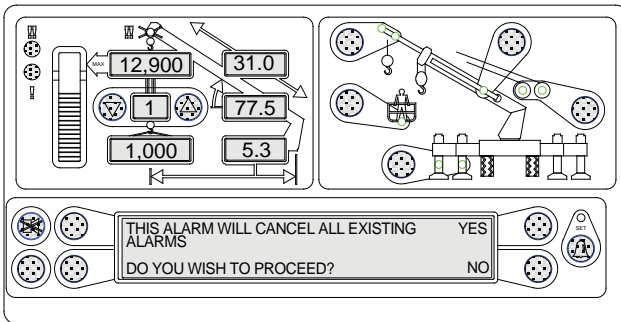


WORKING AREA



For example, selecting “Front” will set the working area from 270° through 90° and set the exclusion zone as shown in the illustration.

EXCLUSION ZONE

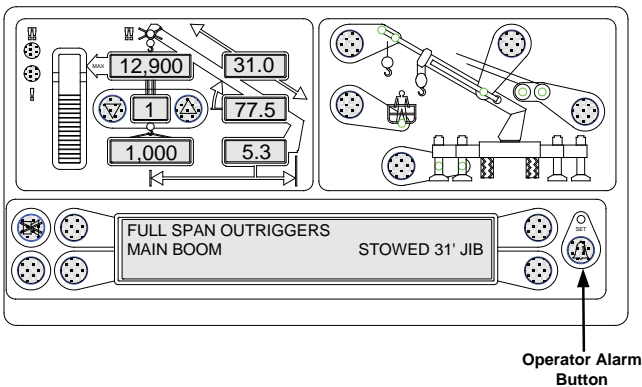


Confirm your selection by pressing the key adjacent to “Yes”. This will cancel all existing swing alarms including manually set alarms.

To cancel the preset alarms, press the **OPERATOR ALARM** key twice, then press the key adjacent to “Swing Alarms”, then press the key adjacent to “Preset Working Area”.

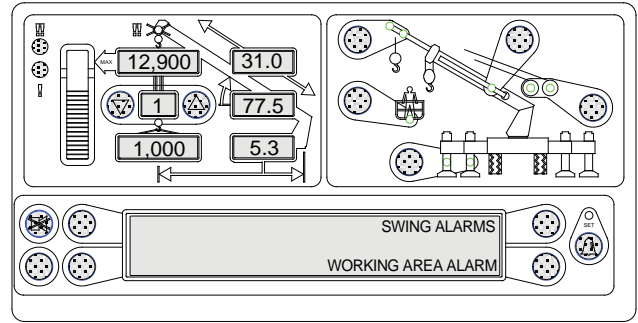
The current preset swing alarm will be blinking. Press the key adjacent to the blinking swing alarm to disable the existing exclusion zone. As well, selecting a different exclusion zone will disable the previous exclusion zone and enable the new exclusion zone.

Setting the Swing Left and Swing Right Alarms (Models Equipped with Short-Span Outriggers)

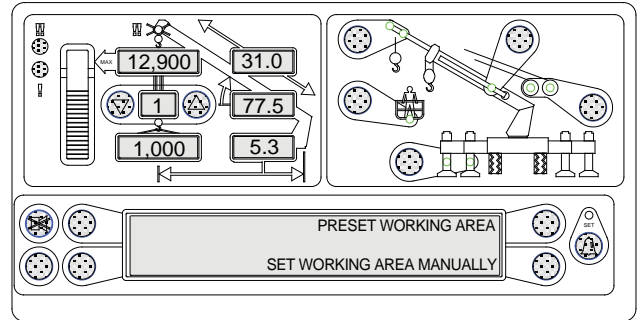


From the main working screen, press the **OPERATOR ALARM** key twice.

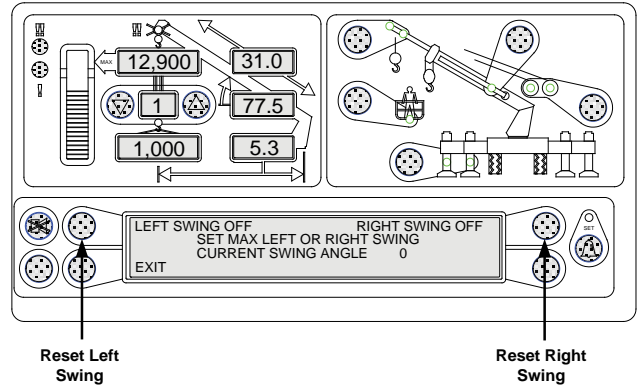
Press the key adjacent to "Swing Alarms".



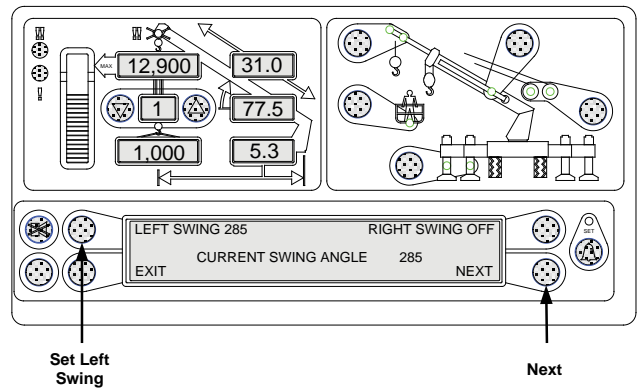
Press the key adjacent to "Set Working Area Manually".

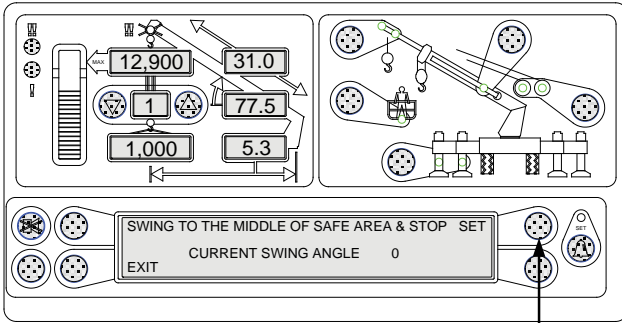


To set a new swing area, you must first reset the left and right points. Press the keys adjacent to "Left Swing" and "Right Swing" so they show "off".



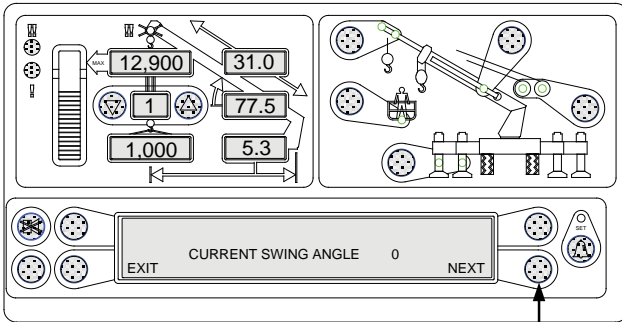
Rotate the boom to the left swing point and press the key adjacent to "Left Swing", then press the key adjacent to "Next" to proceed.





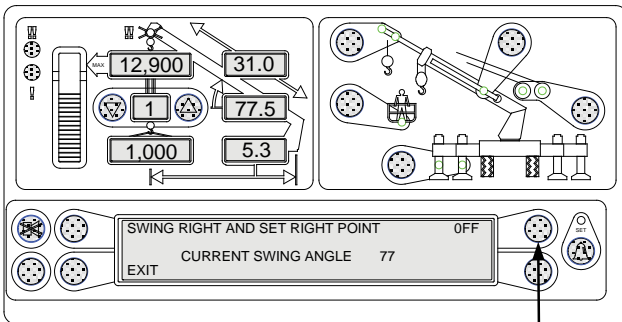
Move the boom to the middle of the swing area and press the key adjacent to "Set".

Set Middle Swing



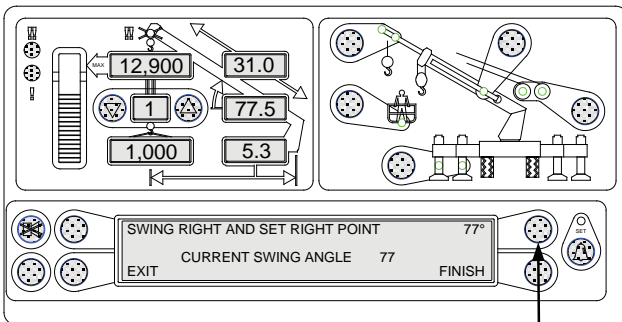
Press the key adjacent to "Next" to proceed.

Next



Rotate the boom to the right swing point and press the key adjacent to "Off".

Set Right Point

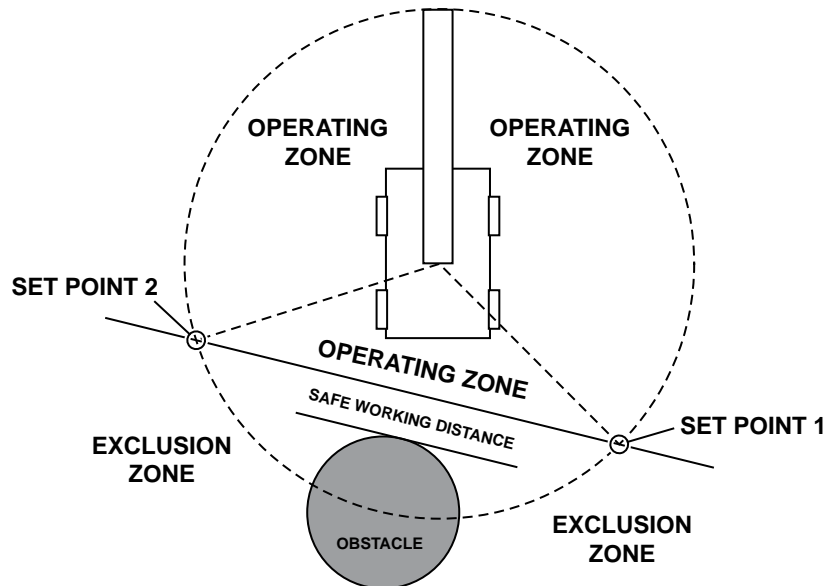


Press the key adjacent to "Finish" to complete the routine.

Set Right Point

Setting the Work Area Alarm

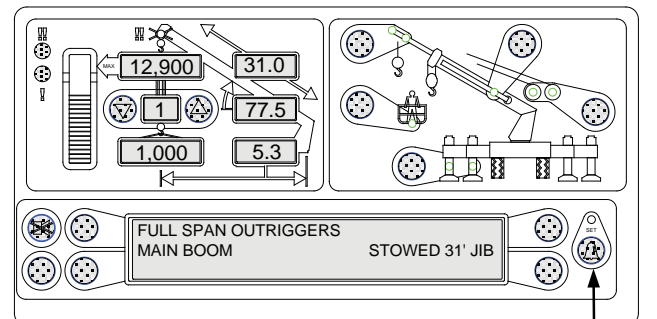
This alarm, when set properly, enables the operator to define a safe operating zone by setting only two points. This results in an enhanced work area and defines the exclusion zone area. The exclusion zone area can be visualized by connecting the two set points with a horizontal line and extending the line upwards to create a vertical plane or wall. When the end of the boom passes through this plane, the red warning lamp will illuminate and the display will show the message "EXCLUSION ZONE".



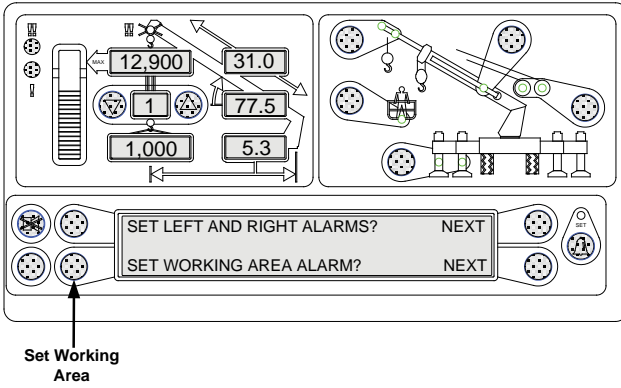
⚠️ WARNING

THE OPERATOR DEFINED WORK AREA ALARM IS A WARNING DEVICE. ALL FUNCTIONS REMAIN OPERATIONAL WHEN ENTERING THE OPERATOR DEFINED EXCLUSION ZONE. SAFE WORKING DISTANCE IS THE TIME IT WOULD TAKE TO REACT TO AN ALARM, AND FOR THE CRANE MOTION TO BE HALTED BEFORE ENTERING THE EXCLUSION ZONE. IT IS IMPORTANT TO SET POINTS THAT ENSURE THAT THE BOOM, ATTACHMENTS, HOOK LOAD, AND RIGGING, MAINTAIN A SAFE WORKING DISTANCE FROM THE OBSTACLE. AVOID POSITIONING THE BOOM, ATTACHMENT, LOAD, AND RIGGING, IN THE EXCLUSION ZONE WHEN MOVING TO SET POINTS 1 AND 2. WHEN SELECTING SET POINTS 1 AND 2, ENSURE THAT THE LOAD WILL MAINTAIN A SAFE DISTANCE FROM THE OBSTACLE. IF THE CRANE OR OBSTACLE IS MOVED, OR IF A DIFFERENT SIZE LOAD IS LIFTED, THE WORK AREA ALARM MUST BE RESET.

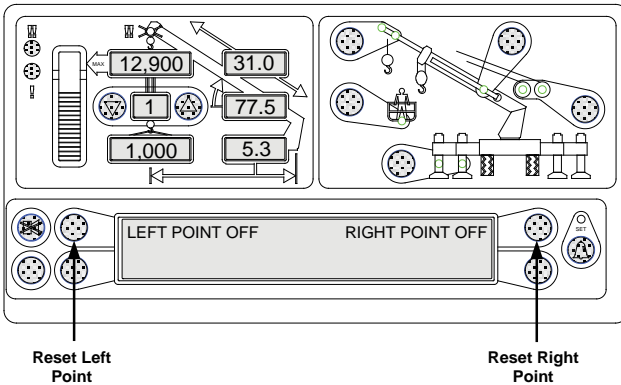
Press the **OPERATOR ALARM** key twice to access the Working Area Alarm menu.



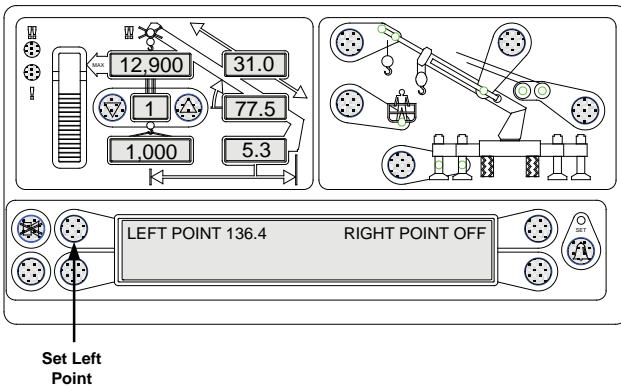
Operator Alarm Button



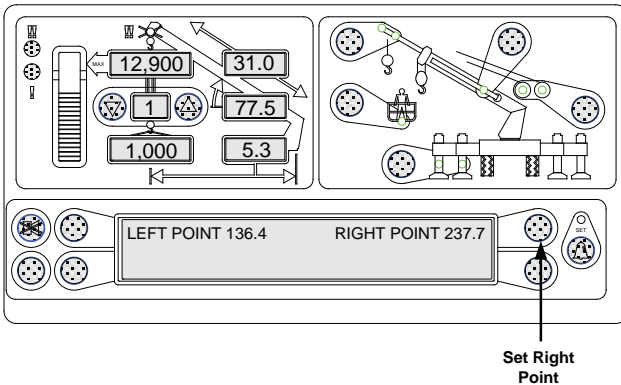
Press the key adjacent to “Set Working Area Alarm”.



To set a new working area, you must first reset the left and right points. Press the keys adjacent to “Left Point” and “Right Point” so they show “off”.



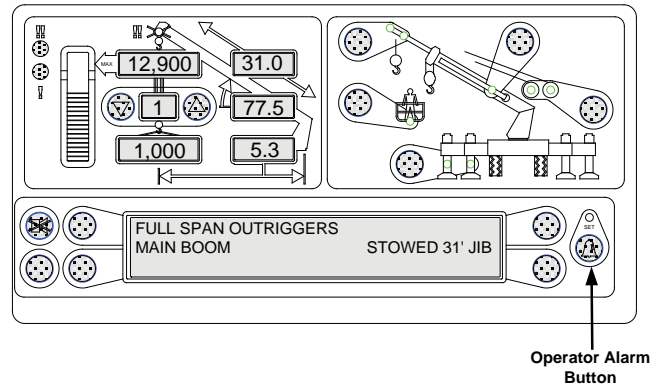
Rotate the boom to the left point. This is the point to the left facing the exclusion zone to be defined. Press the key adjacent to “Left Point”.



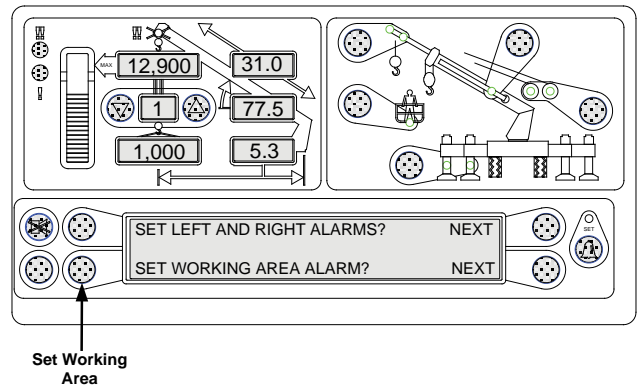
Rotate the boom to the left until the right point is reached (this will avoid having to pass through the exclusion zone). This is the point to the right facing the exclusion zone to be defined.

Press the key adjacent to “Right Point”.

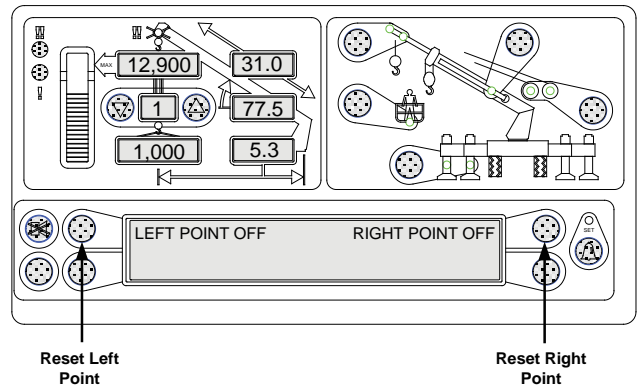
To turn off the Working Area Alarm, press the **OPERATOR ALARM** key twice to access the Working Area Alarm menu.



Press the key adjacent to "Set Working Area Alarm".



Press the keys adjacent to "Left Point" and "Right Point" so they show "off".

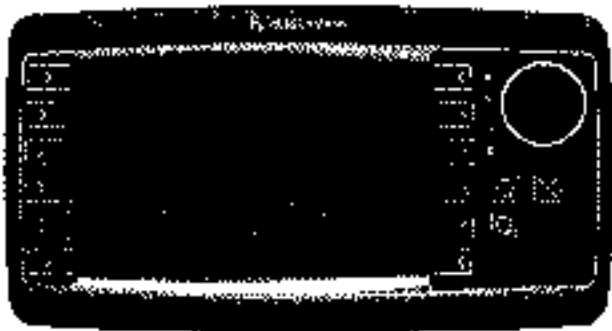


vSCALE D3

Operating console

LMAP system

Altec Telescopic Crane



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Product description	2
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Service and Maintenance	5
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Operator's Manual

Issue A - 02/2014

This document has the order no.

xx-xxx-xx-xxxx_XXXXXX_en

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VERSION OVERVIEW

Issue	Date	Description	Editor
A			

Introduction

Introduction

About this manual	This manual is a component of the equipment or systems supplied by Hirschmann Automation and Control GmbH. Keep this manual in a safe place and ensure that it is available to all users.
Liability disclaimer	The contents of this manual are subject to change. Hirschmann Automation and Control GmbH do not provide any guarantee for this material, including the associated guarantee regarding marketability and suitability for certain intended purposes. Hirschmann Automation and Control GmbH accept no liability for errors in the contents of the manual or for direct or indirect damage in connection with the provision and use of the manual.
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Trademarks	The rendition of common names, trade names, trademarks etc. in this documentation should not be construed to mean that such names, even without special identification, are free in the sense of trademark and trademark protection legislation and hence usable by anyone.
Use for the intended purpose	This device/system is intended exclusively for the tasks described in this manual. Any other use shall be construed as being inappropriate. The manufacturer accepts no liability for damage caused by inappropriate or impermissible use. This device / system may only be used if it is in perfect technical condition.
Qualification of the operating personnel	Only appropriately qualified personnel may work with this device / system, i.e. persons: <ul style="list-style-type: none">▪ who are familiar with the operation or installation and commissioning▪ who know the current regulations for the prevention of accidents

Marking of notices

Dangers and other important notices are marked as follows in this user manual:



WARNING

Warning of direct threat of personal injury and damage to property.
Instructions on precautions to avert the danger.



CAUTION

Warning of dangerous situations. Also warns of damage to property.
Instructions for averting the danger.

IMPORTANT

Warning of possibly damaging situation for the product.
Instructions for avoiding the possibly damaging situation.



NOTE

Usage instructions and information, but no dangerous situation.



HINT

Supplementary comments and recommendations for the user.

1 Safety instructions



WARNING

Imminent threat of personal injury and damage to property due to incorrect system settings!

The correct adjustment of the LMAP to the current set-up status is essential for the correct function of the system and of the crane.

The LMAP can only operate correctly if all settings are entered correctly according to the current set-up status during the SETUP procedure.

The settings can only be carried out by operators who are completely familiar with the operation and functions of the crane and the LMAP.

The correctness of these settings must be guaranteed before starting the crane operations!

IMPORTANT

Connection to the wrong power supply will cause damage to the device.

The device may only be connected to a DC voltage source of 10 V to 30 V!

1.1 EC conformity declaration



The technical design and construction of the **vSCALE D3** console corresponds to requirements of the EMC directive 2004/108/EC and therefore carries the CE symbol.

The device complies with the following harmonised standards:
EN 12895:200, EN 13309:2010, EN ISO 14982: 2009

The full conformity declaration is available from the manufacturer on request.

Product description

2 Product description

The **vSCALE D3** console is the operable interface of the programmable Load Moment and Area Protection system, referred to below as the “LMAP”. The LMAP detects the readings from different sensors and recognizes crane overload statuses depending on further parameters. Visual and audible signals alert the user of the overload status.

The LMAP is comprised of:

- a **cSCALE S6** central control unit
- the **vSCALE D3** display and operating console
- various sensors for detection of readings

The control unit, sensors and operating console is installed in suitable positions onto or inside the crane.

The vSCALE D3 console is used for:

- programming and inputting operating parameters
- displaying the current crane operating data

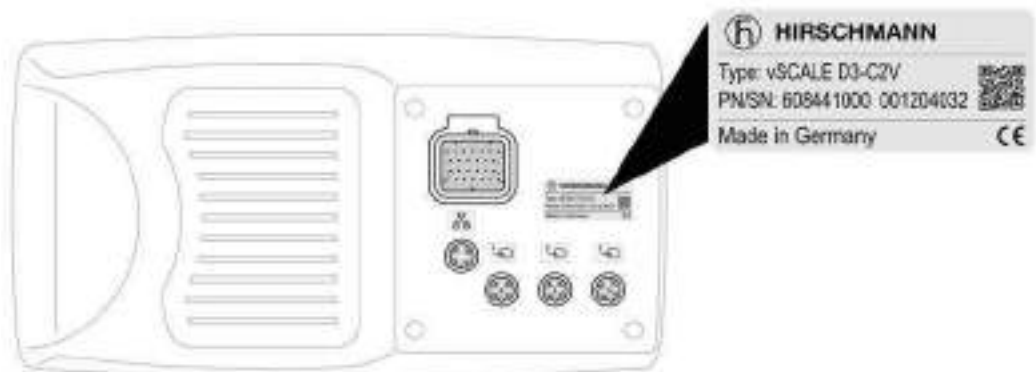
Scope of manual This user manual contains information about installation, operating mode selection, operation and maintenance.

2.1 Product identification

The type plate carries the unique identification of the operating console. It is located on the back of the device.

Please ensure you make a note of all the information on your type plate for queries about this product.

Type plate
(Example)



Product description

2.2 Use for the intended purpose

The **vSCALE D3** is the interface of the Load Moment and Area Protection system (LMAP).

The LMAP detects a crane overload status depending on various parameters.

The crane driver is warned well before the onset of an overload status via visual and audible warning signals.

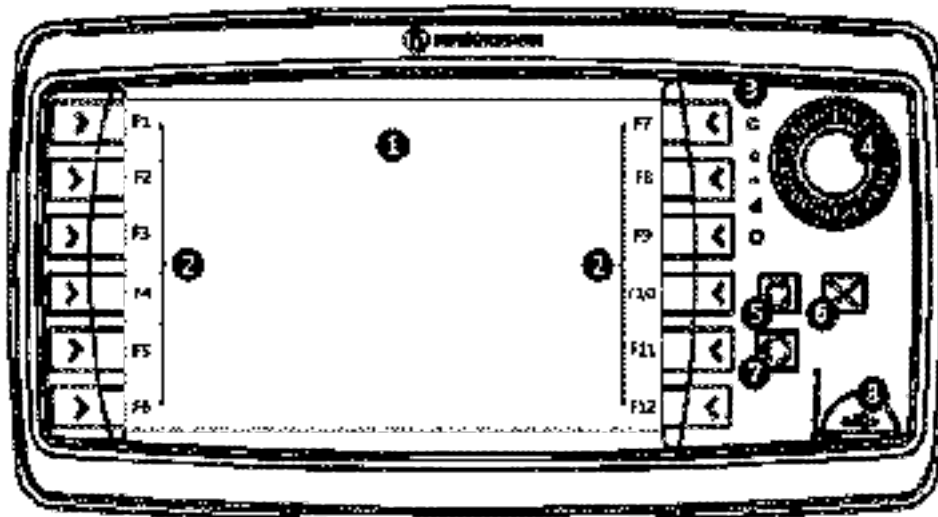
Although the system has signal outputs to switch off the crane movements, this power-off is effective with corresponding external wiring.

Although the system incorporates functions for monitoring adjustable geometrical limit values with visual and audible warnings and a relay output in the event of limit values being exceeded, the system cannot be used as an operational limit switch.

The crane driver is responsible for the safe operation of the crane.

Product description

2.3 Overview of functional elements



- 1 TFTcolor display
- 2 Function keys **F1 - F12**
- 3 Light sensor and status displays (LED)
- 4 Rotary control (encoder) with pushbutton function
- 5 SETkey for silencing alarms and setting system settings
- 6 HOME key for return to LMAP main menu
- 7 ESCAPE key for returningto previous menus or previous setups.
- 8 Front- USB 2.0 interface (use for service purposes)

Operating Mode Selection

3 Operating Mode Selection

This chapter contains information, advice and instructions for choosing an operating mode.

3.1 Switching device on and off

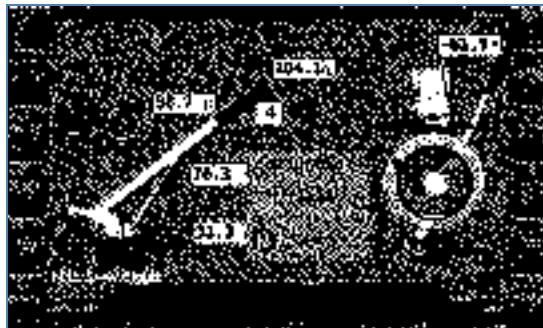
The load limiting device has no on/off switch. The console automatically switches on after engaging the PTO.

After boot-up, the following appears on the display:

Initial display after
boot-up:



Setup Confirmation
after
initial display:



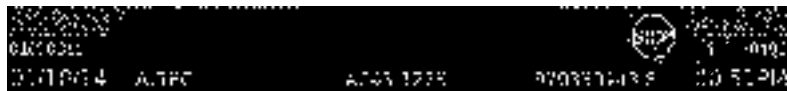
Operation: If the crane configuration has not been changed since the LMAP was last set-up, press the Rotary Control to confirm.

Operating Mode Selection



Otherwise, press the ESCAPEkey  and carry out the set-up procedures.

System malfunction? In the event of a system malfunction an error code is displayed in the bottom right of the display:



Error code

The error codes and what they mean are explained in the error codes table in the [Appendix](#).

The device is not ready for operation until all faults have been rectified and no error codes are displayed. The error codes are displayed in red color.

Operating Mode Selection

3.2 Adjust LMAP to latest set-up status

SETUP procedure The LMAP must be adjusted to the current crane setup status by completing the full SET-UP procedure after any change to the crane configuration. Operation is done with the function keys and the rotary control.

The system should not be used unless all the operational mode setups have been completed.



WARNING

Imminent threat of personal injury and damage to property due to incorrect system settings!

The correct adjustment of the LMAP to the current set-up status is essential for the correct function of the system and of the crane.

The LMAP can only operate correctly if all settings are entered correctly according to the current set-up status during the SETUP procedure.

The settings can only be carried out by operators who are completely familiar with the operation and functions of the crane and the LMAP.

The correctness of these settings must be guaranteed before starting the crane operations!

Selecting operating mode Depending on the inputs during the SETUP procedure and on various sensor values, the system automatically determines the corresponding operating mode with the associated lifting capacity table. The operating mode used by the system at any one time is displayed as a code in the status row:

Operating mode code



Saving settings The settings made during the SETUP procedure are saved. When the system is switched back on, the settings need simply to be checked and confirmed.

Instructions The process for setting the LMAP to the current crane (SETUP procedure) includes the following steps:

- Selection of the boom configuration and jibs
- Selection of the man basket
- Selecting the parts of line
- Selection of winch

Operating Mode Selection

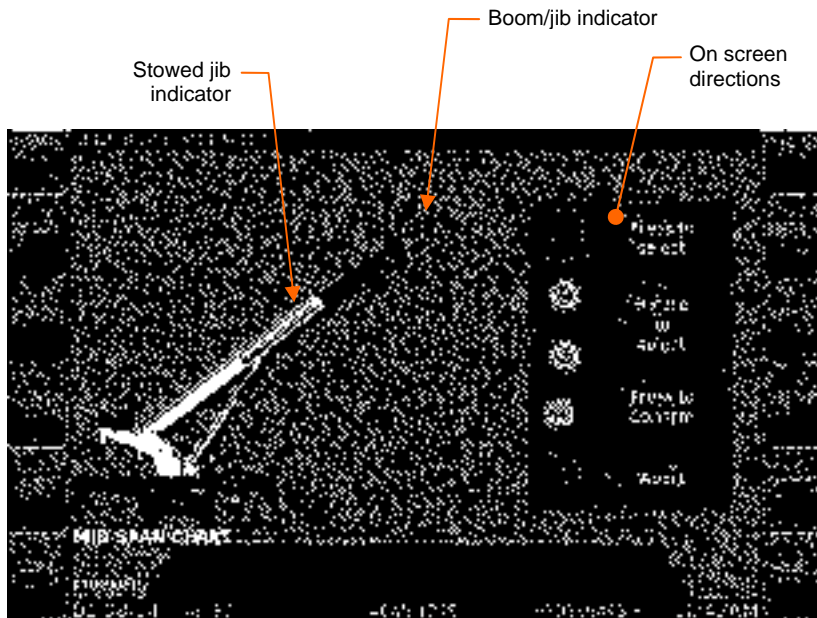
- Selection of counter weight
- Selecting the outrigger position (dynamically done with power up of the LMAP)

3.2.1 Setup boom configuration

Boom configuration is used to select any jib that is being used or stowed.



Boom configuration from main menu




Selections

Possible selections depending on model:

- Main boom
- Fixed jib stowed
- Fixed jib
- Telescopic jib stowed
- Telescopic jib retracted
- Telescopic jib extended
- Fiberglass jib stowed
- Fiberglass jib +15°
- Fiberglass jib 0°
- Fiberglass jib -15°
- Fiberglass jib -30°
- Rooster sheave
- Rooster sheave; fixed jib stowed
- Rooster sheave; telescopic jib stowed
- Rooster sheave; fiberglass jib stowed
- Pole guide
- Pole guide; fixed jib stowed
- Pole guide; telescopic jib stowed
- Pole guide; fiberglass jib stowed

Operating Mode Selection

Instructions

Select by repeatedly pressing the boom configuration function key 
or by rotating the rotary control



After selection is complete, press the rotary control to confirm.




If the selection is valid: The main menu is displayed with a green confirmation box.



Press the rotary control again to confirm a second time.




or the ESCAPE  key to abort and return to the last valid mode selection.

Operating Mode Selection

If the selection is not valid: The main menu is displayed with a yellow confirmation box.



The only choice is to press the

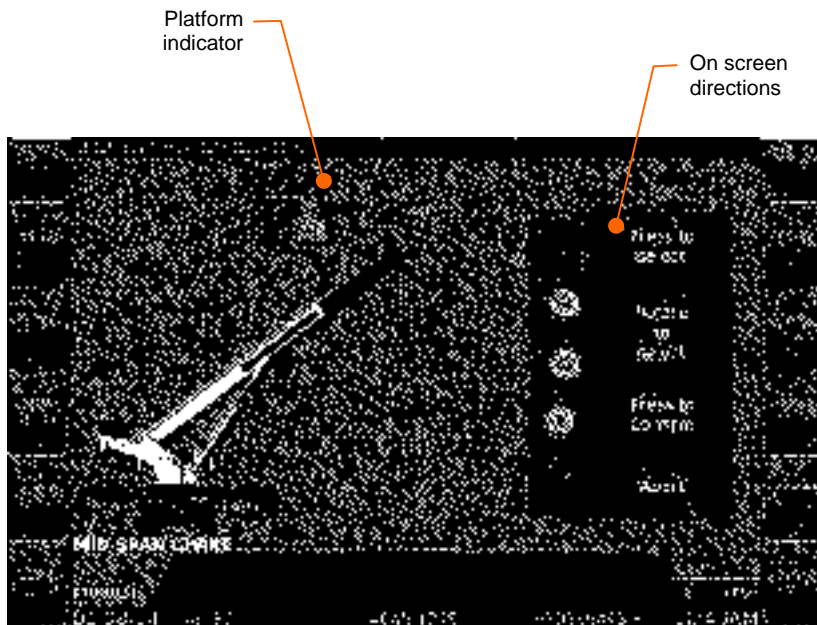
ESCAPE  key to abort and return to the last valid mode selection.

3.2.2 Setup platform configuration

Platform configuration is used to select any platform that maybe attached.



Platform configuration from main menu




Selections Possible selections depending on model:

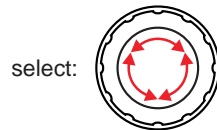
- No platform
- Platform

Operating Mode Selection

- Rotating platform

Instructions

Select by repeatedly pressing the platform configuration function key 
or by rotating the rotary control




After selection is complete, press the rotary control to confirm.



If the selection is valid, the LMAP main menu is displayed with a green confirmation box.

Press the rotary control again to confirm a second time.

If the selection is not valid, the main menu is displayed with a yellow confirmation box.

The only choice is to press the ESCAPE  key to abort.



Optionally, at any time during the selection process pressing the ESCAPE key will abort selection and return to the LMAP main menu.

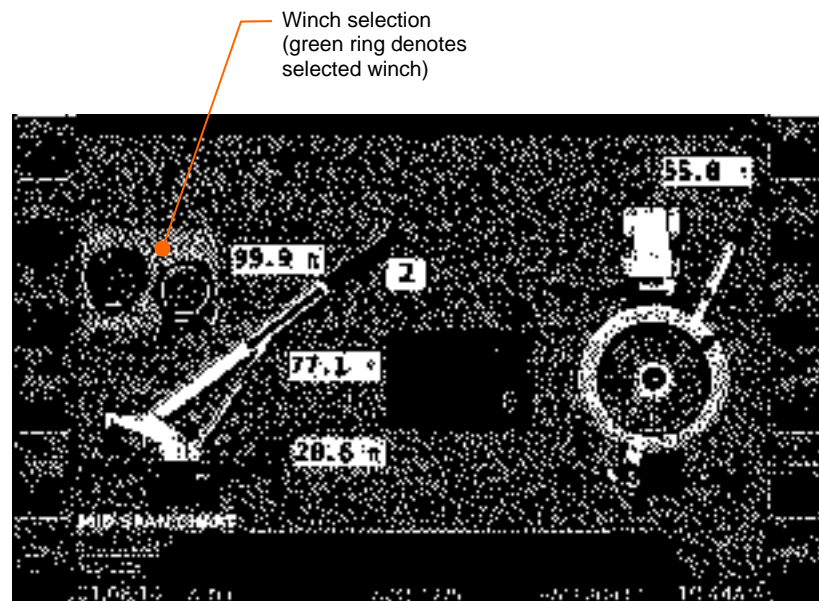
Operating Mode Selection

3.2.3 Setup winch configuration

The winch configuration is used to select between the main and auxiliary winches.




Winch configuration from main menu



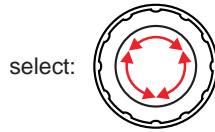
Selections Possible selections depending on model:

- Main winch
- Auxiliary winch

Instructions

Select by repeatedly pressing the winch configuration function key 
or by rotating the rotary control

Operating Mode Selection




After selection is complete, press the rotary control to confirm.



If the selection is valid, the LMAP main menu is displayed with a green confirmation box.

Press the rotary control again to confirm a second time.

If the selection is not valid, the main menu is displayed with a yellow confirmation box.

The only choice is to press the ESCAPE  key to abort.



Optionally, at any time during the selection process pressing the ESCAPE key will abort selection and return to the LMAP main menu.



NOTE

The winch setup is **NOT** available when a platform is selected.

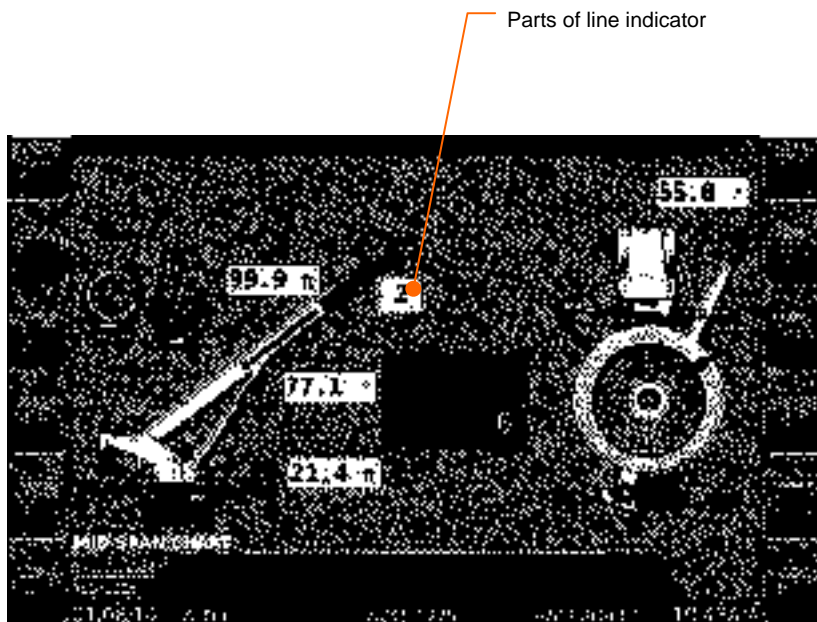
Operating Mode Selection

3.2.4 Setup parts of line

Parts of line configuration is used to change the number of lines that are used.




Parts of line from main menu



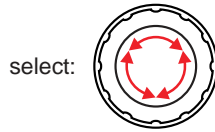
Selections Possible selections depending on model:

- One (1) through eight (8) parts of line can be selected

Instructions

Select by repeatedly pressing the parts of line configuration function key 
or by rotating the rotary control

Operating Mode Selection




After selection is complete, press the rotary control to confirm.



If the selection is valid, the LMAP main menu is displayed with a green confirmation box.

Press the rotary control again to confirm a second time.

If the selection is not valid, the main menu is displayed with a yellow confirmation box.

The only choice is to press the ESCAPE  key to abort.



Optionally, at any time during the selection process pressing the ESCAPE key will abort selection and return to the LMAP main menu.



HINT

The number of lines can only be changed when the main boom is used. Select the correct jib configuration first.

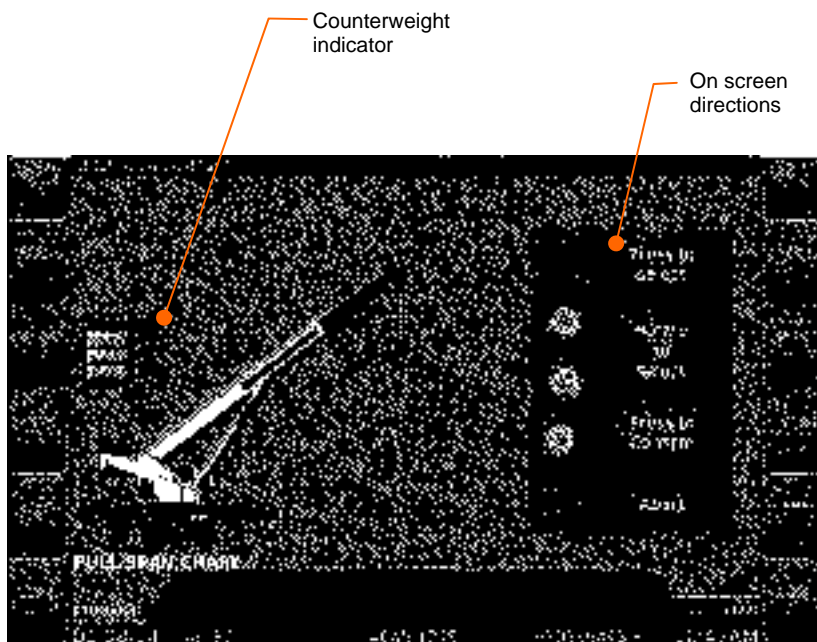
Operating Mode Selection

3.2.5 Setup counterweight configuration

The counterweight configuration is used to select if the counterweight is installed.




Counterweight configuration from main menu



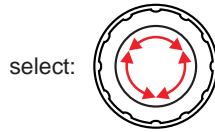
Selections Possible selections depending on model:

- Counterweight installed
- Counterweight uninstalled

Instructions

Select by repeatedly pressing the counterweight configuration function key 
or by rotating the rotary control

Operating Mode Selection




After selection is complete, press the rotary control to confirm.



If the selection is valid, the LMAP main menu is displayed with a green confirmation box.

Press the rotary control again to confirm a second time.

If the selection is not valid, the main menu is displayed with a yellow confirmation box.

The only choice is to press the ESCAPE  key to abort.

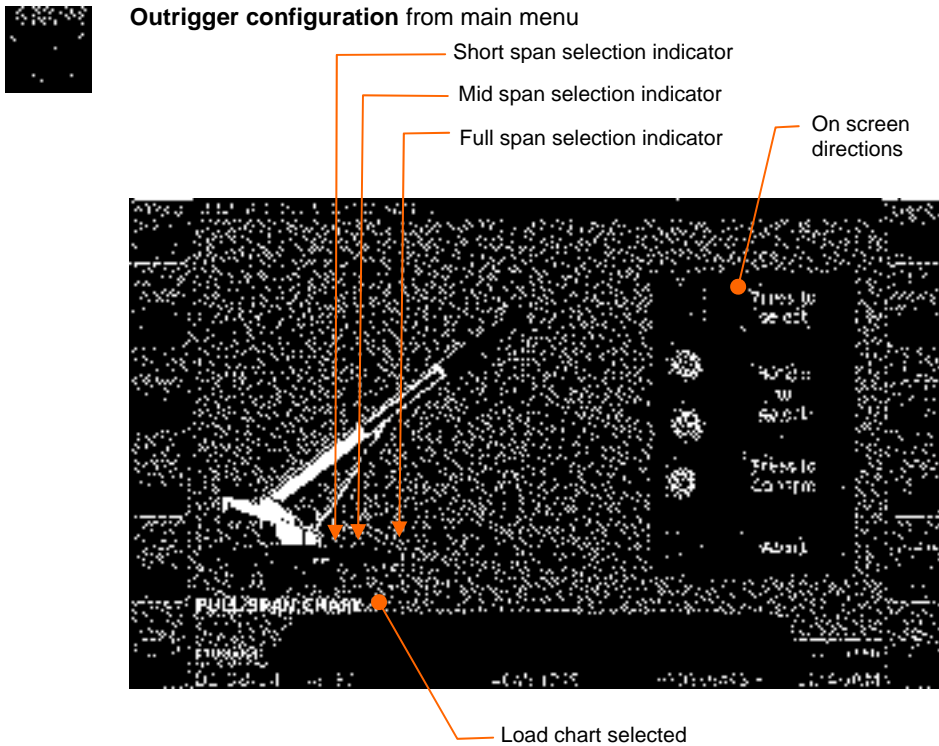


Optionally, at any time during the selection process pressing the ESCAPE key will abort selection and return to the LMAP main menu.

Operating Mode Selection

3.2.6 Setup outrigger configuration


The outrigger configuration is used to select outrigger position and load charts.



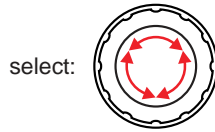
Selections Possible selections:

- Full Span
- Mid Span
- Short Span

Instructions

Select by repeatedly pressing the outrigger configuration function key  or by rotating the rotary control

Operating Mode Selection




After selection is complete, press the rotary control to confirm.



If the selection is valid, the LMAP main menu is displayed with a green confirmation box.

Press the rotary control again to confirm a second time.

If the selection is not valid, the main menu is displayed with a yellow confirmation box.

The only choice is to press the ESCAPE  key to abort.



Optionally, at any time during the selection process pressing the ESCAPE key will abort selection and return to the LMAP main menu.



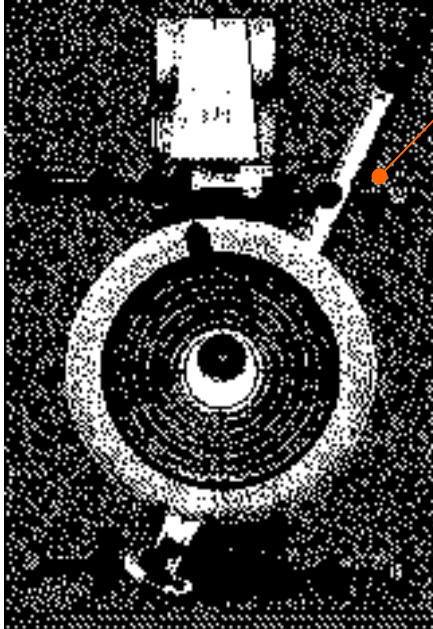
WARNING

Warning the **SELECTED** outrigger position determines the corresponding lifting capacity table **NOT** the actual sensors on the outriggers.

Operating Mode Selection

The right-hand side of the main menu shows the actual outrigger sensor status.

Example



Actual outrigger positions:

- | | |
|--------------|--|
| Green | Matches selected position |
| Flashing Red | Detected outrigger has changed since last operating mode selection |
| Red | Detected outrigger does not match selected position |



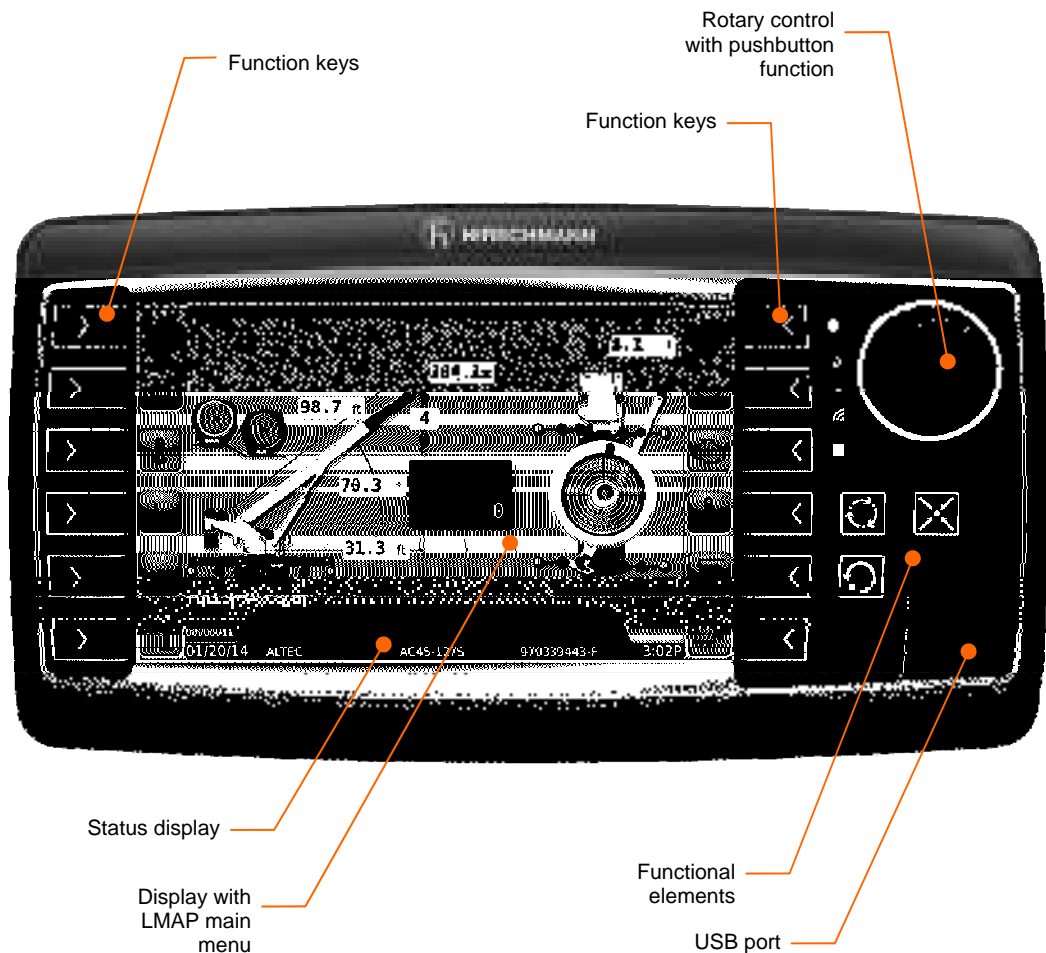
NOTE

If the outriggers position selected does not match the state of the sensors on the outriggers, the indicators on the left-hand side of the screen will turn to red to indicate the outrigger position is overridden.

Operation

4 Operation

This chapter contains information, advice and instructions for using the console. You will also find the description of function elements, functions and menus.



After correct adjustment of the LMAP to the current setup status of the crane, the LMAP is ready for use. (See section [3.2](#))

The crane operator must be familiar with all elements of the LMAP before commencing crane operation.

Operation

All settings must be checked by hoisting a known load and comparing the information with that displayed by the LMAP.



WARNING

Imminent threat of personal injury and damage to property due to incorrect system settings!

The correct adjustment of the LMAP to the current set-up status is essential for the correct function of the system and of the crane.

The correctness of these settings must be guaranteed before starting the crane operations!

Operation

4.1 Functional elements



Function keys F1 to F12: for calling operating functions



Light sensor: measures the ambient brightness for controlling the background lighting (no functionality)



Operating display: shines green when the supply voltage is connected



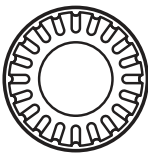
USB data display: shines yellow when data is exchanged via the front USB interface



Multi-function light, colored: (no functionality)



Wireless indicator: lights up during active wireless communication (no functionality)



Encoder with pushbutton function: for selection and confirmation when making inputs



SET key: momentarily silences alarm buzzers and selecting various parameters



HOME key: calls up the LMAP main menu



ESCAPE key: returns to previous menu

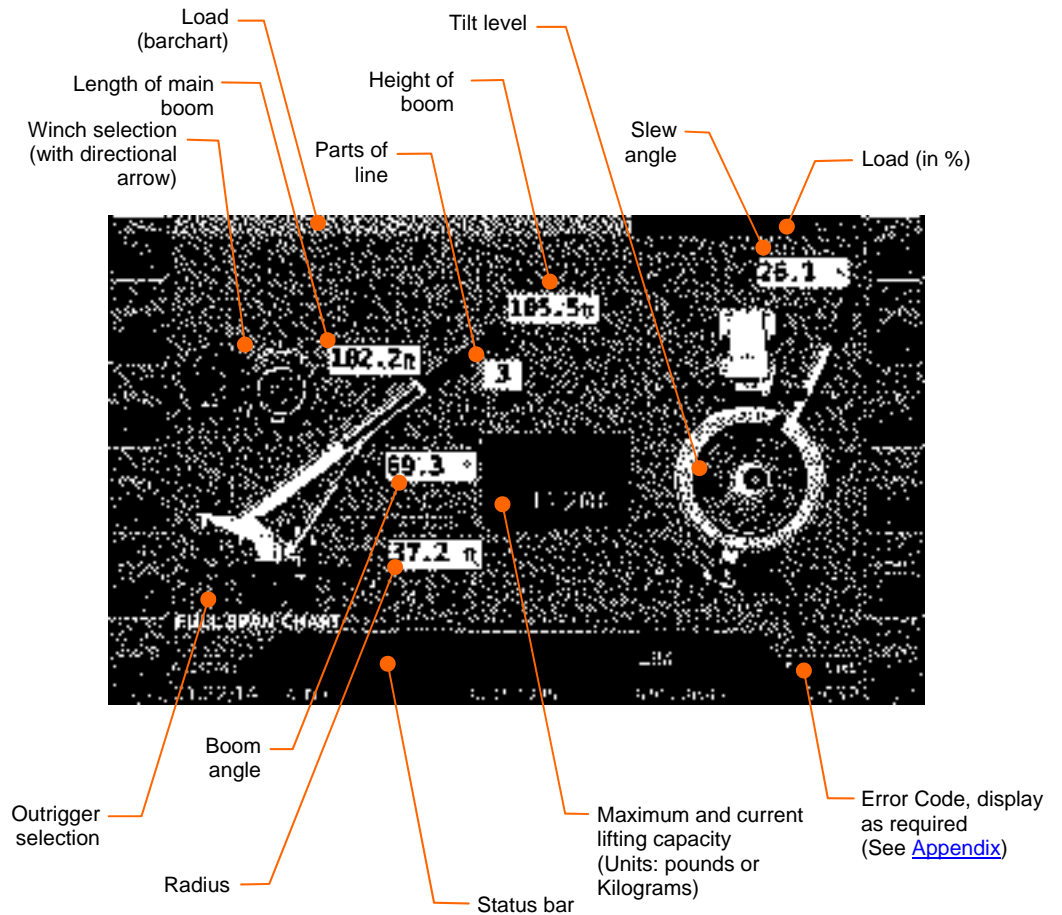
Operation

4.2 LMAP Main Menu

The LMAP main menu is the central operating image during crane operation and the starting point for the selection of various functions.



Press the "HOME" key to display the LMAP main menu:



Operation

Function Keys



Jib configuration



Service menu



Platform configuration



System menu



Parts of line configuration



Chassis menu



Winch configuration



Environmental sensors



User limit menu



Counterweight configuration



Outrigger configuration



Camera menu

Operation

4.2.1 Function keys (soft keys)

The F1-F12 key functions are displayed with assigned symbols:

Example



Function keys with no assigned symbol are not active:



Function key colors

The function key symbols are normally blue.

Certain statuses are indicated by the change in color:

Examples



Grey

Significance here: no geometrical limit programmed



Green

Significance here: Operational mode selection valid



Yellow

Significance here: Operational mode selection not valid



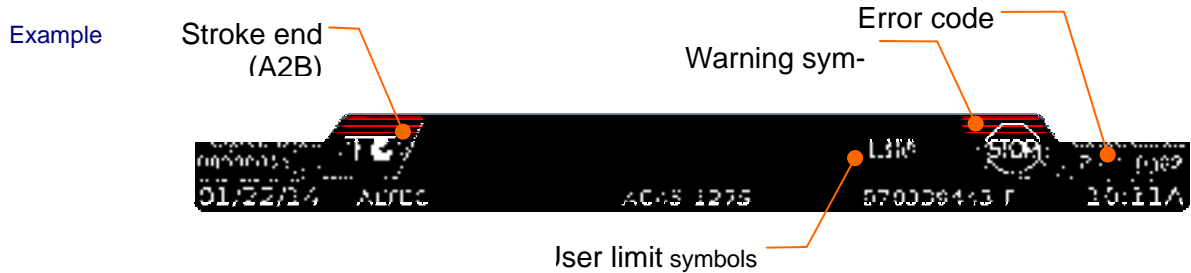
Red

Significance here: Outside a user limit

Operation

4.2.2 Warning lights / audible alarm


Various warning symbols are shown in the status display as required:



Depending on the cause of the warning, the following also occur:

- audible alarm is activated
- error code is displayed (see error table in appendix)
- status is recorded in the data logger

Acknowledging alarm

The audible alarm can be suppressed for a short period by pressing the SET  key.



Early overload warning

This yellow symbol indicates that the crane load is or has already exceeded 90% of the safe working load. An overload status may therefore be imminent!
At the same time, the audible alarm sounds.



Overload warning

This red symbol is lit to indicate that the maximum crane load has been reached or has already been exceeded. The audible alarm sounds an uninterrupted tone. The warning stays on until the load is decreased to less than 90% of the safe working load.



Warning, LMAP bypass

This red symbol lights up during manual override.
No audible alarm. This status is recorded in the data logger.

Operation



Warning, stroke end (A2B)

This red symbol lights up to indicate that a stroke end status has occurred.

A stroke end status is recorded if the load block comes into contact with the boom tip. There is a danger in this case that the lifting rope will break and the load will drop. A stroke end state can be caused by the load being pulled against the boom tip or the boom being extended or lowered without playing out the lifting rope.

The red STOP symbol also lights up at the same time. The audible alarm sounds an uninterrupted tone.



Warning, stroke end bypass

This red symbol lights up during manual override to indicate the stroke end status is bypassed.



User Limit set

This green symbol is lit to indicate that a user limit has been set and active.



User Limit exceeded

This red symbol is lit to indicate that an active user limit has been exceeded. The audible alarm sounds an uninterrupted tone. The warning stays on until the crane is moved inside the user limit or the limit has been turned off.



3RD Wrap Warning

This symbol is lit to indicate the number of wraps on the wench are at or less than three (3).

Operation

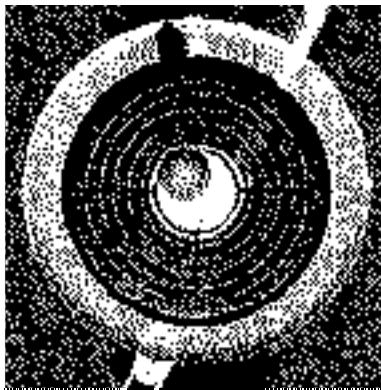
4.3 Tilt level display

A tilt level display is shown on the main menu to monitor the crane inclination.



Press the "HOME" key to display the LMAP main menu:

Example



The tilt level replicates the current status.



When the crane is aligned horizontally, the tilt level color changes to green and stops flashing. The tolerance is 0.52°.

Operation



WARNING

Warning the tilt level does NOT affect the DISPLAYED rated lifting capacity, however, it does affect ACTUAL lifting capacity.

Operation

4.4 Setup user limits




The LMAP system has programmable functions for monitoring geometrical limits of the working area:

- Height monitoring
- Radius monitoring
- Boom angle monitoring
- Rotating angle monitoring
- Virtual wall monitoring
- Boom extension monitoring

Programming is carried out via an interactive menu.

The functions can be set individually or in combination. Active limit values are indicated by the display of color-highlighted symbols.

Overview of symbols:
color highlighting:

-  Limit not programmed or inactive
-  Limit active
-  Limit value reached or exceeded

Exceeding a programmed limit value causes a corresponding symbol to be displayed in red and an audible alarm warning to be sounded.



CAUTION

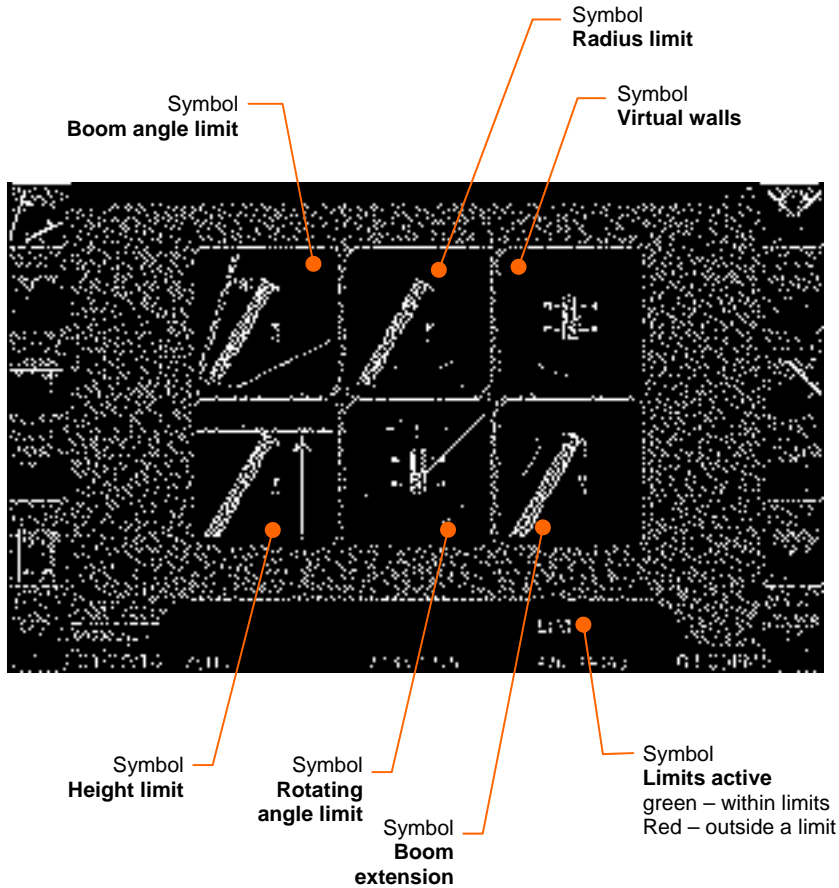
Crane movements are switched off when limit values are exceeded.

Operation










User Limit Menu from main menu

Example



Function Keys

	Boom angle limit		Virtual walls
	Height limit		Boom extension limit
	Radius limit		De-activate all limits
	Rotating angle limit		

Operation

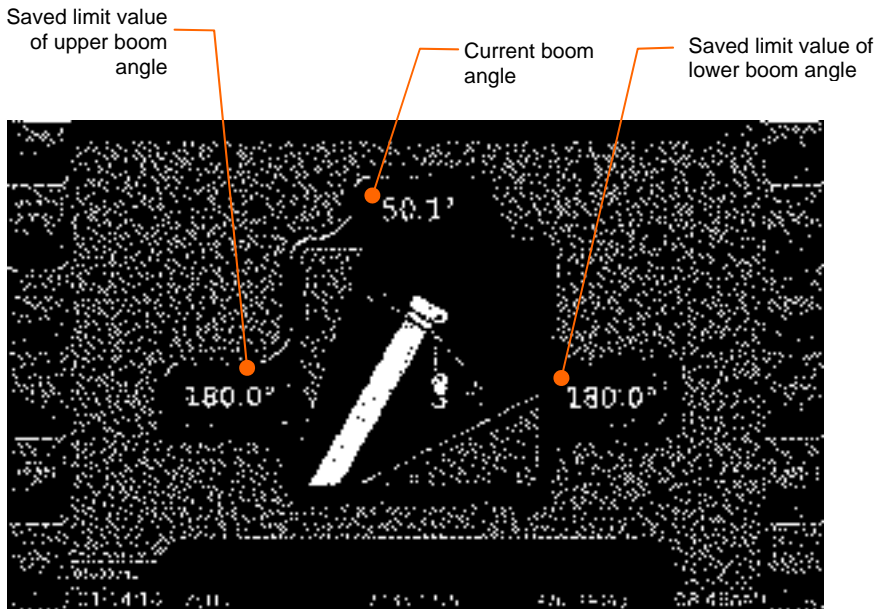
4.4.1 Boom angle monitoring

Programmable function for monitoring the upper/lower boom angle



Boom angle limit from user limit menu

Example



Function Keys



Save current angle as upper limit value & activate, or if currently active, deactivate.



Save current angle as lower limit value & activate, or if currently active, deactivate.



Press the ESCAPE key to go back to the user limit menu.



Press the "HOME" key to display the LMAP main menu.

Operation



HINT

The maximum limit cannot be set if less than the lower limit including when it is inactive.

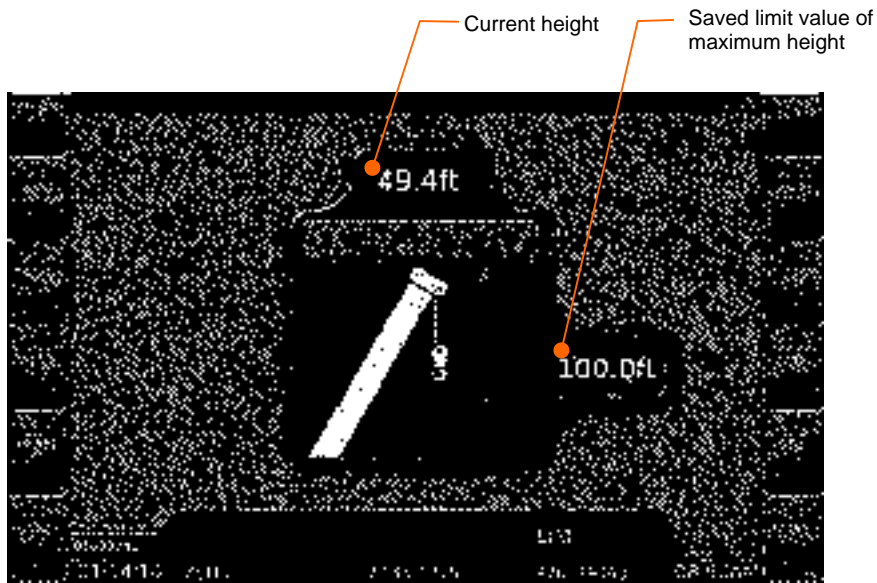
4.4.2 Boom height monitoring

Programmable function for monitoring the maximum boom height



Height limit from user limit menu

Example



Function Keys



Save current height as maximum height value & activate, or if currently active, deactivate.



Press the ESCAPE key to go back to the user limit menu.



Press the "HOME" key to display the LMAP main menu.

Operation

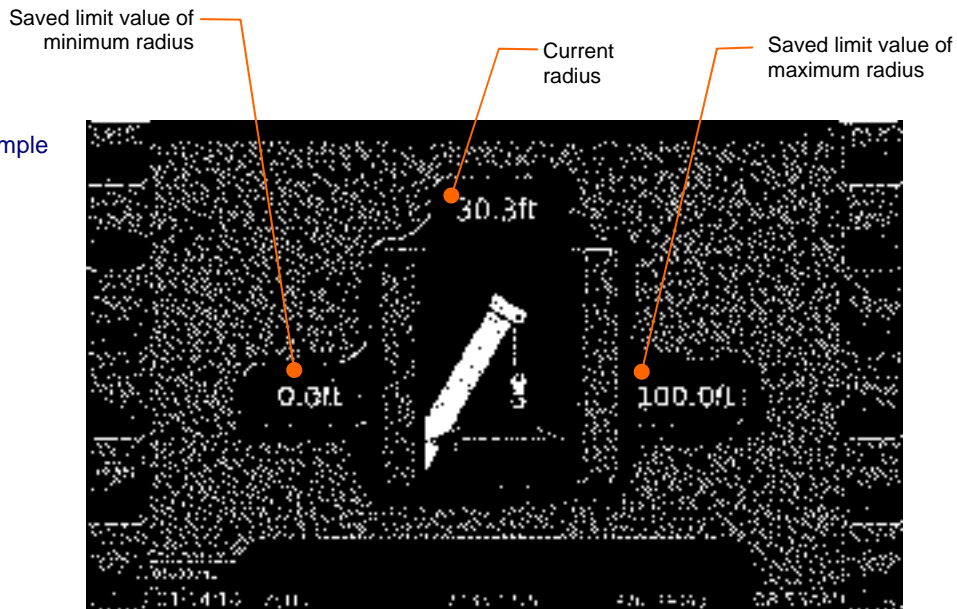
4.4.3 Radius monitoring

Programmable function for monitoring the minimum/maximum radius



Radius limit from user limit menu

Example



Function Keys



Save current radius as the minimum limit value & activate, or if currently active, deactivate.



Save current radius as the maximum limit value & activate, or if currently active, deactivate.



Press the ESCAPE key to go back to the user limit menu.



Press the "HOME" key to display the LMAP main menu.

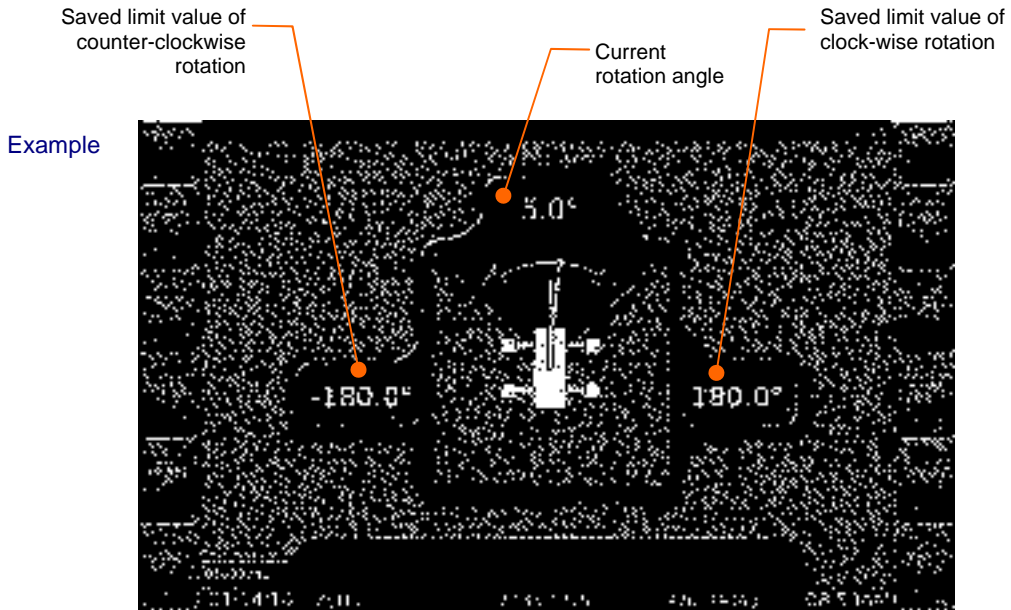
Operation

4.4.4 Rotation angle monitoring

Programmable function for monitoring the left-hand/right-hand rotation angle



Rotation angle limit from user limit menu



Function Keys



Save current rotation angle as counter-clockwise slew limit value & activate, or if currently active, deactivate.



Save current rotation angle as clockwise slew limit value & activate, or if currently active, deactivate.



Press the ESCAPE key to go back to the user limit menu.



Press the "HOME" key to display the LMAP main menu.

Operation

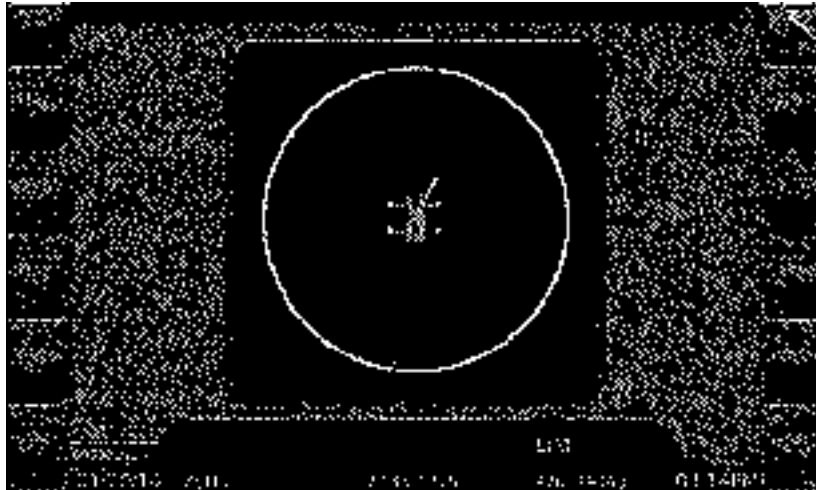
4.4.5 Virtual wall monitoring

Programmable function for monitoring the minimum/maximum virtual walls



Virtual wall limit from user limit menu

Example



Function Keys



Activate/Deactivate current walls (green – active)



Set current point for current wall



Press the ESCAPE key to go back to the user limit menu.



Press the "HOME" key to display the LMAP main menu.

Operation

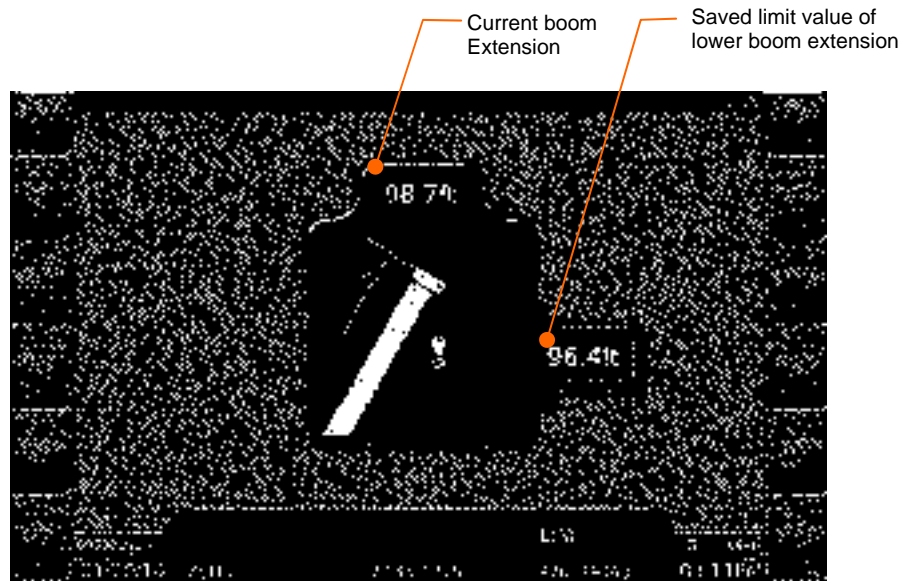
4.4.6 Boom Extension monitoring

Programmable function for monitoring the maximum boom extension



Boom extension limit from user limit menu

Example



Function Keys



Save current extension limit value & activate, or if currently active, deactivate.



Press the ESCAPE key to go back to the user limit menu.



Press the "HOME" key to display the LMAP main menu.

Operation

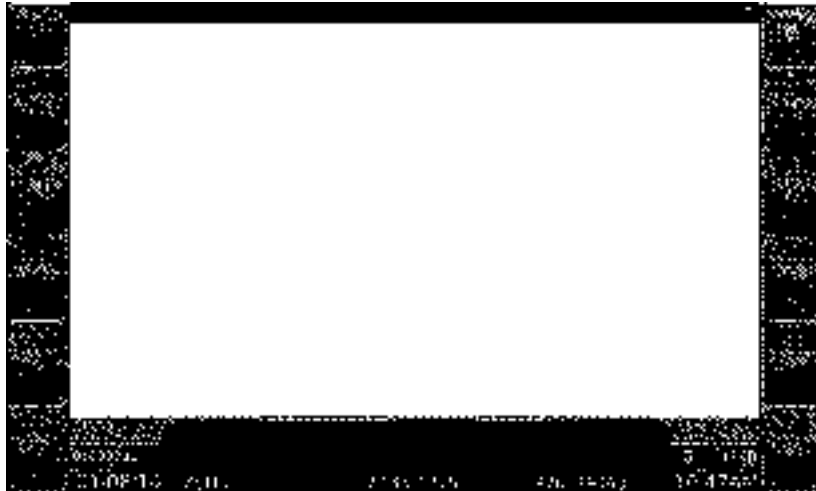
4.5 Camera view (optional)

You can (optionally) view the image from a camera in the display.



Camera view from main menu

Example



Function Keys



No functionality



Press the ESCAPE key to go back to the previous display.



Press the "HOME" key to display the LMAP main menu.

5 Service and Maintenance

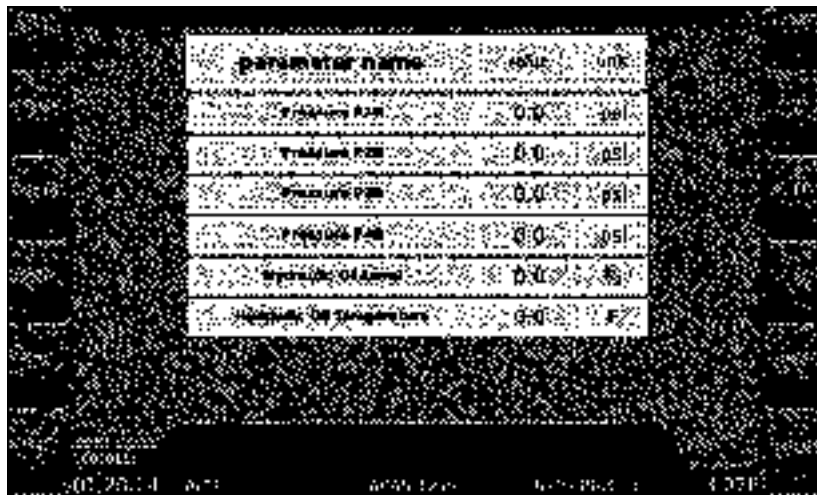
This section describes how various sensors and outputs can be monitored, alarms are checked, and various system parameters can be changed.

5.1 Service menu

The system incorporates a Service menu in which the service related parameters may be monitored.



Service menu from the LMAP main menu



Function Keys



Press the ESCAPE key to go back to the previous display.



Press the "HOME" key to display the LMAP main menu.

Definitions

Pressure P1B	Gauge pressure at _____
Pressure P2B	Gauge pressure at _____
Pressure P3B	Gauge pressure at _____
Pressure P4B	Not currently used
Hydraulic Oil Level	Hydraulic oil level should be above 60%

Service and Maintenance

Hydraulic Oil Temperature	Hydraulic oil temperature should be between 60°F and 180°F
---------------------------	--

Service and Maintenance

5.2 Monitor chassis

The system allows displays information about the status of the chassis.



Chassis information from main menu

Information display 1
Example

Information display 2
Example

Service and Maintenance

Function Keys



Displays chassis information screen 1



Displays chassis information screen 2



Press the ESCAPE key to go back to the previous display.



Press the "HOME" key to display the LMAP main menu.

Definitions

Engine Oil level	Ratio of current volume of engine sump oil to maximum required volume.
Coolant Level	Ratio of volume of liquid found in engine cooling system to total cooling system volume. Typical monitoring location is in the coolant expansion tank.
Power Take Off Speed	Rotational velocity of device used to transmit engine power to auxiliary equipment.
Engine Fuel Rate	Amount of fuel consumed by engine per unit of time. NOTE - See SPN 1600 for alternate resolution.
Fuel Level 1	Ratio of volume of fuel to the total volume of fuel storage container. When Fuel Level 2 (SPN 38) is not used, Fuel Level 1 represents the total fuel in all fuel storage containers. When Fuel Level 2 is used, Fuel Level 1 represents the fuel level in the primary or left-side fuel storage container.
Fuel Level 2	Ratio of volume of fuel to the total volume of fuel in the second or right-side storage container. When Fuel Level 2 is not used, Fuel Level 1 (SPN 96) represents the total fuel in all fuel storage containers.
Soot Load 1	Indicates the soot load percent of diesel particulate filter 1. 100% is the level at which active diesel particulate filter regeneration should be triggered. 100% level is the active regeneration trigger level (and if conditions are not favorable for regeneration, soot loading can continue beyond 100%). During normal operation and regeneration a value 0% will indicate a fully regenerated diesel particulate filter. Values of 25%, 50% and 75% will indicate the general level of soot prior to the 100% level where an active regeneration is needed.
Soot Load 2	Indicates the soot load percent of diesel particulate filter 2. 100% is the level at which active diesel particulate filter regeneration should be triggered. 100% level is the active regeneration trigger level (and if conditions are not favorable for regeneration, soot loading can continue beyond 100%). During normal operation and regeneration a value 0% will indicate a fully regenerated diesel particulate filter. Values of 25%, 50% and 75% will indicate the general level of soot prior to the 100% level where an active regeneration is needed.

Service and Maintenance

Diesel Filter Status	Indicates the state of the diesel particulate filter regeneration need and urgency. This is an aggregate of bank 1 and bank 2. It is a system status and not individual bank status. 000 Regeneration not needed 001 Regeneration needed - lowest level 010 Regeneration needed - moderate level 011 Regeneration needed - highest level 100 reserved for SAE assignment 101 reserved for SAE assignment 110 reserved for SAE assignment 111 not available
Engine Speed	Actual engine speed which is calculated over a minimum crankshaft angle of 720 degrees divided by the number of cylinders.
Coolant Temperature	Temperature of liquid found in engine cooling system.
Engine Oil Pressure	Gauge pressure of oil in engine lubrication system as provided by oil pump.
Fuel Pressure	Gauge pressure of fuel in system as delivered from supply pump to the injection pump. See also SPN 5578 for Fuel Delivery Absolute Pressure.

5.3.1 Status of LMAP sensors

The system incorporates a menu in which the readings of the CAN bus sensors can be displayed: The readings include both the raw and the scaled values based on the units selected.



LMAP sensor data from system menu

Example

Sensor Name	Modu ID	Modu Name	Raw Value	Scaled Value
Wash down depth	15	5	10692	102.12
Wash brush angle	31	5	691	69.30
Wash height	49	5	6088	78.06
Wash brush pressure	60	5	345	506.38
Wash brush speed	61	5	172	249.68
Wash brush temp	93	5	287	20.32
Wash brush pressure	91	5	599	7.05

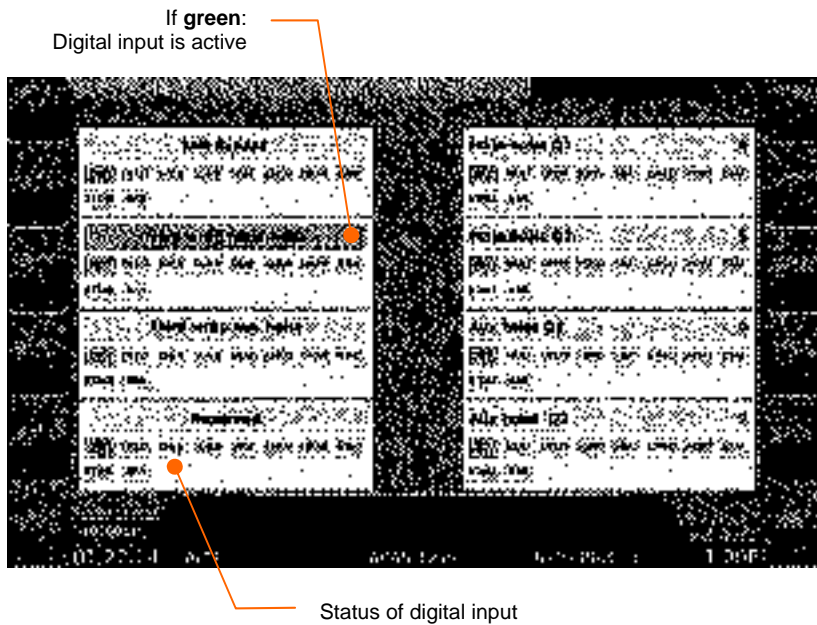
5.3.2 Status of digital inputs

The system incorporates a menu in which the status of the digital inputs can be displayed.



Digital inputs from system menu

Example



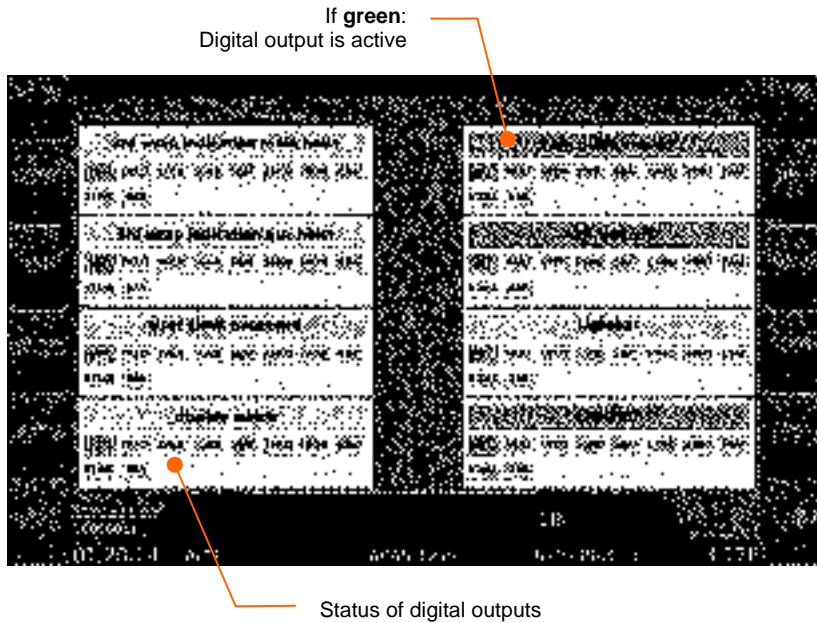
5.3.3 Status of digital outputs

The system incorporates a menu in which the status of the digital outputs can be displayed.



Digital outputs from system menu

Example



Service and Maintenance

5.3.4 Switching units

The system lets you choose between metric and domestic units.



Toggles the units from system menu

Press the function key to toggle between metric (SI) and domestic (CU). The date format also changes with the units from yy/mm/dd to dd/mm/yy respectively.

5.3.5 Switching language

The system lets you choose between English, German and Spanish languages.



Toggles the language from main menu

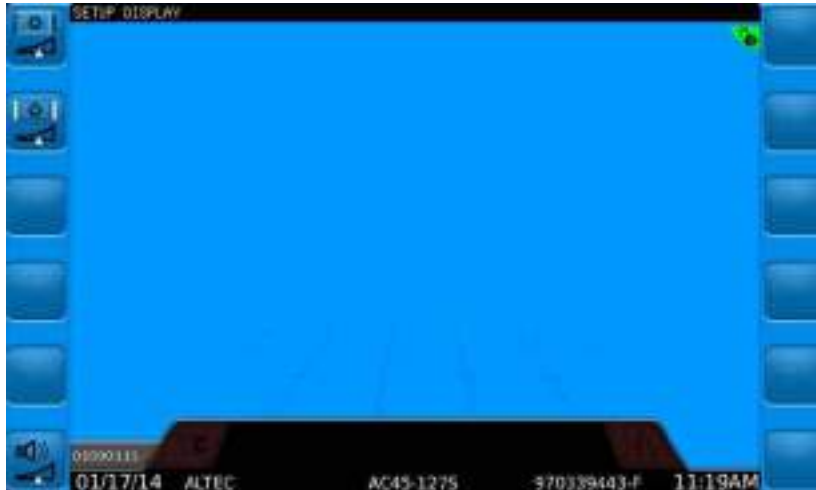
Press the function key to toggle between English, German and Spanish languages.

5.3.6 vSCALE settings

The system lets you change the LCD and key brightness and the audible alarm volume of the console and external alarm:



Settings and audible alarm volume from system menu



Function Keys



LCD brightness



Key brightness



Audible alarm On/Off for both the operating console and external alarms



Press the ESCAPE key to go back to the previous display.



Press the "HOME" key to display the LMAP main menu.



NOTE

The audible alarm volume is password protected. See section [5.5](#) on how to enter the password

5.3.7 Alarm information

The system lets you know what errors you currently have present.



Alarm information from system menu

Example

The screenshot shows a terminal-style display with the following text:

```

2014-01-14 13:49:28 1/2
Function:
Sensor Error
Angle:
CalSysb790c_Angle00007
Prgr: 000001/Errr Code: 2401
InfoCode: 0001007b
errn: sensor: 40Angles - broken
2400
    
```

Callouts in the image point to:

- Type of Error:** Points to the text "Sensor Error".
- Error #/Total errors:** Points to the text "1/2".
- Error information:** Points to the "errn: sensor: 40Angles - broken" line.
- Error code number:** Points to the "2401" value.

Scroll multiple errors by rotating the rotary control



Press the "HOME" key to display the LMAP main menu

5.3.8 Version overview

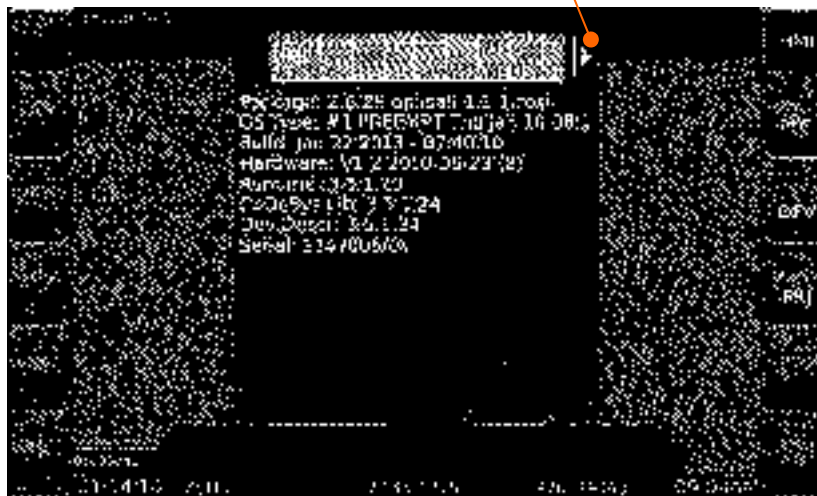
The system lets you know the versions of hardware and software installed.



Version information from system menu

Example

Arrow indicates additional information available. (turn the rotary knob to see additional information)



Function Keys



HMI version and information



PLC version and information



Device version and information



Project version and information

Service and Maintenance



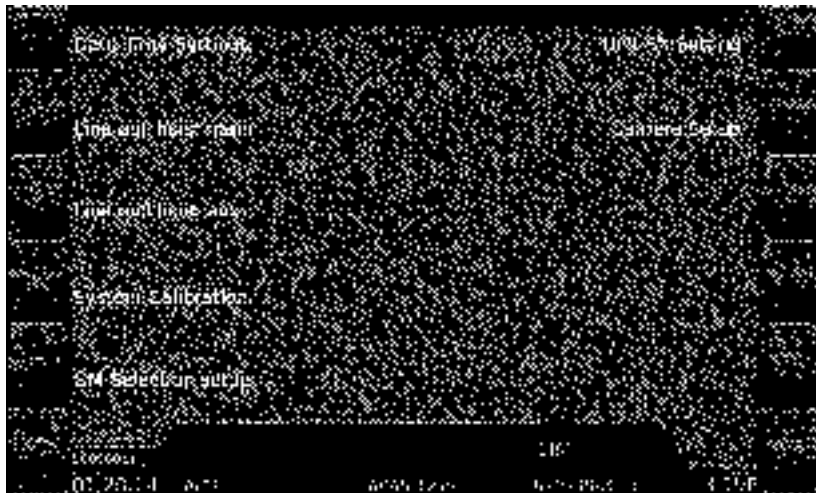
Press the "HOME" key to display the LMAP main menu.

5.3.9 Protected Area

The protected area contains settings that only authorized personnel should change.



Protected area from system menu



The following require a user level password:(see section [5.4](#))

Function keys



Line pull hoist main winch



Line pull hoist auxiliary winch

The following require an administrative level password:(see section [5.5](#))

Function keys



System date and time



Change serial number of unit

Service and Maintenance



System calibration of sensors



Change camera settings



Operation modes selections

5.4 User Level Password Entry

The password allows an operator to change the following:

- Winch line pulling settings
- Camera setup



Instructions

Password entry is done by the following instructions:

- To enter the operator password turn the rotary knob to select the first digit of the password.
- Press the rotary knob to continue to the second digit.
- Continue this process until all four digits have been entered



Press the SET key to enter the password.

Service and Maintenance



Press the ESCAPE key to abort entry and return to the previous menu.

5.5 Administrative Level Password Entry

The administrative password allows a technician to change the following:

- Audible alarm volume
- Date/Time
- Sensor Calibration
- Operating mode configurations
- Serial number setting



NOTE

Safety-relevant settings can only be carried out by authorized personnel after inputting a password (Service Code).

This prevents inadvertent changes being made to the settings.



Instructions

Password entry is done by the following instructions:

- To enter the operator password turn the rotary knob to select the first digit of the password.
- Press the rotary knob to continue to the second digit.
- Continue this process until all four digits have been entered.



Press the SET key to enter the password.

Service and Maintenance



Press the ESCAPE key to abort entry and return to the previous menu.

5.6 Maintenance and Repair

Maintenance The vSCALE D3 operating console contains no wearing parts and therefore cannot be opened. If you notice malfunctions or differences between actual and displayed measured values, you should switch the device off and have it checked and, if necessary, repaired immediately by an authorised Hirschmann service partner.

You must always keep the full details contained on the type plate on hand.

Cleaning Clean the surface and the front screen of the device occasionally with a damp cloth and a mild detergent. Never use abrasive or aggressive detergents as these may damage the device.

IMPORTANT

Device may be damaged by the use of high-pressure cleaners.

The device must not be treated with a high-pressure cleaner or similarly aggressive methods under any circumstances!

Usage Condensation inside the vSCALE console can damage electronic components or the LCD and can condense at the inner side of the front glass/touch. Although the vSCALE console is designed as a closed housing with a Gore-Tex-Membran for breathing, condensation may occur as a physical effect, if the console is exposed to unfavourable temperature/humidity cycles, which pumps humidity inside the housing.

Repair Damage to the front foil can lead to the penetration of moisture and dirt into the interior of the device, which must then be properly repaired without delay.

Keep the contacts and the area around the device connectors clean and check occasionally that all connections are secure.

If parts are damaged, they must be properly repaired or replaced immediately.

Appendix

6 Appendix

This appendix contains additional technical information and the full table of error codes.

6.1 Technical data

Operating voltage	8...36 V DC, suitable for 12 and/or 24 V on-board power supply
Overvoltage protection	overvoltage up to max. 48V DC / 2 minutes
Reverse polarity protection	up to -48V DC
Display	7" TFT Color Graphic LCD, 800 x 480 Pixel (WVGA)
Brightness	400 cd/m ²
Contrast	400:1
Illumination	LED, adjustable brightness
Audible alarm	built-in, output for external horn
Dimensions	H 267 mm x W 144 mm x D 76,2 mm (without plugs or installation accessories)
Operating temperature range	-30°C to +70°C
Protection class	IP 67, suitable for outdoor use
Scope of supply	- vSCALE D3 operating console (depending on scope of delivery with pre-fitted bracket for RAM Mount) - Mount articulated mounting - User manual (PDF file or on data storage device)

6.2 Error codes table

Error code	Description
Zero Event Codes	
0001 - 00FF	
0000	Empty / Deactivated event
0001	System Startup
0002	System Forced Initialization
0011	System Version Information
0021	Machine Information
00AA	System Debug Output
00FE	System Restart after Cold Reset
00FF	System Shutdown
0000	Empty / Deactivated event
0001	System Startup
0002	System Forced Initialization
0011	System Version Information
0021	Machine Information
00AA	System Debug Output
00FE	System Restart after Cold Reset
00FF	System Shutdown
Limit Errors	
0100 - 019F	
01xx	Overall Cut
02xx	Single Cut
03xx	Error / Failure
04xx	Warning
05xx	Advance Warning
0100	Load Tables - Fallen below radius range
0101	Load Tables - Radius range exceeded
0102	Load Tables - Fallen below angle boom range
0103	Load Tables - Angle boom range exceeded
0104	Load Tables - Fallen below angle jib range
0105	Load Tables - Angle jib range exceeded
0106	Load Tables - Fallen below angle jib diff range
0107	Load Tables - Angle jib diff range exceeded
010A	Load Tables - Slewing zone not permitted left
010B	Load Tables - Slewing zone not permitted right
010C	Load Tables - Fallen below length range
010D	Load Tables - Length range exceeded
010E	Load Tables - Fallen below height range
010F	Load Tables - Height range exceeded

Appendix

Error code	Description
0110	Load Tables - Placeholder – Not a Valid Code
0111	Load Tables - Wind speed range exceeded
0112	Load Tables - Fallen below temperature range
0113	Load Tables - Temperature range exceeded
0120	Load Tables – Pre Fallen below radius range
0121	Load Tables – Pre Radius range exceeded
0122	Load Tables – Pre Fallen below angle boom range
0123	Load Tables – Pre Angle boom range exceeded
0124	Load Tables – Pre Fallen below angle jib range
0125	Load Tables – Pre Angle jib range exceeded
0126	Load Tables – Pre Fallen below angle diff jib range
0127	Load Tables – Pre Angle diff jib range exceeded
012A	Load Tables – Pre Slewing zone not permitted left
012B	Load Tables – Pre Slewing zone not permitted right
012C	Load Tables – Pre Fallen below length range
012D	Load Tables – Pre Length range exceeded
012E	Load Tables – Pre Fallen below height range
012F	Load Tables – Pre Height range exceeded
0130	Load Tables – Placeholder – Not a Valid Code
0131	Load Tables – Pre Wind speed range exceeded
0132	Load Tables – Pre Fallen below temperature range
0133	Load Tables – Pre Temperature range exceeded
0140	User Limit – Fallen below radius range
0141	User Limit – Radius range exceeded
0142	User Limit – Fallen below angle boom range
0143	User Limit – Angle boom range exceeded
0144	User Limit – Fallen below angle jib range
0145	User Limit – Angle jib range exceeded
0146	User Limit – Fallen below angle jib diff range
0147	User Limit – Angle jib diff range exceeded
014A	User Limit – Slewing zone not permitted left
014B	User Limit – Slewing zone not permitted right
014C	User Limit – Fallen below length range
014D	User Limit – Length range exceeded
014E	User Limit – Fallen below height range
014F	User Limit – Height range exceeded
0150	User Limit – Fallen below wind speed range
0151	User Limit – Placeholder – Not a Valid Code
0152	User Limit – Fallen below temperature range
0153	User Limit – Temperature range exceeded
0160	User Limit – Pre Fallen below radius range
0161	User Limit – Pre Radius range exceeded
0162	User Limit – Pre Fallen below angle boom range
0163	User Limit – Pre Angle boom range exceeded
0164	User Limit – Pre Fallen below angle jib range
0165	User Limit – Pre Angle jib range exceeded
0166	User Limit – Pre Fallen below angle jib diff range
0167	User Limit – Pre Angle jib diff range exceeded
016A	User Limit – Pre Slewing zone not permitted left
016B	User Limit – Pre Slewing zone not permitted right

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Error code	Description
016C	User Limit – Pre Fallen below length range
016D	User Limit – Pre Length range exceeded
016E	User Limit – Pre Fallen below height range
016F	User Limit – Pre Height range exceeded
0170	User Limit – Pre Fallen below wind speed range
0171	User Limit – Placeholder – Not a Valid Code
0172	User Limit – Pre Fallen below temperature range
0173	User Limit – Pre Temperature range exceeded
Application Error Codes	
0A00 - 0A9F	
0A00	Utilization / Rated Capacity Alarm 1
0A01	Utilization / Rated Capacity Alarm 2
0A02	Utilization / Rated Capacity Alarm 3
0A03	Utilization / Rated Capacity Alarm 4
0A04	Utilization / Rated Capacity Alarm 5
0A05	Utilization / Rated Capacity Alarm 6
0A06	Utilization / Rated Capacity Alarm 7
0A07	Utilization / Rated Capacity Alarm 8
0A08	Utilization / Rated Capacity Warning 1
0A09	Utilization / Rated Capacity Warning 2
0A0A	Utilization / Rated Capacity Warning 3
0A0B	Utilization / Rated Capacity Warning 4
0A0C	Utilization / Rated Capacity Warning 5
0A0D	Utilization / Rated Capacity Warning 6
0A0E	Utilization / Rated Capacity Warning 7
0A0F	Utilization / Rated Capacity Warning 8
0A10	Utilization / Rated Capacity Limit 1
0A11	Utilization / Rated Capacity Limit 2
0A12	Utilization / Rated Capacity Limit 3
0A13	Utilization / Rated Capacity Limit 4
0A14	Utilization / Rated Capacity Limit 5
0A15	Utilization / Rated Capacity Limit 6
0A16	Utilization / Rated Capacity Limit 7
0A17	Utilization / Rated Capacity Limit 8
0A20	Overall Load Cut
0A21	Overall Load Warning
0A22	Overall Safety Cut
0A23	Overall Speed Cut
0A24	A2B Switch
0A25	Third Watch Switch
0A26	High Voltage Detection Unit
0A27	Overall Load Cut Tracking
0A28	Overall Load Warning Tracking
0A29	Overall Safety Cut Tracking
0A2A	Overall Speed Cut Tracking
0A2B	A2B Switch Tracking
0A2C	Third Watch Switch Tracking

Appendix

Error code	Description
0A2D	High Voltage Detection Unit Tracking
0A2E	Overall Cut
0A2F	Overall Cut Tracking
0A30	Setup Mode
0A31	Rigging Mode (without tables)
0A32	Cutoff Bridged (non EN13000)
0A33	Cutoff Bypass (EN13000 key)
0A34	Enable Boom Up
0A35	A2B Switch Bridged
0A36	Third Wrap Switch Bridged
0A37	Cutoff Bridged (Hardwired)
0A38	High voltage Detection Bridged
0A3C	Jib Up Disabled
0A3D	Jib Up Disabled Motion Tracking
0A3E	Jib Down Disabled
0A3F	Jib Down Disabled Motion Tracking
0A40	Boom Up Disabled
0A41	Boom Up Disabled Motion Tracking
0A42	Boom Down Disabled
0A43	Boom Down Disabled Motion Tracking
0A44	Tele Out Disabled
0A45	Tele Out Disabled Motion Tracking
0A46	Tele In Disabled
0A47	Tele In Disabled Motion Tracking
0A48	Slew Left Disabled
0A49	Slew Left Disabled Motion Tracking
0A4A	Slew Right Disabled
0A4B	Slew Right Disabled Motion Tracking
0A4C	Winch Up Disabled
0A4D	Winch Up Disabled Motion Tracking
0A4E	Winch Down Disabled
0A4F	Winch Down Disabled Motion Tracking
0A50	Invalid Operation Mode
0A51	Invalid Tele Mode
0A52	Invalid Reeving Mode
0A53	Invalid Hosting Mode
0A54	Invalid Outrigging Mode
0A55	Invalid Pinning Mode
0A56	Invalid Counterweight Mode
0A57	Invalid Winch Mode
0A58	Invalid Boom Mode
0A59	Invalid Flags Mode
0A5A	Operation Mode not Possible
0A5B	Invalid Utilization Value
0A61	Mode Sanity Check 1 Failed
0A62	Mode Sanity Check 2 Failed
0A63	Mode Sanity Check 3 Failed
0A64	Mode Sanity Check 4 Failed
0A65	Mode Sanity Check 5 Failed
0A66	Mode Sanity Check 6 Failed

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Error code	Description
0A67	Mode Sanity Check 7 Failed
0A68	Mode Sanity Check 8 Failed
0A6A	Invalid Radius Calculated
0A6B	Invalid Height Calculated
0A6C	Invalid Length Calculated
0A70	Redundancy Failure for length
0A71	Redundancy Failure for height
0A72	Redundancy Failure for radius
0A73	Redundancy Failure for load
0A74	Redundancy Failure for angle
0A75	Redundancy Failure for pressure
0A76	Redundancy Failure for force
0A77	Redundancy Failure for slewing angle
0A7F	Redundancy Failure for Operation Mode
CAN and I/O Error Codes	
1100 - 119F	
11xx	Cable Break / Open Load / Lower Limit
12xx	Short-Circuit to Ground / Upper Limit
13xx	Short-Circuit Battery / Upper Limit
14xx	Error on Module
15xx	Output deactivated
16xx	Battery Error
17xx	Data Error / CAN not initialized
18xx	Timeout / CAN Device not responding
19xx	Safety Failure
1Axx	Parameter Failure
1Bxx	I/O not o.k. – unspecified error
1100	Failure for length tele 1
1101	Failure for angle luffing 1
1102	Failure for pressure piston 1
1103	Failure for pressure rod 1
1104	Failure for length tele 2
1105	Failure for angle luffing 2
1106	Failure for pressure piston 2
1107	Failure for pressure rod 2
1108	Failure for length tele 3
1109	Failure for angle luffing 3
110A	Failure for pressure piston 3
110B	Failure for pressure rod 3
110C	Failure for length tele 4
110D	Failure for angle luffing 4
110E	Failure for pressure piston 4
110F	Failure for pressure rod 4
1110	Failure for pinning 1
1111	Failure for pinning 2
1112	Failure for pinning 3
1113	Failure for pinning 4

Appendix

Error code	Description
1114	Failure for pinning 5
1115	Failure for pinning 6
1116	Failure for pinning 7
1117	Failure for pinning 8
1118	Failure for misc input 1
1119	Failure for misc input 2
111A	Failure for misc input 3
111B	Failure for misc input 4
111C	Failure for misc input 5
111D	Failure for misc input 6
111E	Failure for misc input 7
111F	Failure for misc input 8
1120	Failure for force transducer 1
1121	Failure for force transducer 2
1122	Failure for force transducer 3
1123	Failure for force transducer 4
1124	Failure for force transducer 5
1125	Failure for force transducer 6
1126	Failure for force transducer 7
1127	Failure for force transducer 8
1128	Failure for slewing angle 1
1129	Failure for slewing angle 2
112A	Failure for slewing angle 3
112B	Failure for slewing angle 4
112C	Failure for misc angle 1
112D	Failure for misc angle 2
112E	Failure for misc angle 3
112F	Failure for misc angle 4
1130	Failure for outrigger 1
1131	Failure for outrigger 2
1132	Failure for outrigger 3
1133	Failure for outrigger 4
1134	Failure for wind speed 1
1135	Failure for wind speed 2
1136	Failure for counterweight 1
1137	Failure for counterweight 2
1138	Failure for inclination x 1
1139	Failure for inclination y 1
113A	Failure for inclination x 2
113B	Failure for inclination y 2
113C	Failure for A2B Switch 1
113D	Failure for A2B Switch 2
113E	Failure for Third Wrap Switch 1
113F	Failure for Third Wrap Switch 2
1140	Failure for Setup Switch 1
1141	Failure for Setup Switch 2
1142	Failure for Luffing Up Button 1
1143	Failure for Luffing Up Button 2
1144	Failure for Cut Bypass Switch 1
1145	Failure for Cut Bypass Switch 2

Appendix

Error code	Description
1146	Failure for Engine Stop Message 1
1147	Failure for Engine Stop Message 2
1148	Failure for Joystics in Base Position 1
1149	Failure for Joystics in Base Position 2
114A	Failure for High Voltage Detection Unit 1
114B	Failure for High Voltage Detection Unit 2
114C	Failure for A2B Switch Bypass 1
114D	Failure for A2B Switch Bypass 2
114E	Failure for Third Wrap Switch Bypass 1
114F	Failure for Third Wrap Switch Bypass 2
1150	Failure for Telescope 1 active
1151	Failure for Telescope 2 active
1152	Failure for Telescope 3 active
1153	Failure for Telescope 4 active
1154	Failure for Telescope 5 active
1155	Failure for Telescope 6 active
1156	Failure for Telescope 7 active
1157	Failure for Telescope 8 active
1158	Failure for Telescope 1 limit switch
1159	Failure for Telescope 2 limit switch
115A	Failure for Telescope 3 limit switch
115B	Failure for Telescope 4 limit switch
115C	Failure for Telescope 5 limit switch
115D	Failure for Telescope 6 limit switch
115E	Failure for Telescope 7 limit switch
115F	Failure for Telescope 8 limit switch
1160	Failure for Safety Cut Output
1161	Failure for Cut Output
1162	Failure for Speed Cut Output
1163	Failure for Rigging Mode Output
1164	Failure for Enable Telescope In Output
1165	Failure for Enable Telescope Out Output
1166	Failure for Enable Boom Up Output
1167	Failure for Enable Boom Down Output
1168	Failure for Enable Slew Left Output
1169	Failure for Enable Slew Right Output
116A	Failure for Enable Winch Up Output
116B	Failure for Enable Winch Down Output
116C	Failure for Green Lamp Output
116D	Failure for Yellow Lamp Output
116E	Failure for Red Lamp Output
116F	Failure for Horn Output
1170	Failure for Safety Checkback 1
1171	Failure for Safety Checkback 2
1172	Failure for Safety Checkback 3
1173	Failure for Safety Checkback 4
1174	Failure for Safety Cut Output 1
1175	Failure for Safety Cut Output 1
1176	Failure for Safety Cut Output 1
1177	Failure for Safety Cut Output 1

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Error code	Description
1178	Failure for Left Output
1179	Failure for Right Output
117A	Failure for Left Output
117B	Failure for Right Output
117C	Failure for Temperature 1
117D	Failure for Temperature 2
117E	Failure for misc output 1
117F	Failure for misc output 2
1180	Failure for misc output 3
1181	Failure for misc output 4
1182	Failure for misc output 5
1183	Failure for misc output 6
1184	Failure for misc output 7
1185	Failure for misc output 8
119F	Failure for Non Specified Sensor
System Error Codes	
1F00 – 1FFF	
1F00	System Error
1F01	Console communication error / timeout
1F02	Kinematics communication error / timeout
1F03	Limiter communication error / timeout
1F04	Datalogger communication error / timeout
1F05	Ext System 1 communication error / timeout
1F06	Ext System 2 communication error / timeout
1F07	Ext System 3 communication error / timeout
1F08	Ext System 4 communication error / timeout
1F10	Scalable Control Library Error
1F11	Parameter Manager Error
1F12	File Operations Error
1F13	Version Service Error
1F14	Version Device Error
1F15	Blackbox Error
1F16	Data / Blackboard Error
1F17	Wrong Machine Variant Error
1F30	Redundancy Relay Checkback Invalid
1F31	Redundancy System 1 Failure
1F32	Redundancy System 2 Failure
1F40	Error Power Supply Voltage
1F41	Error Battery Voltage
1F42	Error Temperature Power Supply
1F43	Error Temperature CPU
1F44	Error CanOpen Fatal
1F1F	Outputs Deactivated by Application
1F2F	Outputs Deactivated by Firmware
1F3F	Machine data does not match application
1F4F	Machine parameters does not match app
1FFF	System Safety Fault

Appendix

Appendix

Suggestions for improvement and additional information:

General comments:

Sender:

Company / Department

Name / Phone

Street

Zip code / City

Date / Signature

Dear user,

please complete and return both pages of this feedback:

- via Fax an: +49 (0)7243 709 3222
- via Post an: Hirschmann Automation and Control GmbH
Documentation
Hertzstr. 32-34
76275 Ettlingen



Appendix

Thank You !

Appendix
