



Vanguard
Equipment,
Inc.

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Operation and Maintenance Manual

71H II – EPH Pipelayer for D6N LGP

S/N 043050090021– UP (Sideboom)

**TO BE USED WITH CATERPILLAR
D6N LGP SGG00100-UP TRACTOR OPERATION AND MAINTENANCE MANUALS**

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Foreword

Literature Information

This manual should be stored in the operator's compartment in the literature holder or seat back literature storage area.

This manual contains safety information, operation instructions, transportation information, lubrication information and maintenance information.

The information contained in this manual is limited to the pipelayer components and specific modifications made to the tractor unit, refer to the CATERPILLAR Tractor Operation and Maintenance Manual for complete information regarding the tractor unit.

Some photographs or illustrations in this publication show details or attachments that can be different from your machine. Guards and covers might have been removed for illustrative purposes.

Continuing improvement and advancement of product design might have caused changes to your machine which are not included in this publication. The latest version of this publication is available for download from the internet at vanguardequip.com. Read, study and keep this manual with the machine.

Whenever a question arises regarding your machine, or this publication, please consult Vanguard Equipment for the latest available information.

Machine Description

The sideboom equipment is attached to a Caterpillar D6N LGP tractor. The primary use of this machine is for petroleum-product pipeline-construction in the 16" to 24" (405 to 610 mm) pipeline range.

The operator should read, understand, and follow both the tractor and the pipelayer operating and maintenance instructions. The operator must comply with all pipelayer procedures, regulations, and safety precautions.

This equipment is to be operated by qualified personnel only.

This equipment is to be serviced and maintained by qualified personnel only.

The daily service/inspection procedure should be performed before start-up.

Operate all pipelayer controls with no load, until familiar with machine operation.

Note: Refer to the Caterpillar operation manual for detailed information on the specific operation of the tractor unit.

Safety

The safety section lists basic safety precautions. In addition, this section identifies the text and locations of warning signs and labels used on the machine.

Read and understand the basic precautions listed in the safety section before operating or performing lubrication, maintenance and repair on this machine.

NOTICE

Other safety precautions related to the operation of the tractor also apply.

Refer to CATERPILLAR Tractor Operation and Maintenance manual, Safety Section.

Operation

The operation section is a reference for the new operator and a refresher for the experienced operator. This section includes a discussion of gauges, switches, pipelayer controls, transportation and towing information.

Photographs and illustrations guide the operator through correct procedures of checking, starting, operating and stopping the machine.

Operating techniques outlined in this publication are basic. Skill and techniques develop as the operator gains knowledge of the machine and its capabilities.

Maintenance

The maintenance section is a guide to equipment care. The Maintenance Interval Schedule (MIS) lists the items to be maintained at a specific service interval. Items without specific intervals are listed under the "When Required" service interval. The Maintenance Interval Schedule lists the page number for the step-by-step instructions required to accomplish the scheduled maintenance. Use the Maintenance Interval Schedule as an index or "one safe source" for all maintenance procedures.

Maintenance Intervals

Use the service hour meter to determine servicing intervals. Calendar intervals shown (daily, weekly, monthly, etc.) can be used instead of service hour meter intervals if they provide more convenient servicing schedules and approximate the indicated service hour meter reading. Recommended service should always be performed at the interval that occurs first. Under extremely severe, dusty or wet operating conditions, more frequent lubrication than is specified in the maintenance intervals chart might be necessary. Perform service on items at multiples of the original requirement. For example, at every 500 service hours or 3 months, also service those items listed under every 250 service hours or monthly and every 10 service hours or daily.

Machine Capacity

Additional attachments or modifications may exceed machine design capacity which can adversely affect performance characteristics. Included would be stability and system certifications such as brakes, steering, and rollover protective structures (ROPS). Contact your Caterpillar dealer for further information.

Safety Section

Certain conditions and precautions are peculiar to pipelaying operations. The following represents the minimum considerations for safe operations.

NOTICE

Other safety precautions related to the operation of the tractor also apply.
Refer to CATERPILLAR Tractor Operation and Maintenance manual, Safety Section.

Safety Messages – 71H II Pipelayer

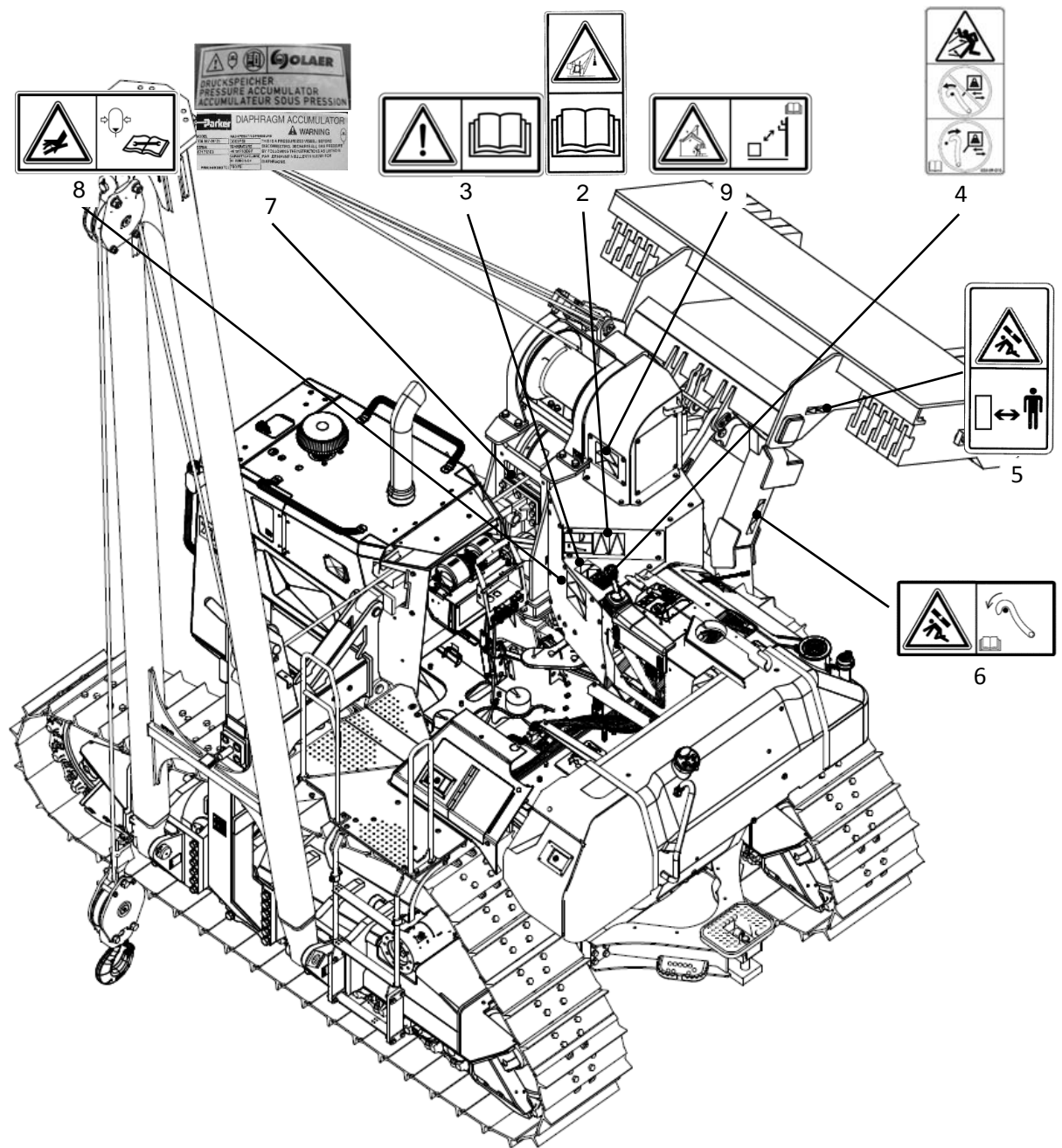


Figure 1: Safety Messages 71H II Pipelayer (cab not shown)

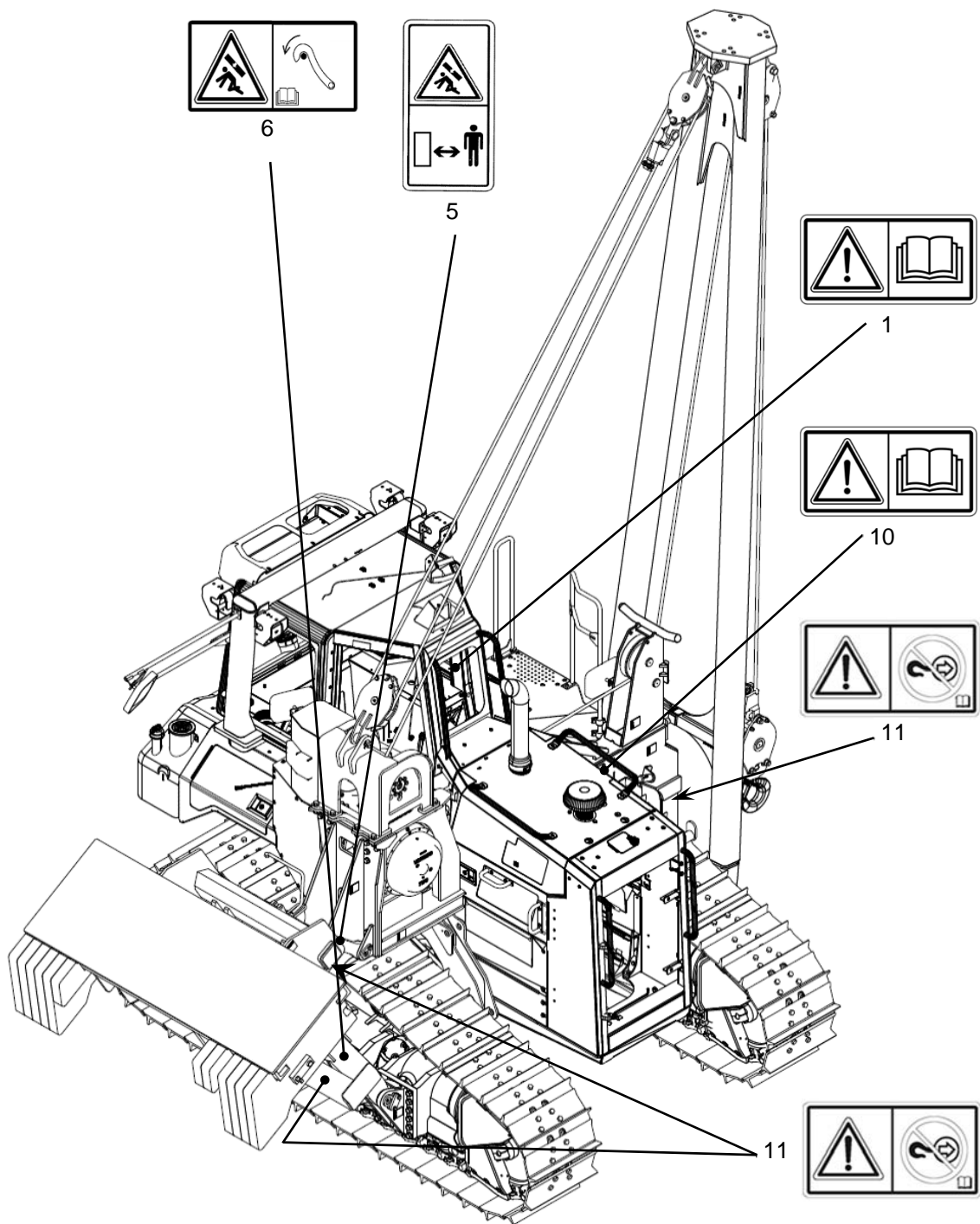


Figure 2: Safety Messages 71H II Pipelayer

There are several specific safety messages on this machine. The exact location of the hazards and the description of the hazards are reviewed in this section. Please become familiarized with all safety messages.

Make sure that all of the safety messages are legible. Clean the safety messages or replace the safety messages if you cannot read the words. Replace the illustrations if the illustrations are not visible. When you clean the safety messages, use a cloth, water, and soap. Do not use solvent, gasoline, or other harsh chemicals to clean the safety messages. Solvents, gasoline, or harsh chemicals could loosen the adhesive that secures the safety messages. Loose adhesive will allow the safety message to fall. Do not use pressure washers to clean the warning signs.

Replace any safety message that is damaged or missing. If a safety message is attached to a part of the machine that is replaced, install a safety message on the replacement part.

Do Not Operate (1)



Do not operate or work on this machine unless you have read and understand the instructions and warnings in the Operation and Maintenance Manuals. Failure to follow the instructions or heed the warnings could result in injury or death. Contact your dealer for replacement manuals. Proper care is your responsibility.

Safety message (1) is located on the left hand door pillar, above the tractor controls.

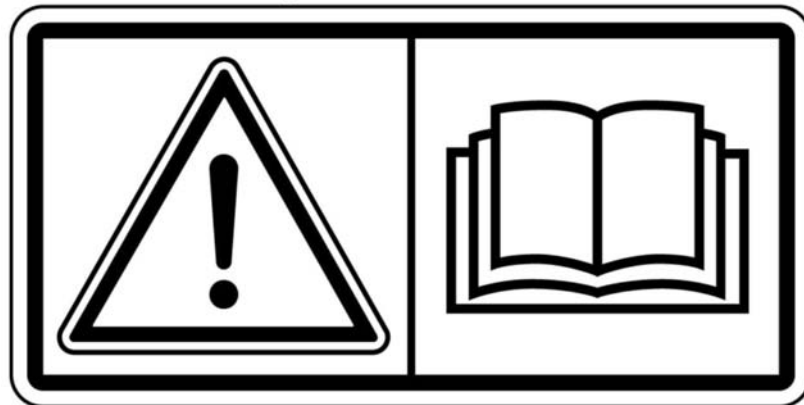


Figure 3: Do not operate (1)

Tipover Hazard (2)



The machine may tip and personal injury may occur if the maximum load capacities are exceeded. Load capacities assume that the machine is stationary on a level concrete surface with the counterweight extended. Lift capacities will decrease on slopes or soft ground. See Operation and Maintenance Manual "Lifting Capacities".

Safety message (2) is located on the right hand side, on the upper winch guarding, facing rear.

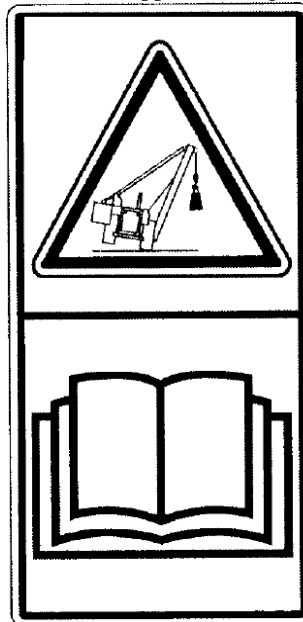


Figure 4: Tipover Warning (2)

Free Fall Active - Do Not Operate (3)



Dropping load hazard! The free fall control remains live for several hours after the engine has been stopped. Operation of the free fall control could cause a sudden uncontrolled drop of any supported load. Do not operate the free fall control when personnel are near a suspended load, even with the engine stopped. See Operation and Maintenance Manual "Pipelayer Operation" for complete description of control operation.

Safety message (3) is located on the outside of the right hand operator console arm rest, in front of the joystick.



Figure 5: Free fall active warning (3)

Counterweight Lock Lever Thrown or Flying Objects – Full Body Exposure (4)



Thrown or flying objects - full body exposure! Do not operate counterweight while the counterweight lock lever is engaged. Retracting the counterweight while the lock lever is engaged could cause serious equipment damage, personnel injury, or even death. Ensure the counterweight lock lever is fully disengaged before retracting the counterweight.

Safety message (4) located on the right side, near the joystick.



Figure 6: Thrown or flying objects - counterweight lock lever instruction (4)

Counterweight Crushing Hazard (5)



Crushing Hazard! Be sure no one is under or near the counterweight before lowering the counterweight. When the counterweight is in the fully extended position for servicing the machine, secure the extended counterweight with the counterweight lock lever. Use the counterweight lock lever to avoid possible personnel injury or death from crushing. Keep all personnel away from the counterweight when lowering the counterweight to avoid possible personnel injury or death.

Safety message (5) is located on the front and rear sides of the counterweight frame, and on the front and rear counterweight link arms.



Figure 7: Counterweight crushing hazard and pinch point (5)

Counterweight Crushing Hazard (6)



Crushing Hazard! When the counterweight is in the fully extended position for servicing the machine, secure the extended counterweight with the counterweight lock lever. Use the counterweight lock lever to avoid possible personnel injury or death from crushing.

Use the lock to secure the counterweight when the machine is serviced. Refer to Operation and Maintenance Manual, "Counterweight Lock Lever" for details.

Safety message (6) is located on the front and rear sides of the Counterweight arm.



Figure 8: Counterweight crushing hazard, use lock lever (6)

Hydraulic Accumulator (7, 8)

WARNING

High Pressure Cylinder: Rapid discharging from disconnecting or disassembly or failure to follow the instructions and warnings could cause an explosion, resulting in possible injury or death. Do not expose to fire. Do not weld. Do not drill. Do not remove any hydraulic system lines, taps or parts until pressure has been relieved. Relieve pressure before discharging. See Operation and Maintenance Manual "Accumulator" for charging and discharging. See your Dealer for tools and detailed information. Precharge only with dry nitrogen gas.

Safety message (7) is attached to the hydraulic accumulator. The hydraulic accumulator is located on the right side of the operator seat, on the winch base to the left of the hook winch.



Figure 9: Hydraulic accumulator (7)

Safety message (8) is located outside of the right hand operator console arm rest, in front of the joystick.

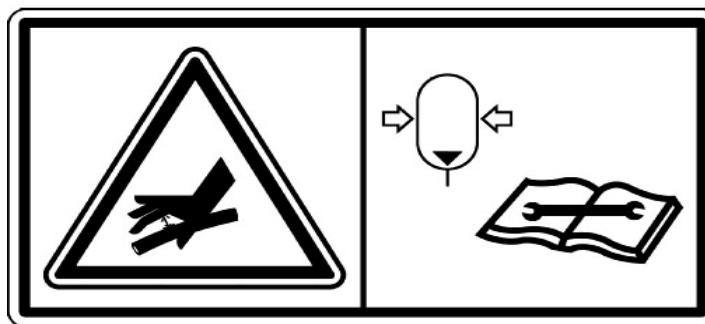


Figure 10: System equipped with an accumulator (8)

Electrical Power Lines (9)



Electrocution Hazard! Keep the machine and attachments a safe distance from electrical power. Stay clear 3 M (10 ft) plus twice the line insulator length. Read and understand the instructions and warnings in the Operation and Maintenance Manual. Failure to follow the instructions and warnings will cause serious injury or death.

Safety message (9) is located on the right hand side, on the upper winch guarding, facing left.

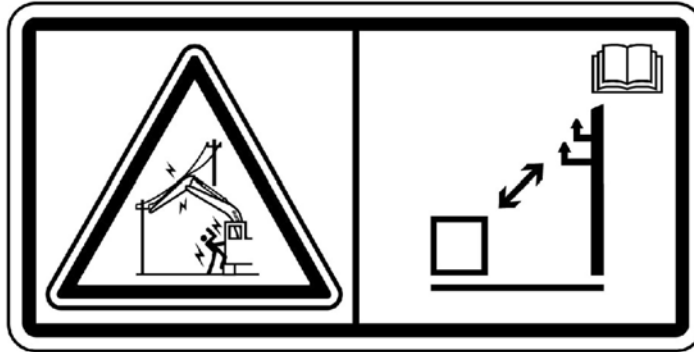


Figure 11: Electrical power lines (9)

Boom Stop Operation and Adjustment - Do Not Operate (10)



The Boom Stop system stops the boom winch from hauling-in when the boom is vertical, preventing overloading of key machine components. Defeating the boom stop switch could result in serious equipment damage, personnel injury, or even death. The boom stop function must be checked and verified daily, Do not Operate until it has been checked and properly adjusted. See the Operation and Maintenance Manual "Boom Stop Switch".

Safety message (10) is located on the left hand frame at the front, on the boom stop switch access panel.



Figure 12: Boom Stop Switch (10)

Not a Tow Point (11)



Equipment Damage Hazard! Do not use pipelayer structures or components for towing purposes of any kind. Only used designated tractor tow points for towing purposes. Refer to Operation and Maintenance Manual, "Towing Information" for details. Failure to follow the instructions and warnings could result in structural damage which cause serious injury or death.

Safety message (11) is located on the left side of the Left Hand Frame, on the front side of the Right Hand Frame, and on the lower cross-tube of the Counterweight swing frame yoke.



Figure 13: Equipment damage hazard, not a tow point (11)

Before Operation

Clear all personnel from the machine and from the area.

Remove all obstacles from the path of the machine. Beware of hazards such as wires, ditches, etc.

Make sure that the machine horn, the backup alarm (if equipped) and all other warning devices are working properly.

Reference: Refer to Operation and Maintenance Manual, "Daily Inspection" in this manual and in the Tractor's manual.

Fasten the seat belt securely.

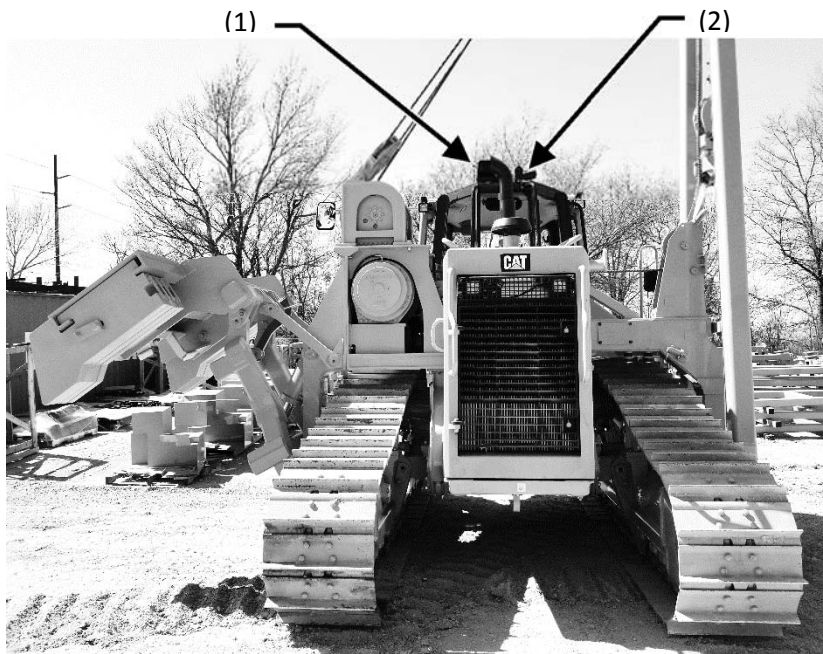
Visibility Information

Before starting the machine, the operator shall perform a walk-around inspection in order to ensure that there are no hazards around the machine.

While the machine is in operation, the operator should constantly survey the area around the machine. The operator needs to identify potential hazards as a hazard becomes visible around the machine.

Your machine may be equipped with mirrors or other visual aids. An example of a visual aid is Closed Circuit Television (CCTV). The operator should ensure that the visual aids are in proper working condition and that the visual aids are clean. Adjust the visual aids for the best visibility of all areas around the machine.

This machine is equipped with closed circuit television. There are two cameras located on top of the operator's enclosure. Camera (1) points forward and aids in the operators forward field of view. Camera (2) points at the boom head from where the boom head's visibility begins to be obstructed by the operator's enclosure to where the boom is vertical. The video monitor (3) is located in front of the operator below the tractor digital dash as shown. The operator shall adjust the orientation of camera (1) for the best visibility to the front of the machine and camera (2) so that the boom head is always visible either directly or on the video monitor (3). The operator shall read the operating instructions for video monitor (3) in Appendix B and be comfortable with its operation.



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(3)

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Figure 14: Closed Circuit Television Components

It may not be possible to provide direct visibility on large machines to all areas around the machine. Appropriate job site organization is required in order to minimize hazards that are caused by restricted visibility. Job site organization is a collection of rules and procedures that coordinates machines and people that work together in the same area.

Examples of job site organization include the following:

- Safety instructions
- Controlled patterns of machine movement
- Controlled patterns of vehicle movement
- Restricted areas
- Operator training
- Warning symbols or warning signs on machines or on vehicles
- A system of communication
- Communication between workers and operators prior to approaching the machine

Operation

Machine Operating Temperature Range

The standard pipelayer component configuration is intended for use within an ambient temperature range of -30 °C (-22°F) to 50 °C (122 °F). Special configurations for different ambient temperatures may be available. Consult your dealer for additional information. Refer to the specific tractor Operation and Maintenance manual for standard tractor capabilities.

Machine Operation

Only operate the machine while you are in a seat. The seat belt must be fastened while you operate the machine. Only operate the controls while the engine is running.

Before you move the machine, make sure that no one will be endangered.

Check for proper operation of all controls and protective devices while you operate the machine slowly in an open area. Do not allow riders on the machine unless the machine has the following equipment:

- additional seat
- additional seat belt

Report any needed repairs that were noted during operation.

Do not go close to the edge of a cliff, an excavation, or an overhang.

If the machine begins to sideslip, turn the machine downhill.

Be careful to avoid any condition which could cause the machine to tip. The machine can tip when you work on hills, banks and slopes. Also, the machine can tip when you cross ditches, ridges or other obstacles.

Whenever it is possible, operate the machine up the slopes and down the slopes. Avoid operating the machine across the slope, when possible.

Keep the machine under control. Do not overload the machine beyond capacity.

Be sure that the towing eyes and towing devices are adequate.

Towing eyes and towing devices should only be used to recover the machine.

Connect trailing equipment to a drawbar or to a hitch only.

When you maneuver the machine to connect equipment, be sure that there are no personnel between the machine and the trailing equipment. Block the hitch of the trailing equipment in order to align the equipment with the drawbar.

Never straddle a wire cable or allow other personnel to straddle a wire cable.

Know the maximum dimensions of your machine.

Lifting Capacities

Maintain control of the machine. Do not overload the machine beyond the machine capacity. Ensure that the correct load chart is referenced. Loads must be within the capabilities of the machine. Lifting capacity decreases as the load is moved further from the machine.

Use lifting slings that are approved and use lifting slings that are load tested. Also, all wire ropes or chains must be properly maintained. The wire ropes and chains must meet local regulations. You must know the load carrying capacity of these devices and you must know the correct use of these devices.

Wire rope limitations, soil conditions, and slope of terrain reduce actual capacity. All lifts must be made with the load line vertical, and the boom centerline directed toward the load.

To prevent cable from slipping off the drum, a minimum of five full-wraps of cable must remain on the winch drum at maximum working extension of the hook or boom.

Limitations on Lifting Loads That Exceed the Working Range

Do not load the boom beyond the maximum load capacity. See Operation and Maintenance Manual, "Lifting Capacities" for the load capacity of the boom.

When the load capacity is exceeded, refer to "American National Standards ANSI/ASME B30.14", or to ISO 8813.

Also, follow the procedures that are listed below:

- Inspect the wire cable for defects prior to the lift operation
- Inspect the wire cable for defects after the lift operation
- Do not exceed the load capacity of the boom
- The load must be handled safely in order to minimize tipping effects
- The lift operation and the inspections must be made under controlled conditions by a competent, authorized person

Electrical Power Lines



Serious injury or death by electrocution can result if the machine or attachments are not kept the proper distance from electrical power lines.

Use the following chart, and refer to ANSI/ASME B30.14-3.4.2 in order to determine the safe distance from high voltage wires during these conditions:

- machine operation
- machine transportation

When Operating Near High Voltage Power Lines	
Normal Voltage (Phase to Phase)	Minimum Clearance Required
0 Volts to 50 kVolts	3.05 Meters (10 Feet)
Over 50 kVolts to 200 kVolts	4.60 Meters (15 Feet)
Over 200 kVolts to 350 kVolts	6.10 Meters (20 Feet)
Over 350 kVolts to 500 kVolts	7.62 Meters (25 Feet)
Over 500 kVolts to 750 kVolts	10.67 Meters (35 Feet)
Over 750 kVolts to 1000 kVolts	13.72 Meters (45 Feet)
While in Transit Near High Voltage Power Lines	
Normal Voltage (Phase to Phase)	Minimum Clearance Required
0 Volts to 0.75 kVolts	1.22 Meters (4 Feet)
Over 0.75 kVolts to 50 kVolts	1.83 Meters (6 Feet)
Over 50 kVolts to 345 kVolts	3.05 Meters (10 Feet)
Over 345 kVolts to 750 kVolts	6.10 Meters (20 Feet)
Over 750 kVolts to 1000 kVolts	7.62 Meters (25 Feet)

Table 1: Power lines, minimum clearance

Parking

Park on a level surface. If you must park on a grade, use blocks to prevent the machine from rolling.

Apply the service brake in order to stop the machine. Move the transmission control to the NEUTRAL position and move the engine speed switch to the LOW IDLE position. Engage the parking brake.

Lower any load to the ground and fully retract the counterweight.

Refer to the tractor's operation and maintenance manual for the specific procedures regarding engine shut down and/or other implement attachments.

Slope Operation

Machines that are operating safely in various applications depend on these criteria: the machine model, configuration, machine maintenance, operating speed of the machine, conditions of the terrain, fluid levels. The most important criteria are the skill and judgment of the operator.

A well trained operator that follows the instructions in the Operation and Maintenance Manual has the greatest impact on stability. Operator training provides a person with the following abilities: observation of working and environmental conditions, feel for the machine, identification of potential hazards, and operating the machine safely by making appropriate decisions.

When you work on side hills and when you work on slopes, consider the following important points:

Speed of travel - At higher speeds, forces of inertia tend to make the machine less stable.

Roughness of terrain or surface - The machine may be less stable with uneven terrain.

Direction of travel - Avoid operating the machine across the slope. When possible, operate the machine up the slopes and operate the machine down the slopes. Place the heaviest end of the machine uphill when you are working on an incline.

Mounted equipment - Balance of the machine may be impeded by the following components: equipment that is mounted on the machine, machine configuration, weights, and counterweights.

Nature of surface - Ground that has been newly filled with earth may collapse from the weight of the machine.

Surface material - Rocks and moisture of the surface material may drastically affect the machine's traction and machine's stability. Rocky surfaces may promote side slipping of the machine.

Slippage due to excessive loads - This may cause downhill tracks or downhill tires to dig into the ground, which will increase the angle of the machine.

Width of tracks - Narrower tracks further increase the digging into the ground which causes the machine to be less stable.

Implements attached to the drawbar - This may decrease the weight on the uphill tracks. The decreased weight will cause the machine to be less stable.

Height of the working load of the machine - When the working loads are in higher positions, the stability of the machine is reduced.

Operated equipment - Be aware of performance features of the equipment in operation and the effects on machine stability.

Operating techniques - Keep all attachments or pulled loads low to the ground for optimum stability.

Machine systems have limitations on slopes - Slopes can affect the proper function and operation of the various machine systems. These machine systems are needed for machine control on slopes.

Note: Safe operation on steep slopes may require special machine maintenance. Excellent skill of the operator and proper equipment for specific applications are also required. Consult the Operation and Maintenance Manual sections for the proper fluid level requirements and intended machine use.

Note: Refer to the tractor's operation and maintenance manual for further specific requirements for safe operation on steep slopes.

Equipment Lowering with Engine Stopped

Before lowering any equipment with the engine stopped, clear the area around the equipment of all personnel. The procedure will cause immediate, rapid lowering of the load. Wear appropriate personal protective equipment and follow the established procedure in the Operation and Maintenance Manual, "Equipment Lowering with Engine Stopped" in the Operation Section of the manual.

Sound Information and Vibration Information

Sound Level Information

Hearing protection may be needed when the machine is operated with an open operator station and an open cab for extended periods or in a noisy environment. Hearing protection may be needed when the machine is operated with a cab that is not properly maintained, or when the doors and windows are open for extended periods or in a noisy environment.

"The European Union Physical Agents (Vibration) Directive 2002/44/EC"

Refer to the tractor operation and maintenance manual "The European Union Physical Agents (Vibration) Directive 2002/44/EC" for complete information, noting that the Information Concerning Whole Body Vibration Level will not be greater than the typical operating activity values given for dozing.

Guards

There are different types of guards that are used to protect the operator.

A daily inspection of the guards is required in order to check for structures that are bent, cracked or loose. Never operate a machine with a damaged structure.

The operator becomes exposed to a hazardous situation if the machine is used improperly or if poor operating techniques are used. This situation can occur even though a machine is equipped with appropriate protective guards. Follow the established operating procedures that are recommended for your machine.

Product Information Section

General Information

Components

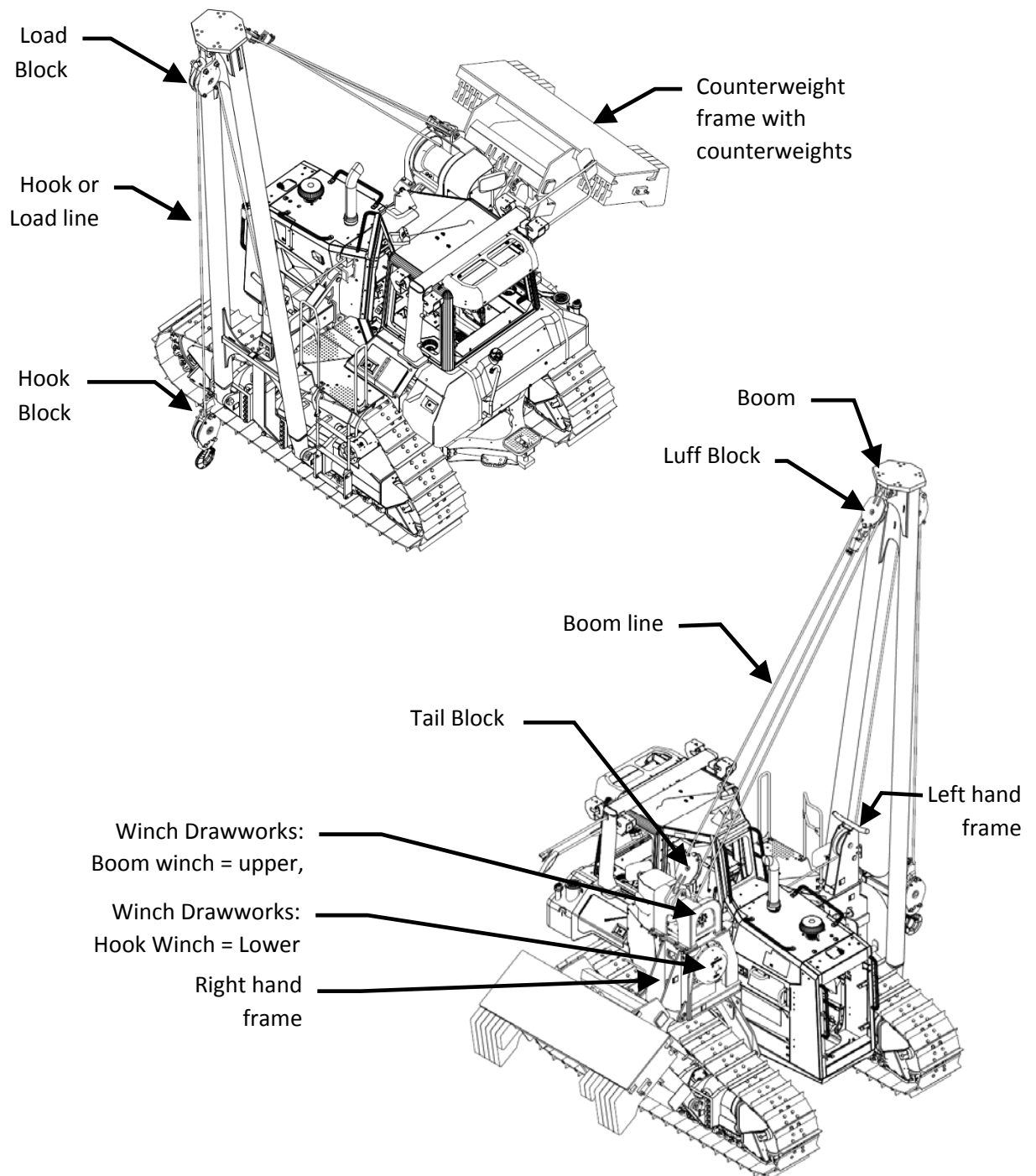


Figure 15: Component identification

Specifications

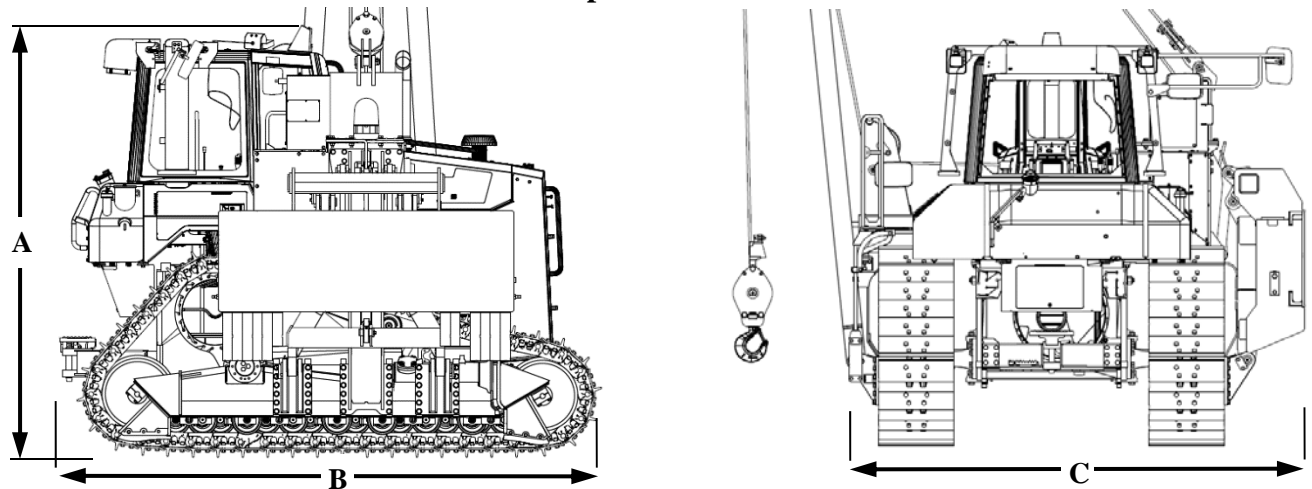


Figure 16: Standard shipping specifications, height and width

71H II Pipelayer	
Operating weight of the standard machine ¹	22 181 kg (48,900 lb)
Shipping weight of the standard machine ²	20 452 kg (46,086 lb)
Weight of the 6.1 m (20 ft) boom	965 kg (2127 lb)
Weight of the boom sheave blocks, the load blocks, and pins	204 kg (450 lb)
Height of the machine without the boom (A)	3297mm (129.8 in)
Length of the machine (B)	4146 mm (163.2 in)
Width of the machine without the boom (C)	3658 mm (144 in)
Height of the machine with the 20 ft boom (per ISO 8813, 1.25 m overhang)	6910mm (272 in)
Ground clearance from ground face of shoe (per SAE)	507 mm (20 in)

Table 2: Specifications

Intended Use

This machine is a Pipelayer that is described in ISO 6165:2012. The machine is intended to perform the following functions: lift, handle, and lay down pipe with a side mounted boom.

Restrictions to Application and Configuration

Maximum approved operating weight is 22 200kg (48,942lb).

The maximum lift capacity per ISO 8813:1992, is 27215 kg (60,000 lb).

The maximum fore and aft slope is 45 degrees or a 100 percent grade for the proper lubrication of the pipelayer components.

Refer to the tractor operation and maintenance manual for additional restrictions.

¹Operating Weight: Includes lubricants, coolant, 100% fuel, hydraulic controls and fluids, backup alarm, seat belt, 600 mm (23.6 in) single grouser shoes, drawbar, counterweight, boom and pulley blocks and cable, and operator.

²Shipping Weight: Includes lubricants, coolant, 10% fuel, hydraulic controls and fluids, backup alarm, seat belt, 600 mm (23.6 in) single grouser shoes, drawbar, counterweight, pulley blocks, and cables.

Lifting Capacities

! WARNING

The machine may tip and personal injury may occur if the maximum load capacities are exceeded. Load capacities assume that the machine is stationary on a level concrete surface with the counterweight extended. Lift capacities will decrease on slopes or soft ground.

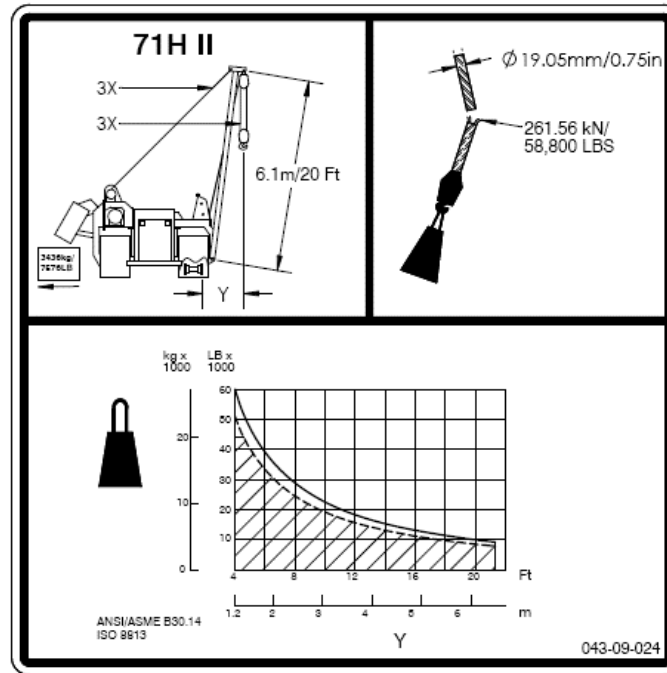


Figure 17: Lifting capacities

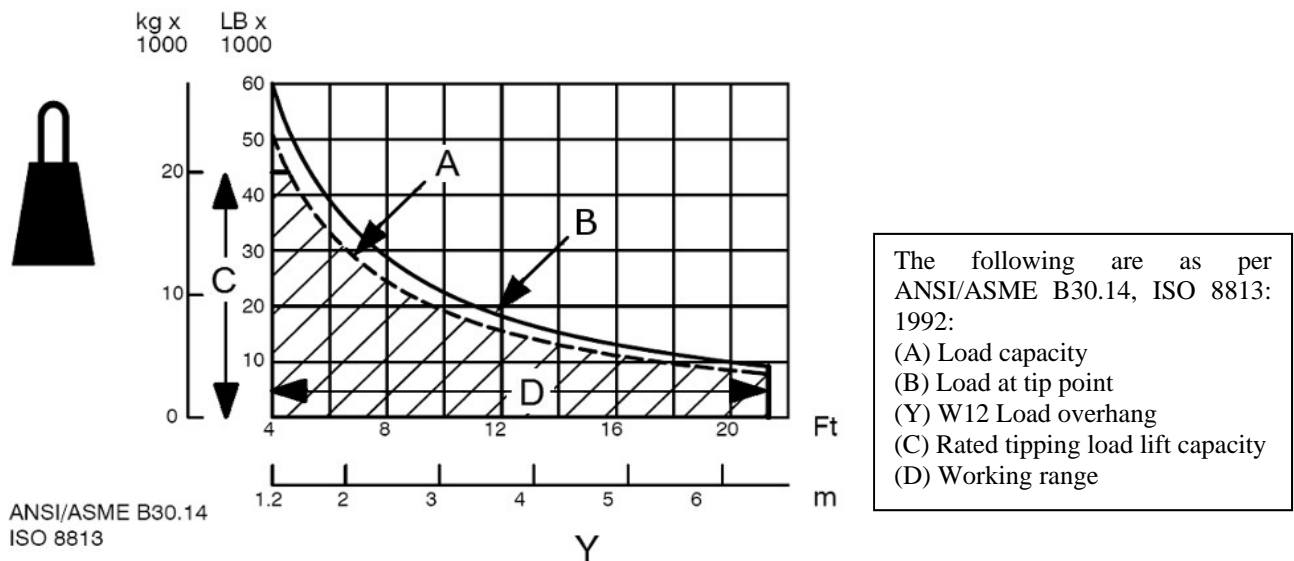


Figure 18: Lift capacity chart

NOTE: Do not exceed the lifting capacity that is shown in the chart in illustration above.

The lift capacity chart is located on the right hand winch-guarding to the front of the controls. The lift capacities are based on a stationary machine with the following specifications:

71H II Pipelayer	
Wire rope diameter	19.05 mm (0.75 inch)
Minimum breaking strength of the wire rope	261.56 kN (58,800 lb)
3 part load line	
3 part boom line	
Mass of the extended counterweight	3,436 kg (7,576 lb)
Standard boom length	6.1 m (20 ft)
Total operating weight of the machine³	22,181 kg (48,900 lb)

Table 3: Stationary specifications

If the lift capacity chart indicates that the lift operation is within the capability of the machine, attempt to perform the operation but proceed with care. Remember that the load may weigh more than the estimate for the load. The lift capacity chart is for estimating the lift operation only.

NOTICE

Installation of additional equipment or other options may reduce the tipping characteristics of the machine below those indicated in the chart. Use additional care when working with installed attachments.

Operation Section

Before Operation

Mounting and Dismounting



Figure 19: Mounting and dismounting machine

Use steps and handholds whenever you mount the machine. Use steps and handholds whenever you dismount the machine. Before you mount the machine, clean the step and the handholds. Inspect the step and handholds. Make all necessary repairs.

Face the machine whenever you mount the machine and whenever you dismount the machine. Maintain a three-point contact with the step and with handholds.

Note: Three-point contact can be two feet and one hand. Three-point contact can also be one foot and two hands.

Do not mount a moving machine. Do not dismount a moving machine. Never jump off the machine. Do not try to mount the machine when you carry tools or supplies. Do not try to dismount the machine when you are carrying tools or supplies. Use a hand line to pull equipment onto the platform. Do not use any controls as handholds when you enter the operator compartment or when you exit the operator compartment.

³Operating Weight: Includes lubricants, coolant, 100% fuel, hydraulic controls and fluids, backup alarm, seat belt, 600 mm (23.6 in) single grouser shoes, drawbar, counterweight, boom and pulley blocks and cable, and operator.

Daily Inspection

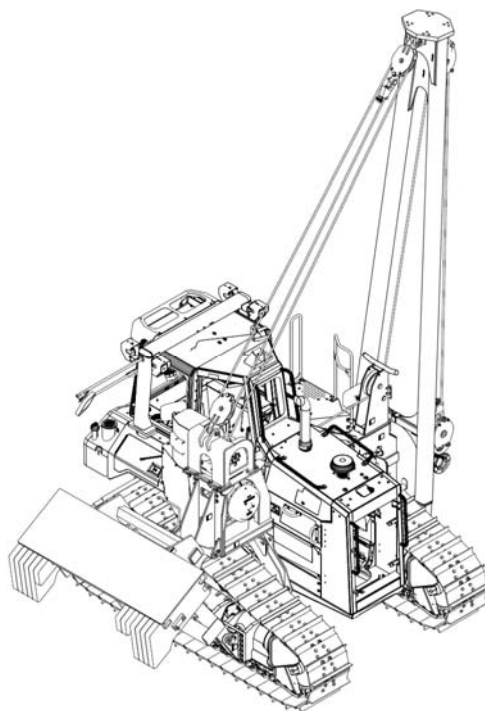


Figure 20: Daily inspection walk around

For maximum service life of the machine, perform a daily walk-around inspection.

Note: Watch closely for leaks. If leaking is observed, find the source of the leak and correct the leak. If leaking is suspected or leaking is observed, check the fluid levels more frequently.

Inspect the machine for the following items:

- Inspect the hydraulic system for leaks. Repair any hydraulic system leaks. Inspect the hoses, the seals, and the flanges.
- Inspect the winch final drive for leaks. Repair any final drive leaks.
- Inspect covers and the guards for damage, for loose bolts, and for missing bolts.
- Inspect the condition of the steps and of the handholds. Inspect the steps and the handholds for cleanliness. If necessary, repair the steps or clean the steps.
- Inspect the operator compartment for cleanliness. Remove any trash buildup and any dirt buildup.
- Inspect mirrors and make sure they are in good condition and replace if broken.
- Inspect the cables securing the roof mounted CCTV cameras. If the cables are worn or frayed install new cables.

Note: Refer to the tractor operation manual for detailed information on the specific daily inspection of the tractor unit.

NOTICE

Accumulated grease and oil on a machine is a fire hazard.

Remove debris with steam cleaning or high pressure water, at the specified interval in the Maintenance Interval Schedule or each time any significant quantity of oil is spilled on the machine.

Daily Checks

After you inspect the machine, perform the daily maintenance that is listed in the maintenance interval schedule. Perform the daily maintenance before you mount the machine in order to operate the machine.

Refer to Operation and Maintenance Manual, "Maintenance Interval Schedule" for the correct procedures for the following checks:

- "Boom Pivot Pins - Lubricate"
- "Cooling System Coolant Level - Check"
- "Counterweight Cylinder Bearings - Lubricate"
- "Counterweight Hinge Pins - Lubricate"
- "Fairlead Sheave - Lubricate"
- "Hook and Wire Cable Inspect"
- "Hydraulic System Oil Level - Check"
- "Sheave Block Bearings - Lubricate"
- "Boom Stop Switch - Check operation"

Note: Refer to the tractor operation manual for detailed information on the specific daily checks of the tractor unit.

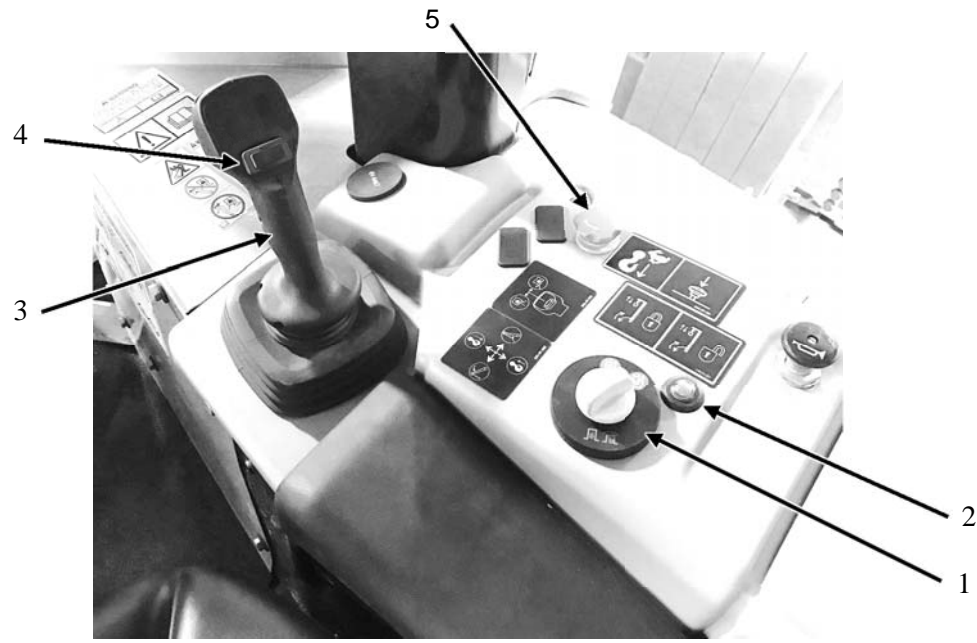
Tractor Operation

Refer to the tractor operation and maintenance manual for the specific procedures regarding complete Tractor Operation.

Hydraulic Oil Temperature

Refer to the tractor operation and maintenance manual "Gauges" for the specific procedures regarding hydraulic oil temperature indication and operating temperature.

Pipelayer Operation



043-09-63-003A

Figure 21: Controls for pipelayer

Lockout Switch (1)

The Lockout Switch has two positions: Lock and Unlock.



LOCKED POSITION—WINCH AND COUNTERWEIGHT CONTROLS LOCKED: To prevent accidental actuation of the winch and counterweight controls while not in use, move the Lockout Switch to the “Locked” position. In this position, the winch and counterweight controls do not function. Always place Lockout Switch in the LOCKED POSITION whenever the machine is left unattended, or when inadvertent control operation could result in a dangerous situation arising. When in the LOCKED POSITION the green “Unlocked Control Indicator LED” (2) will be OFF.



UNLOCKED POSITION—WINCH AND COUNTERWEIGHT CONTROLS UNLOCKED: Place the Lockout Switch in the UNLOCKED POSITION to activate the boom winch, hook winch, and counterweight controls. When in the UNLOCKED POSITION the green “Unlocked Control Indicator LED” (2) will be ON.

Joystick Hook Control (3A)

HOLD: The joystick self-centres to this position whenever it is released. In this position, the load winch brake will set, and the hook will stop and remain at the position it is in.



LOWER: Move the joystick to this position to lower the hook with controlled winch power. The further the joystick is pushed away from HOLD, the faster the hook will lower. The closer the joystick is toward HOLD, the slower the hook will lower. When the joystick is released, it will return to the HOLD position, the winch brake will set, and the hook will stop and remain at the position it is in. Hook winch line speed varies with engine throttle setting. Hook control is smoothest at engine speeds faster than idle.



RAISE: Move the joystick to this position to raise the hook. The further the joystick is pulled away from HOLD, the faster the hook will raise. The closer the joystick is toward HOLD, the slower the hook will raise. When the joystick is released, it will return to the HOLD position and the hook will stop and remain at the position it is in. Hook winch line speed varies with engine throttle setting. Hook control is smoothest at engine speeds faster than idle.

NOTE: The hydraulic pilot system and some machine controls, namely the hook Free Fall, are "**LIVE**" for as long as the accumulator holds a charge, even if the engine is not running. This pressure charge will take approximately four hours or more to bleed off. Refer to the operation and maintenance manual "Free Fall Active" for dropping load hazard warning. Refer to the operation and maintenance manual "Accumulator - Relieving Charge" to bleed off the residual pressure if required and when safe to do so.

Accumulator - Relieving Charge

To relieve the accumulator charge, with no load on the hook and the engine stopped:

1. Turn the key to the "ON" position. Electrical power is required to operate the winches.
2. Turn the lockout switch to the UNLOCK POSITION
3. Move the joystick *hook control* from "**HOLD**" to "**RAISE**" 10 times.

Free Fall Button (5)



Component failure! Re-engaging the free fall while the load is dropping causes shock loads which could cause component structural failure, resulting in possible personnel injury or death.




(Emergency Lower) Free Fall – Press the red free fall button (2) to lower the load fast in an emergency. The load winch's free fall brake will release, and the hook will move down under the weight of the load. Upon activating the free fall function the load will drop and must be allowed to fall to its end travel without re-engagement. Turn the free fall button counter-clockwise to reset the free fall button and reactivate the hook winch controls.


NOTICE

The Free Fall is used for a full release of a suspended load up to the maximum lift capacity of the hook winch. Upon activating the free fall function the load will drop and must be allowed to fall to its end travel without re-engagement.

Boom Control (3B)

- A) **HOLD:** The joystick self-centres to this position whenever it is released. In this position, the boom winch brake will set, and the boom will stop and remain at the position it is in.

- B)  **LOWER:** Move the joystick to this position to lower the boom. The further the joystick is pushed away from HOLD, the faster the boom will lower. The closer the joystick is toward HOLD, the slower the boom will lower. When the joystick is released, it will return to the HOLD position, and the boom will stop and remain at the position it is in. Boom winch line speed varies with engine throttle setting. Boom control is smoothest at engine speeds faster than idle.

- C)  **RAISE:** Move the joystick to this position to raise the boom. The further the joystick is pulled away from HOLD, the faster the boom will raise. The closer the joystick is toward HOLD, the slower the boom will raise. When the joystick is released, it will return to the HOLD position, and the boom will stop and remain at the position it is in. Boom winch line speed varies with engine throttle setting. Boom control is smoothest at engine speeds faster than idle.

Boom Stop Switch

The boom stop switch is a safety device that is intended to automatically stop the boom winch from hauling-in when the boom is vertical, preventing overloading of key machine components. Refer to the Operation and Maintenance manual, Boom Stop Switch Adjustment, for correct operation and adjustment. Check its function daily.

Counterweight Control (4)

NOTICE

In order to prevent machine damage, check to make sure the counterweight lock lever is not locked in the extended position before you operate this control. Refer to Operation and Maintenance manual, "Safety Section".

Hold - When the operator releases the counterweight control rocker from any position, the control will return to the HOLD and the counterweight will remain in position.



Out - Move the counterweight control rocker to this position in order to move the counterweight outward. When the counterweight control rocker is released, it returns to the HOLD position and the counterweight will remain in position.

Refer to the Operation and Maintenance Manual, "Counterweight Lock Lever" for the procedure to mechanically lock the counterweight in the fully extended position when you service the machine.



In - Move the counterweight control rocker to this position in order to move the counterweight inward. When you release the counterweight control rocker, it returns to the HOLD position and the counterweight will remain in position.

Counterweight Lock Lever

⚠ WARNING

Crushing Hazard! When the counterweight is in the fully extended position for servicing the machine, secure the extended counterweight with the counterweight lock lever. Use the counterweight lock lever to avoid possible personnel injury or death from crushing.



Figure 22: Counterweight Lock Lever (1) locked in the extended position, viewed from front

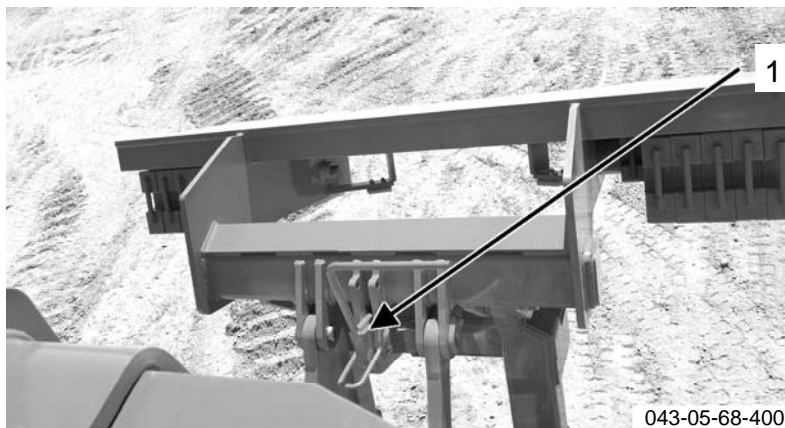


Figure 23: Counterweight Lock Lever (1), locked in the extended position, side view (1)

NOTICE

When you engage the locking device for the counterweight or when you disengage the locking device for the counterweight use the Lockout Switch on the controls. Turn the Lockout Switch to “Lock” in order to avoid the inadvertent movement of the counterweight. Refer to the topic "Lockout Switch" in the Operation and Maintenance Manual, "Operator Controls".

Lock the counterweight when you service the machine.

Locked - Extend counterweight cylinders to maximum length, engage the lock lever (1).

Slowly retract the counterweight slightly until there is pressure on the lock lever (1). Do not continue to retract the counterweight against the lock lever once the lock lever is engaged. Refer to Operation and Maintenance manual, Safety Section "Counterweight Lock Lever Thrown or Flying Objects – Full Body Exposure".

Unlocked - Extend counterweight cylinders to maximum length. Disengage the lock lever (1). Retract the counterweight.

The locking mechanism will hold the counterweight in position in the event of a hydraulic failure.

Equipment Lowering with Engine Stopped

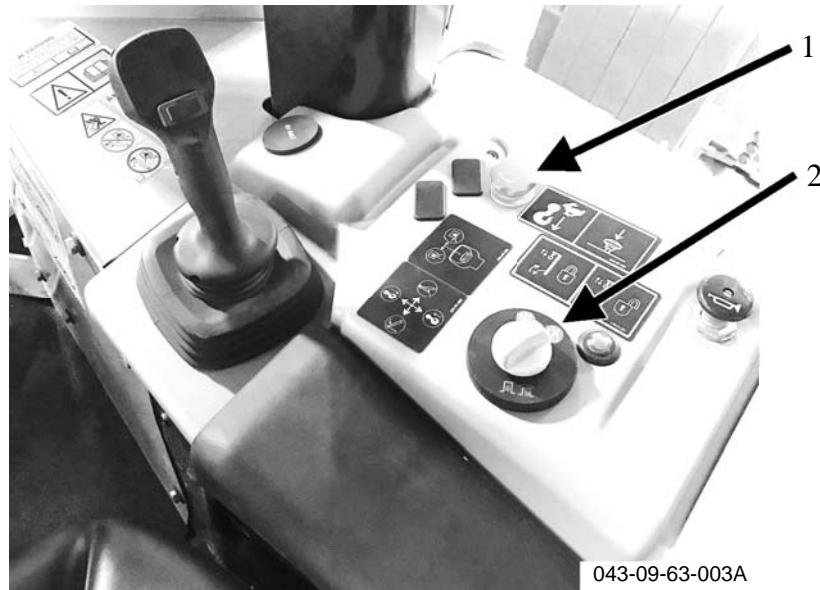


Figure 24: Controls for Equipment lowering with engine stopped

NOTICE

Before lowering any equipment with the engine stopped, clear the area around the equipment of all personnel. The procedure will cause immediate, rapid lowering of the load. Refer to Operation and Maintenance Manual, "Hook Control" for complete control function description.


If the machine does not have engine power, in order to lower the equipment follow these steps:

- Turn the key to the "ON" position. Electrical power is required to operate the Free Fall.
- Turn the Lockout Switch (2) to the UNLOCK POSITION
- Press the red Free Fall button on the dash (1) **(Emergency Lower) Free Fall.**
- If the accumulator still has residual pressure reserve, it will provide pilot pressure that will allow the hook to be immediately lowered fast under the weight of the load.
- Do not twist the Free Fall button to re-engage the Free Fall until the load is completely lowered.
- Refer to the Testing and Adjusting manual for pressure charging procedures if there is insufficient pressure reserve in the accumulator.

Machine Warm-Up

NOTICE

Refer to the tractor operation and maintenance manual for additional requirements and information on Engine and Machine Warm-Up.

The hydraulic oil will warm up faster, if the counterweight is fully retracted and the counterweight control rocker is held in the IN (

Once the hydraulic oil is sufficiently warm, set the engine idle to LOW.

Cycle all controls in order to allow warm hydraulic oil to circulate through the hydraulic system and through all hydraulic lines:

Slowly cycle the hook winch up and down several times (5 - 10).

Set the engine idle to HIGH idle (full throttle).

Slowly cycle the hook up and down 2 - 3 times.

Rapidly cycle the hook up and down several times.

Set the engine idle to LOW.

Slowly raise the boom up, stopping the boom at the 1.25 m (4 ft) overhang.

Slowly cycle the boom fully down and then up, stopping the boom at the 1.25 m (4 ft) overhang. Do not allow the boom to contact the boom kickout rod or the left-hand frame. Repeat this 2 - 3 times.

Set the engine idle to HIGH idle (full throttle).

Slowly cycle the boom fully down and then up, stopping the boom at the 1.25 m (4 ft) overhang. Do not contact the left-hand frame or the boom kickout rod. Repeat this 2 - 3 times.

Rapidly cycle the boom down, and then up stopping the boom at the 1.25 m (4 ft) overhang. Do not contact the left-hand frame or the boom kickout rod.

Verify the function of the boom stop switch as per the "Boom Stop Switch Adjustment" section in this manual.

Transportation Information

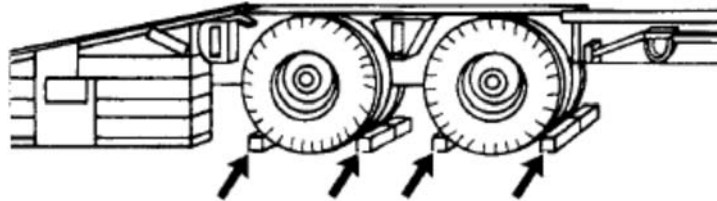
Shipping the Machine

Investigate the travel route for overpass clearances. Make sure that there is adequate clearance for the machine that is being transported.

Remove ice, snow, or other slippery material from the loading dock and from the truck bed before loading. Removing ice, snow, or other slippery material will prevent slippage while you load the machine. Removing ice, snow, or other slippery material will prevent the machine from slipping in transit.

NOTICE

Obey all state and local laws governing the weight, width, and length of a load. Observe all regulations governing wide loads.



1. Place blocks under the trailer wheels or under the rail car wheels before loading, as shown.
2. Move the transmission control to the NEUTRAL position.
3. Engage the parking brake switch.
4. Stop the engine.
5. Turn the start switch key to the OFF position. Remove the key and lock the parking brake switch.
6. Turn the battery disconnect switch to the OFF position. Remove the key.
7. Attach any vandalism protection and lock the access covers.
8. Inspect the cables securing the roof mounted CCTV cameras. If the cables are worn or frayed install new cables.
9. Install the tie-downs at several locations and chock the tracks in the front and in the rear.
10. Cover the opening for the engine exhaust in order to prevent rotation of the turbocharger that is caused by the force of the wind.

NOTICE

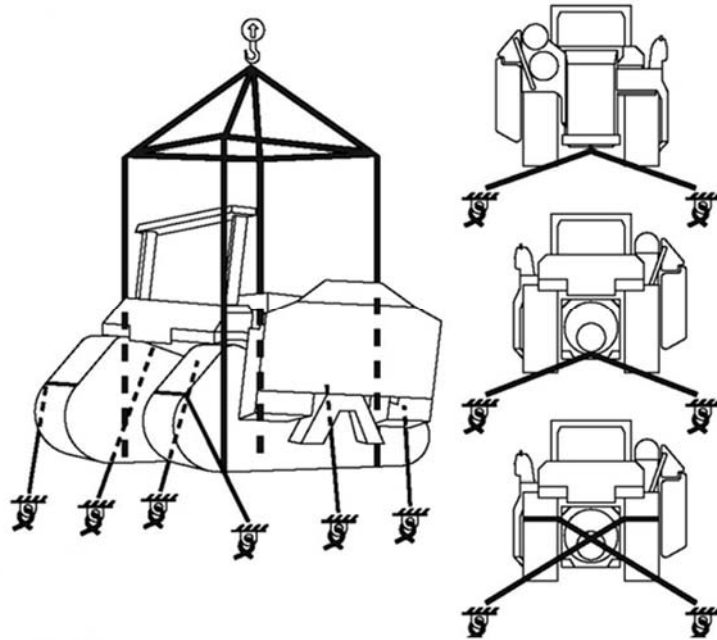
Rotation of the turbocharger without engine operation can result in damage to the turbocharger. Cover the exhaust opening or secure the rain cap in order to prevent the turbocharger from wind milling in transit. Refer to the tractor operation and maintenance manual for additional requirements and information.

Lifting and Tying Down the Machine



Improper lifting and improper tie-downs can allow the load to shift or fail and cause injury or damage. Use only properly rated cables and slings with lift and tie down points provided.

Follow the instructions in Operation and Maintenance Manual, “Lifting and Tying Down the Machine” for the proper technique for securing the machine. Refer to Operation and Maintenance Manual, “Specifications” for specific pipelayer weight information.



An image of a standard equipped pipelayer is shown for example only.

NOTICE

Improper lifting or tie-downs can allow load to shift and can cause injury and damage.

Refer to the tractor's *Operation and Maintenance Manual* for correct lifting and tying down procedures, including precautions and for locations of tie-downs.

Towing Information

Refer to the tractor's *Operation and Maintenance Manual* for correct towing procedures.



Personal injury or death could result when towing a disabled machine incorrectly. Block the machine to prevent movement before releasing the brakes. The machine can roll free if it is not blocked. Refer to the tractor's operation and maintenance manual for complete detailed towing instructions.



Personal injury or death can result from worn wire rope cable. Worn or frayed cable could break causing injury. Check the wire rope cable. If cable is worn or is frayed install a new cable.

NOTICE

DO NOT connect to any part of the pipelayer structures or components for towing purposes of any kind.

DO NOT connect to any front mounted attachments for towing purposes of any kind, unless the attachment is specifically intended for towing purposes.

DO NOT connect to any rear mounted attachments for towing purposes of any kind, unless the attachment is specifically intended for towing purposes.

Refer to the tractor's *Operation and Maintenance Manual* for correct towing procedures.

Removal of the Boom

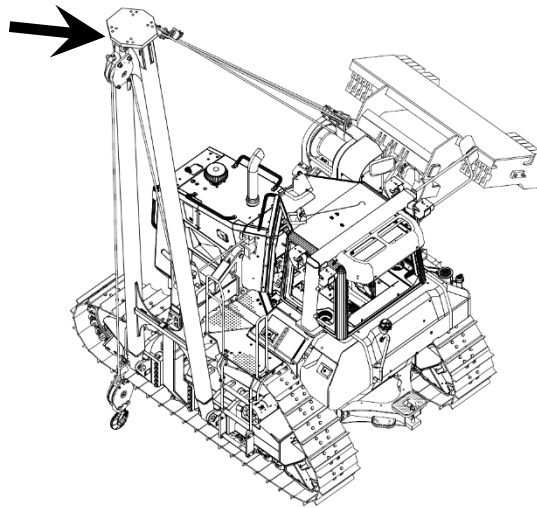


Figure 25: Removal of the boom

1. Lower the boom enough to remove the load blocks and the sheave block.

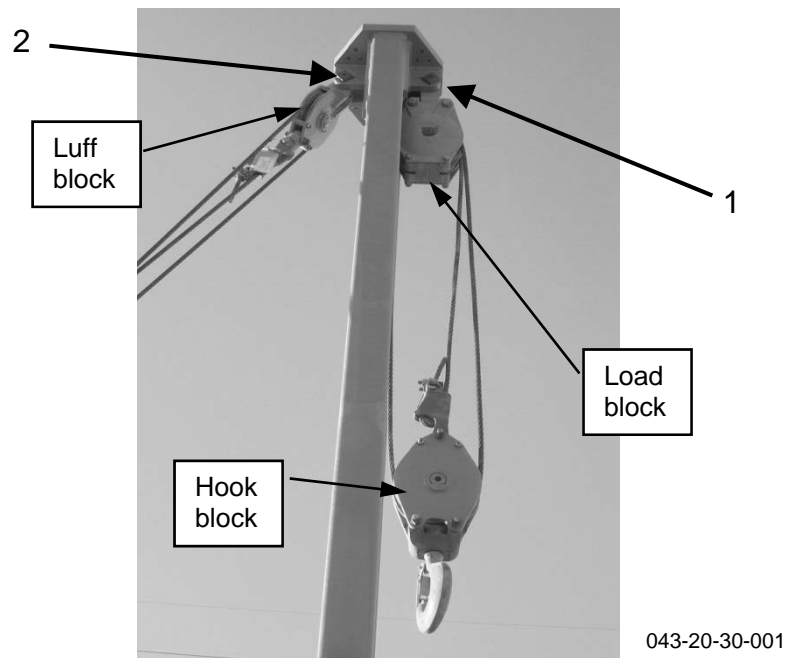


Figure 26: Removal of boom, steps 1, 2

2. Remove cotter pin, the retainer, and pin (1). Lower the load block and the hook block to the ground.
The approximate weight of the load block is 87 kg (192 lb). The approximate weight of the hook block is 73 kg (160 lb). The combined weight of the load block and the hook block is approximately 160 kg (352 lb).
3. Replace the pin (1) in the boom.

4. Secure the load block and the hook block to the tractor tow point for transportation.



Figure 27: Secure Load and Hook Blocks for Transport

5. Draw in the excess hook cable in order to pull the sheave blocks to the machine. Use the Hook Line Stowing Guide to keep the line clear of the tracks. DO NOT over tighten the cables.
6. Lower the boom to the horizontal position onto wood blocks that are sufficient to support the boom.
7. Remove the cotter pin, the retainer, and pin (2). The approximate weight of the luff block is 39 kg (85 lb).
8. Replace the pin and the retainer (2) in the boom.
9. Move the luff block clear of the boom and area; it will be secured after the boom has been removed.

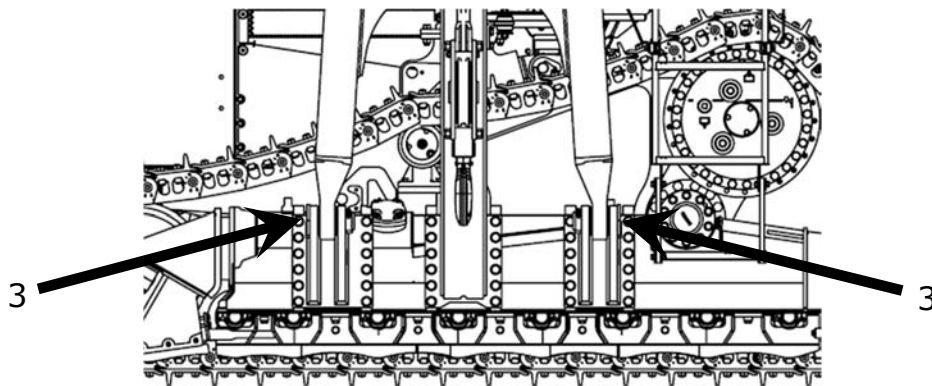


Figure 28: Location of pins for removal of boom

10. Fasten an appropriate lifting device to the boom. The approximate weight of the boom is 965 kg (2127 lb).
11. Remove the cotter pins, the retainers, and the pins (3) from both sides of the support.
12. Remove the boom from the machine. Replace the pins (3) in the support.
13. Draw in the excess line for the boom in order to pull the luff block to the machine, ensuring not to over tighten the cables to avoid causing kinks.



043-05-30-400

Figure 29: Secure Luff Block for Transport

14. Secure the Luff Block to the stowing bracket on the left hand frame, and retain with a Ø3/8" x 4" long cotter pin all blocks to the machine when transporting.

NOTICE

DO NOT over tighten lines. DO NOT kink or flatten lines.

Maintenance and Lubrication Section

Lubricant Viscosities - General

- Follow tractor manufacture's maintenance and lubrication instructions for tractor service as required.
- Follow tractor and/or winch manufacture's lubrication instructions for the pipelayer hydraulic system.

Selecting the Viscosity

The proper oil viscosity grade is determined by the minimum outside temperature. This is the temperature when the machine is started and when the machine is operated. In order to determine the proper oil viscosity grade, refer to the "Min" column in the table. This information reflects the coldest ambient temperature condition for starting a cold machine and for operating a cold machine. Refer to the "Max" column in the table in order to select the oil viscosity grade for operating the machine at the highest temperature that is anticipated. Use the highest oil viscosity that is allowed for the ambient temperature when you start the machine.

Machines that are operated continuously should use oils that have the higher oil viscosity in the final drives and in the differentials. The oils that have the higher oil viscosity will maintain the highest possible oil film thickness. Consult your dealer if additional information is needed.

Lubricant Viscosities for Ambient Temperatures

Lubricant Viscosities for Ambient Temperatures						
Compartment or System	Oil Type and Classification	Oil Viscosities	°C		°F	
			Min	Max	Min	Max
Hydraulic System	Refer to Tractor Operation and Maintenance Manual					
Winch Gearbox and Hook Winch Freefall	Mobil Delvac Synthetic Gear Oil	75W-90	-40	50	-40	122
	CAT Arctic GO	75W-90	-40	40	-40	104
Winch Brake	Cat HYDO Advanced 10	SAE 10W	-20	40	-4	104
	Cat HYDO Advanced 30	SAE 30	0	50	32	122
	Cat BIO HYDO Advanced	"ISO 46" Multi-Grade	-30	45	-22	113
	Cat DEO-ULS Cold Weather	SAE 0W-40	-40	40	-40	104
	Cat TDTO Cold Weather	SAE 0W-20	-40	40	-40	104
	Cat MTO	SAE10W-30	-20	40	-4	104
	Cat TDTO-TMS	Multi-Grade	-15	50	5	122

Table 4: Lubricant viscosities for ambient temperature

Lubricant Capacities (Refill)

NOTICE

Use only none EP-Oil in the winch brake housing. Do not use Gear Oil in the brake housing.

NOTICE

Do not use Cat GO (Gear Oil) or commercial gear oil in the machine compartments unless specifically recommended by Caterpillar. The gear oil can cause seals to fail. The seals can also leak. The gear oil may not be compatible with friction materials. The oil can reduce the efficiency of the transmission and the brake performance. Refer to the Tractor Operation and Maintenance Manual for complete details.

APPROXIMATE LUBRICANT REFILL CAPACITIES			
Compartment or System	Liters	US gal	Imperial gallon
Hydraulic Oil (Tank only)	29.5	7.79	6.48
Hydraulic Oil (System)	41.5	11	9.13
Hook Winch Freefall	4	1.05 (4.2 Quarts)	0.87
Hook Winch Brake	0.24	0.06 (0.25 Quart)	0.05
Hook Winch Gearbox	1.9	0.5 (2 Quarts)	0.42
Boom Winch Brake	0.24	0.06 (0.25 Quart)	0.05
Boom Winch Gearbox	0.95	0.25 (1 Quart)	0.21

Table 5: Lubricant refill capacities

S-O-S Information

S O S Services is a highly recommended process for Caterpillar customers to use in order to minimize owning and operating cost. Customers provide oil samples, coolant samples, and other machine information. The dealer uses the data in order to provide the customer with recommendations for management of the equipment. In addition, S O S Services can help determine the cause of an existing product problem. Refer to Caterpillar Special Publication, SEBU6250, "Caterpillar Machine Fluid Recommendations" for detailed information concerning S O S Services.

Refer to the Operation and Maintenance Manual, "Maintenance Interval Schedule" for a specific sampling location and a service hour maintenance interval.

Consult your dealer for complete information and assistance in establishing an S-O-S program for your equipment.

Maintenance Interval Schedule (MIS)

Ensure that all safety information, warnings, and instructions are read and understood before any operation or any maintenance procedures are performed. The user is responsible for the performance of maintenance, including all adjustments, the use of proper lubricants, fluids, filters, and the replacement of components due to normal wear and aging. Failure to adhere to proper maintenance intervals and procedures may result in diminished performance of the product and/or accelerated wear of components. Use mileage, fuel consumption, service hours, or calendar time, **WHICH EVER OCCURS FIRST**, in order to determine the maintenance intervals. Products that operate in severe operating conditions may require more frequent maintenance.

Service Intervals

Note: Before each consecutive interval is performed, all maintenance from the previous interval must be performed. Perform the following servicing at EVERY interval they occur; for example, the 10 hour and 50 hour service are also performed at the 200 hour interval, etc.

When Required

- Boom Line – Install
- Hook Load Line – Install

Every 10 Service Hours or Daily

- Controls for proper operation of boom and hook– Check
- Boom Stop operation – Check, adjust if required
- Boom Pivot Pins – Lubricate
- Counterweight Cylinder Bearings – Lubricate
- Counterweight Hinge Pins – Lubricate
- Fairlead Sheave – Lubricate
- Hook and Wire Cable (Boom and Hook lines) – Inspect
- Hydraulic System Oil Level – Check
- Hoses and fittings for leaks – Check
- Sheave Block Bearings – Lubricate
- Pipelayer structures and components for loose bolts, cracks, damage, etc. – Inspect
- Inspect the cables securing the roof mounted CCTV cameras
- Inspect the hook for any distortion, bends, twists, etc. Inspect the hook for any wear, cracks, nicks, or gouges. Refer to American National Standard Institute ANSI/ASME B30.14, or ISO 8813.
- Blocks, and yokes for wear or damage – Inspect
- Ensure that area between tractor tracks and pipelayer-structures are free from dirt, debris, ice, snow, etc. – Inspect
- Hook Winch check – refer to Winch OEM Service Manual
- Boom Winch check – refer to Winch OEM Service Manual

Every 50 Service Hours or Weekly

- Thoroughly check Boom Stop system operation and adjustment, lubricate boom stop switch roller and actuator.
- Lightly lubricate wire rope with recommended engine or hydraulic oil.
- Hook Winch: Freefall, Brake, Gearbox oil level – Check
- Boom Winch: Brake, Gearbox oil level – Check
- Hook Winch check – refer to Winch OEM Service Manual
- Boom Winch check – refer to Winch OEM Service Manual

Every 500 Service Hours

- Hydraulic System Oil Sample - Obtain

Every 500 Service Hours or 3 Months

- Hydraulic System Oil Filter – Replace
- Hydraulic System Case Drain Filter - Replace

Every 1000 Service Hours or 6 Months

- Hook Winch: Freefall, Brake, Gearbox Oil– Change
- Boom Winch: Brake, Gearbox Oil– Change

Every 2000 Service Hours or 1 Year

- Hydraulic System Oil - Change

Accumulator



This system contains high pressure gas. Failure to follow the instructions and warnings could cause an explosion, resulting in possible injury or death. Do not expose to fire. Do not weld. Do not drill. Do not remove any hydraulic system lines, taps or parts until pressure has been relieved. Relieve pressure before discharging. See Operation and Maintenance Manual "Accumulator - Relieving Charge". See Operation and Maintenance Manual "Accumulator" for charging and discharging. See your Dealer for tools and detailed information.

Accumulator must be charged with dry nitrogen (N₂) gas by qualified personnel only. Gas pressure varies the temperature. The accumulator must be at the same temperature as the surrounding air before being checked or charged. Charge the accumulator according to the precharge table below, see the figure below. NOTE: The precharge value on the accumulator label is for an ambient temperature of 20°C (68°F).

Instructions continued on next page.

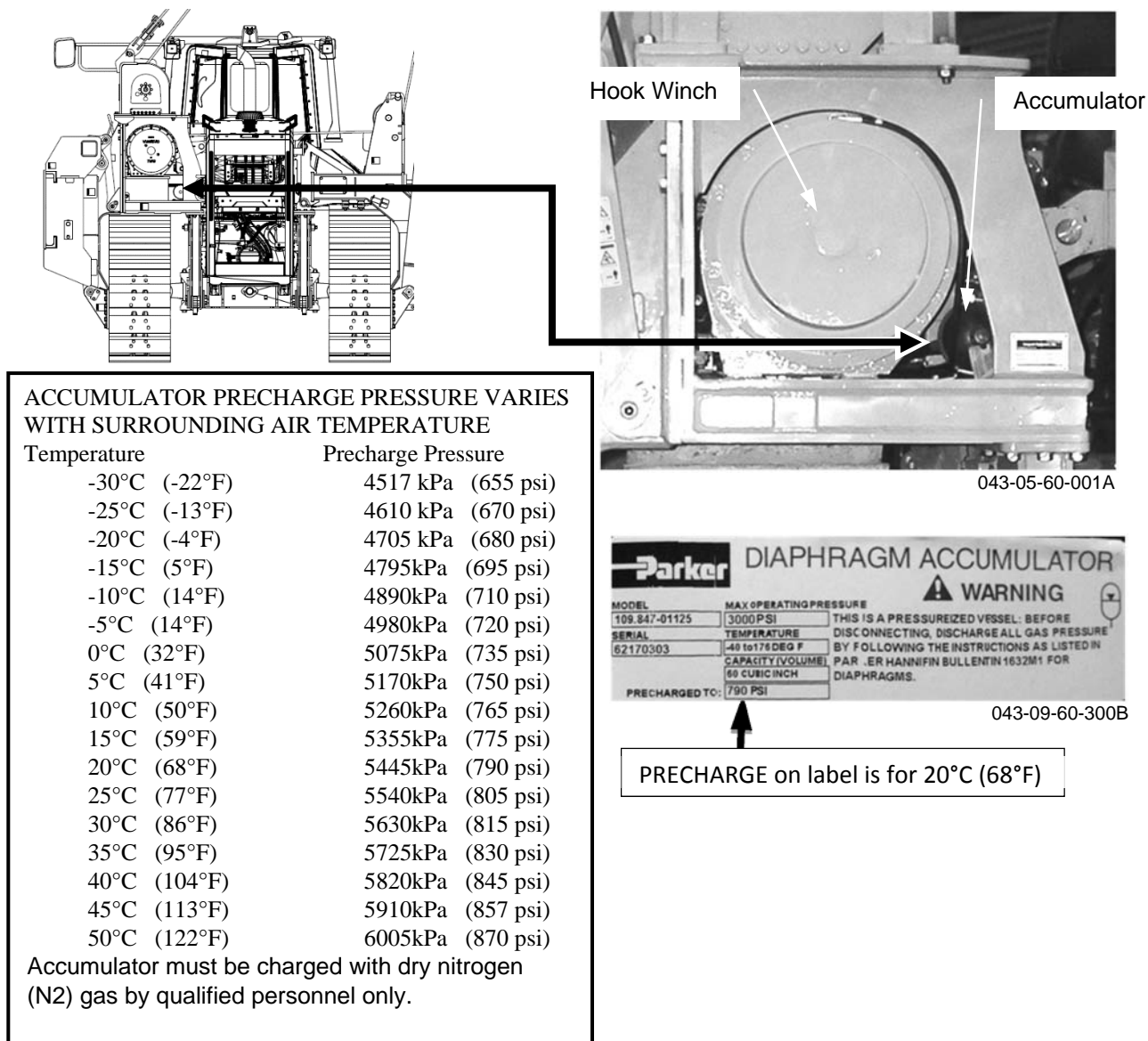


Figure 30: The hydraulic accumulator is located on the right side of the operator seat, on the winch base to the left of the hook winch.

Boom Stop Switch Operation and Adjustment

! WARNING

The Boom Stop system stops the boom winch from hauling-in when the boom is vertical, preventing overloading of key machine components. Incorrectly adjusting, or defeating the boom stop switch could result in serious equipment damage, personal injury, or even death. Its operation must be checked and verified daily.

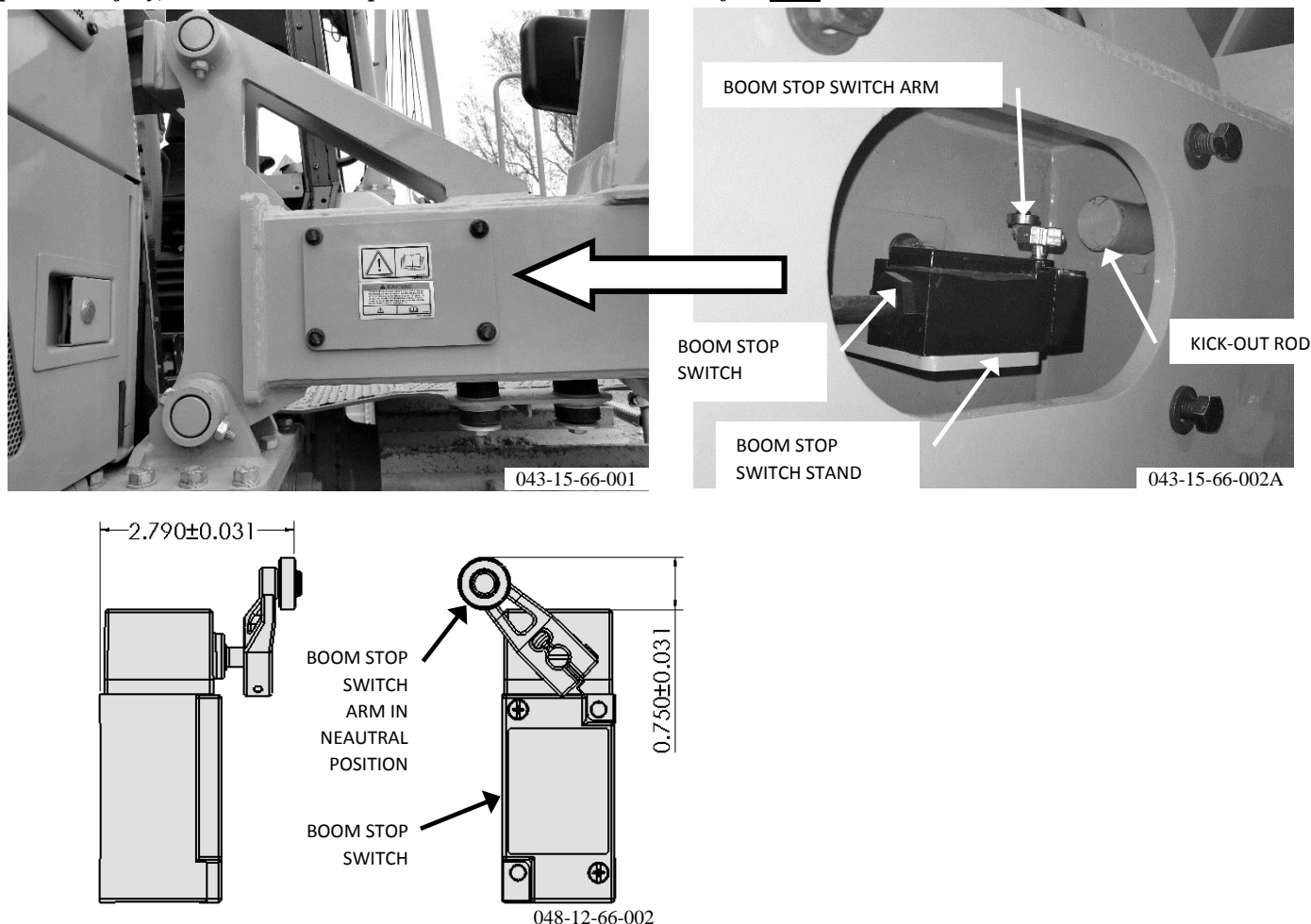


Figure 31: Boom stop switch location & adjustment.

- To check the operation, boom in slowly taking care not to over tension the boom lines when the boom goes vertical. When the boom is vertical, the boom winch should stop. No increase in tension should occur once the boom comes into contact with the left hand tower. If the boom winch does not stop and continues to increase the cable tension, STOP the operation at once and lower the boom to release the tension. Adjust the boom stop switch as set out below.
- Remove the boom stop switch access panel from the tower.
- Ensure boom stop switch arm is adjusted relative to boom stop switch as shown in Figure 31 when in neutral position.
- Ensure boom stop switch is fastened to the boom stop stand as shown in Figure 31.
- Adjust boom stop stand so that the boom stop switch arm is 74 mm (2.90 inches) from contacting the kick-out rod. (Note: when the boom is vertical it will push the kick-out rod in 85 mm (3.33 inches) and push the boom stop switch arm 11 mm (0.43 inches))
- Ensure the boom stop switch arm will stay in contact with the kick-out rod face for the entire distance it is pushed in (and will not roll off the face of the rod).
- Ensure all boom stop switch and stand fasteners are sufficiently torqued.
- Test the boom stop switch to see that it works properly. To do this, slowly raise the boom vertical so that it is **JUST** in contact with the tower; the boom kick-out rod is fully retracted into the tower. At this point the boom winch should be stopped and no increase in tension in the boom cable lines should occur once the boom comes in contact with the left

hand tower. Do not over tighten the lines to the point that the boom or structures are overly stressed when testing boom stop switch operation.

- Lower the boom until the boom stop switch arm is free from the kick-out rod.
- Replace the boom stop switch access panel from the tower.
- Boom in slowly taking care not to over tension the boom lines when the boom goes vertical. When the boom is vertical, the kick-out rod will move the boom stop switch arm in 11 mm (0.43 in), and the boom winch should stop with the boom vertical. No increase in tension should occur once the boom comes into contact with the left hand tower, readjust the boom stop switch as required.

Boom Line – Install

! WARNING

Do not operate or work on this equipment unless you have read and understand the instructions and warnings in the Operation and Maintenance Manual. Failure to follow the instructions or heed the warnings could result in injury or death. Contact your dealer or Vanguard Equipment or visit our website at vanguardequip.com for replacement manuals. Proper care is your responsibility.

! WARNING

Personal injury or death can result from worn wire rope cable. Worn or frayed cable could break causing injury. Check the wire rope cable. If cable is worn or is frayed install new cable. Wear gloves when handling the wire rope cable. Proper care is your responsibility.

NOTICE

Make sure that the construction of the wire rope is 6x25 IWRC XIPS (Independent Wire Rope Core, eXtra Improved Plow Steel) conforming to ISO 2408. Also, the established grade of the wire rope is the improved plow bolt (steel), 26670 kg (58,800lb) minimum breaking strength.

SPECIFICATIONS (WIRE ROPE)		
Boom Line Cable		
Boom Length	Diameter of Cable	Length of Cable
6.1m (20 ft)	19.05 mm (0.75 inch)	41.1 m (135 ft)

Table 6: Boom line wire rope specifications

1. Lower the boom to the ground and support the boom.

Note: The loaded force in the winch drum must be neutralized before removing the wire rope from a loaded drum.

2. Remove the anchor for the wire rope from the drum for the boom. Remove the old wire rope.
3. Unroll the new wire rope from the spool.

Note: Weld the cable ends in order to prevent fraying.

NOTICE

Unroll all of the cable from the spool. Lay the wire rope on a flat surface. Never lift the wire rope off the spool in coils.

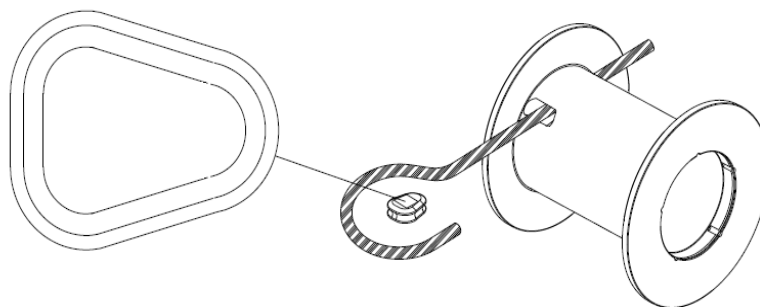
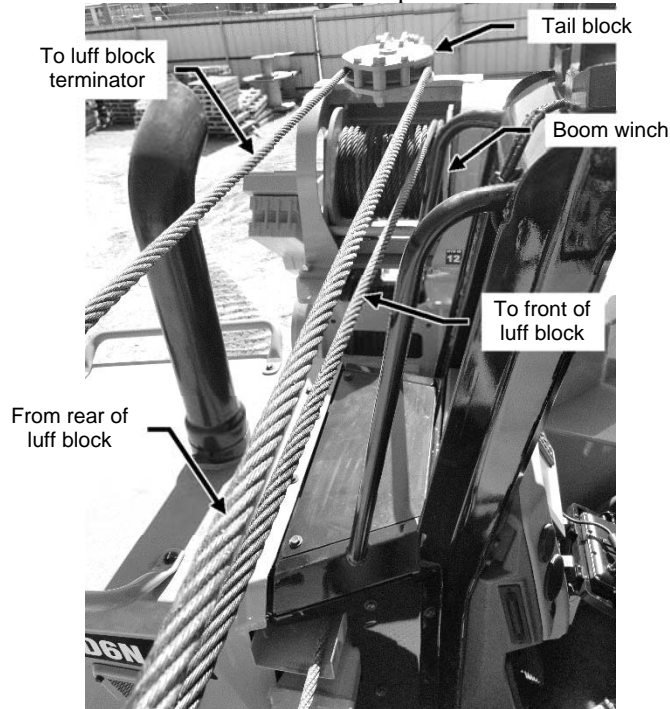


Figure 32: Installing boom line, cable anchor assembly

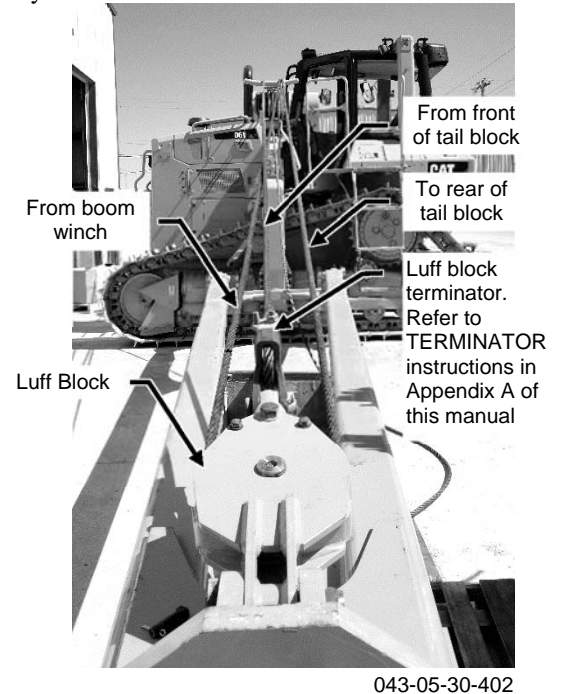
4. Install the cable into the small slot and through the larger slot in the drum for the boom.
 - a. Start with inserting the cable anchor into the longer slot as far as allowed.

- b. Make a loop with the end of the wire rope and insert the end into the slot past the cable anchor.
- c. Pull the wire rope until the wire rope and anchor assembly are securely seated inside the slot.

5. Wind one half of the wire rope on the drum. Wind the wire rope evenly across the drum.



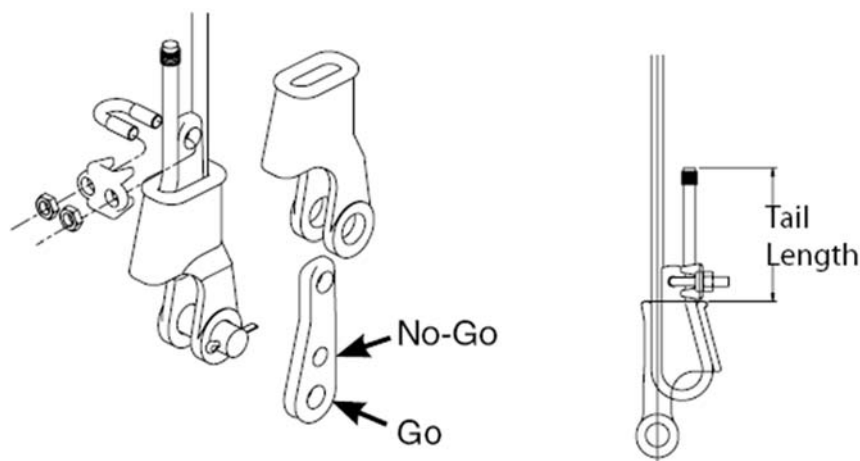
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Figure 33: Installing boom line

6. Install the wire rope from the boom winch to front of the luff block. Install the wire rope from the front of the machine toward the rear of the machine.
7. Secure the line to the line terminator on the Luff block, as per Terminator instructions outlined in **Appendix A**.



NOTE: Do not clamp the loaded end of the wire rope and the tail end of the wire rope together. Refer to TERMINATOR instructions in Appendix A of this manual.

8. Apply a test first load in order to seat wedge.

Boom Pivot Pins – Lubricate

The grease fittings for lubricating the boom pivot pins are located on the left side of the machine.

There is one grease fitting for each pin. The grease fittings are located on the end of the pin on the outside face of the boom.

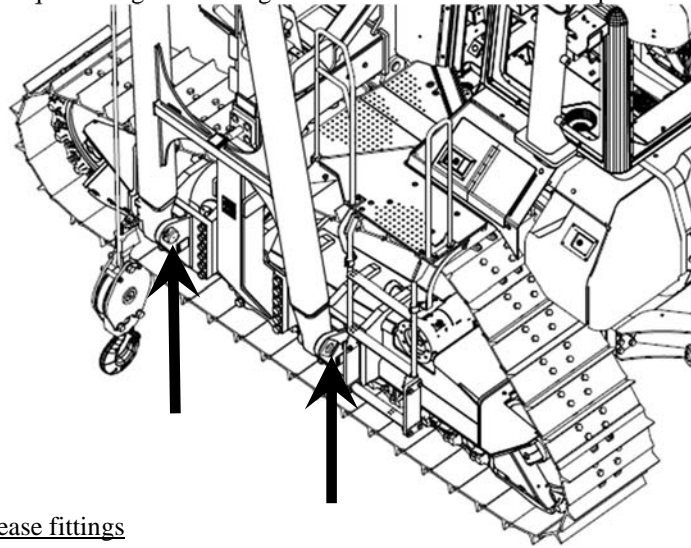


Figure 34: Boom pivot pins, grease fittings

Lubricate the boom pivot pins through the two fittings.

Counterweight Cylinder Bearings – Lubricate

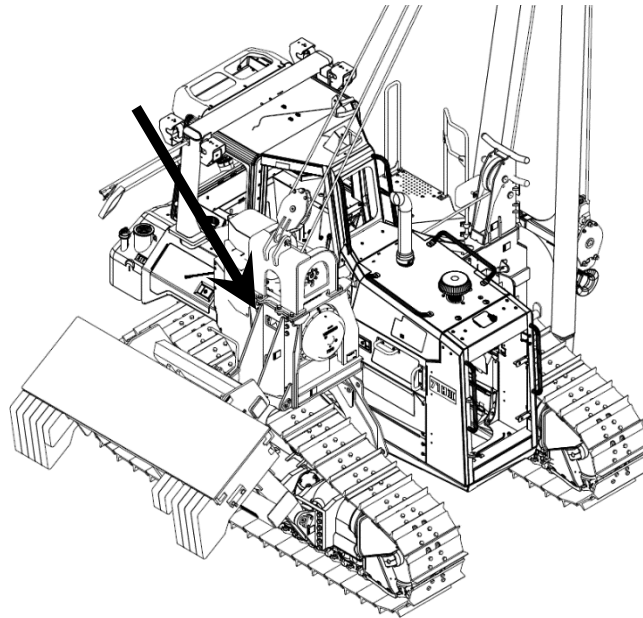
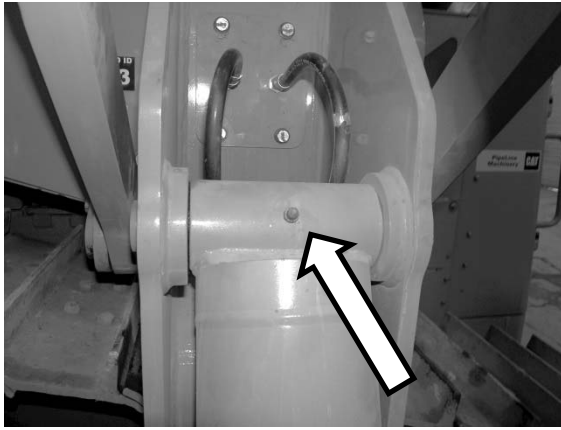
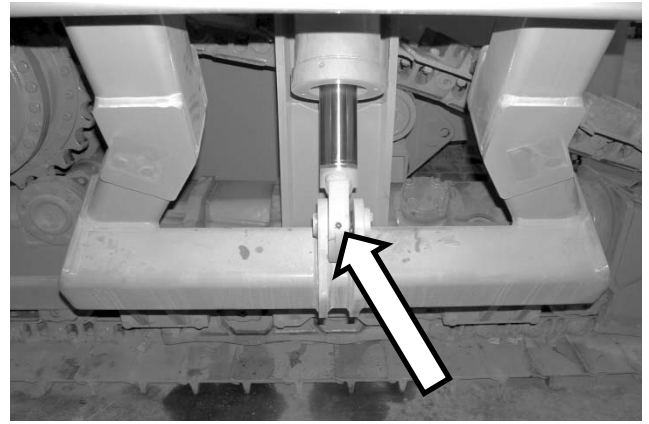


Figure 35: Counterweight cylinder bearings fittings location



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043-60-68-002

Figure 36: Counterweight cylinder bearings location

There are two grease fittings for the counterweight cylinder.

1. Extend the counterweight and lock the counterweight into position.

Refer to the Operation and Maintenance Manual, “Counterweight Lock Lever” for the proper procedure to lock the counterweight into position.

2. Lubricate the upper grease fitting that is located in the head end of the cylinder.
3. Lubricate the grease fitting that is located in the rod end of the cylinder.
4. Follow the procedure to unlock the counterweight and retract the counterweight.

Counterweight Hinge Pins - Lubricate

WARNING

Use a stable work platform placed in a secure location when lubricating the counterweight hinge pins. If a secure location is not available, use the appropriate safety equipment to prevent falling off of the machine. Failure to work from a secure location may result in injury or death from a slip or a fall.

Lubricate the eight pins through the grease fittings. There are four grease fittings that face toward the front of the machine and there are four grease fittings that face toward the rear of the machine.

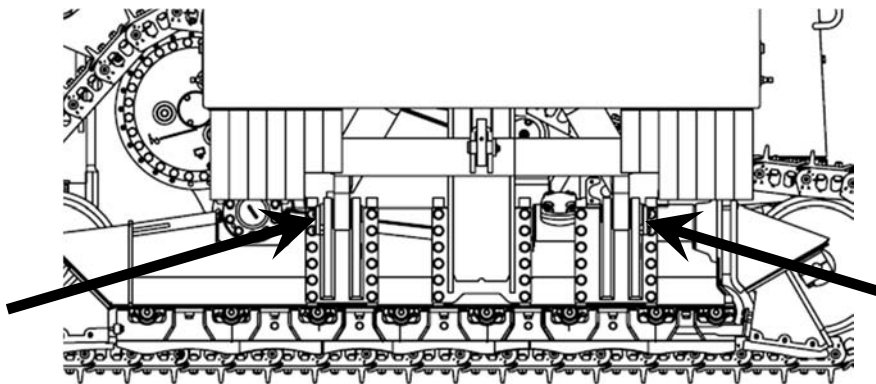


Figure 37: Counterweight hinge pins located right side of machine

Note: If the counterweight is fully extended, install the counterweight lock lever in order to lubricate the counterweight hinge pins. Refer to Operation and Maintenance Manual, “Counterweight Lock Lever” for more details.

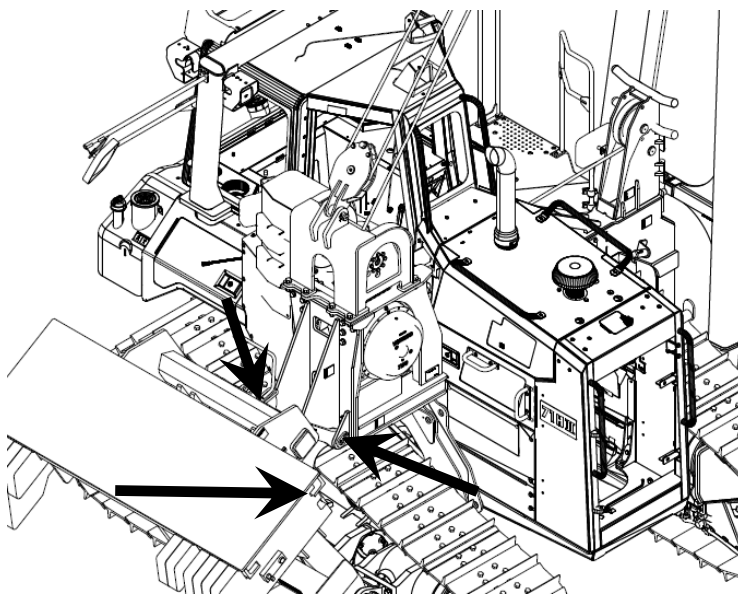


Figure 38: Counterweight hinge pins lubrication points

Fairlead Sheave – Lubricate

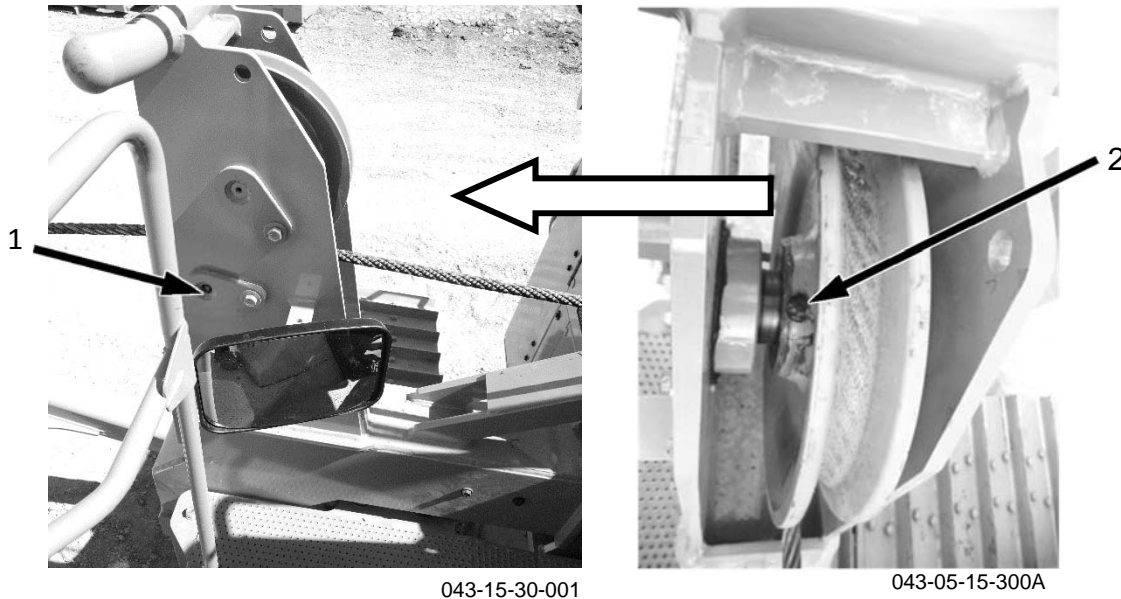


Figure 39: Fairlead sheave lubrication points

Lubricate one fitting in the lower pin (1) and lubricate one fitting in the upper sheave (2).

Hook and Wire Cable – Inspect

Inspect the Hook

Inspect the hook frequently. The inspections should include observation of the hook during operation of the hook. A designated person determines if the conditions that are found during the inspections constitute a hazard. The designated person will determine if a more detailed inspection is required.

- Inspect the hook for any distortion such as bends in the hook or twists in the hook.
- Inspect the hook for any wear.
- Inspect the hook for cracks, nicks, or gouges.
- If a latch is provided, inspect the latch. Make sure that the latch engages properly. Inspect the latch for any damage. Make sure that the latch is not malfunctioning.
- Inspect the hook assembly and the means for securing the hook assembly.
- For additional information on the proper maintenance and on the proper inspection of hooks, refer to "American National Standard Institute ANSI/ASME B30.14" or ISO 8813.

Inspect Wire Cable - Boom and Hook lines

Make a visual inspection of all running cables that are in continuous use. Make the inspection of the running cables on a daily basis before the machine is placed in operation. Inspect all of the cables on a monthly basis.

All inspections shall be performed by a designated person. Keep a dated report of the condition of the cable on file in a location that is available to designated personnel. Perform a close inspection of the sections of the cable that are normally hidden during the visual inspection and the maintenance inspection. (This includes the sections of the cable that pass over the sheaves.) These points are the sections of the cable that are most likely to fail.

Note any deterioration that results in a notable loss of the original strength. (See the conditions that are described below.) Determine if further use of the cable will constitute a hazard.

Inspect the cable on a daily basis for the following conditions:

- Inspect the cable for a reduction in the diameter of the cable below the nominal diameter. A loss of support in the cored wire of the cable may be caused by internal corrosion, external corrosion, or wear of the outside wires.
- Inspect the cable for broken outside wires. Check for the degree of distribution of the broken outside wires. Check for the concentration of outside broken wires.
- Inspect the cable for worn outside wires.
- Inspect the cable for corroded wires and for broken wires at the connection on the wire cable end.
- Inspect the cable end for connections that are corroded, cracked, bent, worn, or improperly installed.
- Inspect the cable for sections that are crushed or kinked and for any loose wire strands.

Excessive wear or broken wires may occur in sections of the cable that are in contact with saddles, equalizer sheaves, or other sheaves. Excessive wear or broken wires can also occur when cable travel is limited. Take care to inspect the ropes at these locations.

When a machine is shutdown for a month or more, inspect all of the cables thoroughly. When a side boom machine has been in storage for a month or more inspect all of the cables thoroughly. The inspection should be completed before the machine is returned to operation.

The inspection should be for all types of deterioration. The inspection should be performed by a designated person or by an authorized person. The authorized person's approval is required for further use of the cable.

A dated report on the condition of the cable should be kept on file.

Take care in the inspection of cable that is resistant to rotation.

Any new poured socket or swaged socket assembly that is used as a standing cable (guy) shall be proof tested. Test the cable to the lift capacity of the side boom machine or to the manufacturer's recommendation.

Never give the cable a rating that is greater than 50 percent of the wire rope's nominal strength or of the structural strand's nominal strength.

Note: For additional information on the proper maintenance and on inspection of the cable, refer to "American National Standards Institute ANSI/ASME B30.14" or ISO 8813.

Hook Load Line – Install

! WARNING

Do not operate or work on this equipment unless you have read and understand the instructions and warnings in the Operation and maintenance Manual. Failure to follow the instructions or heed the warnings could result in injury or death. Proper care is your responsibility.

! WARNING

Personal injury or death can result from worn wire rope cable. Worn or frayed cable could break causing injury. Check the wire rope cable. If cable is worn or is frayed install new cable. Wear gloves when handling the wire rope cable.

NOTICE

Make sure that the construction of the wire rope is 6x25 IWRC XIPS (Independent Wire Rope Core, eXtra Improved Plow Steel) conforming to ISO 2408. Also, the established grade of the wire rope is the improved plow bolt (steel), 26670 kg (58,800 lb) minimum breaking strength.

SPECIFICATIONS (WIRE ROPE) Hook Load Line Cable		
Boom Length	Diameter	Length
6.1 m (20 ft)	19.05 mm (0.75 inch)	45.7 m (150 ft)

Table 7: Hook load line wire rope specifications

1. Lower the boom to the horizontal position.
2. Remove the anchor for the wire rope from the drum for the hook. Remove the old wire rope.
3. Unroll the new wire rope from the spool.

Note: Weld the cable ends in order to prevent fraying.

NOTICE

Unroll all of the cable from the spool. Lay the wire rope on a flat surface. Never lift the wire rope off the spool in coils.

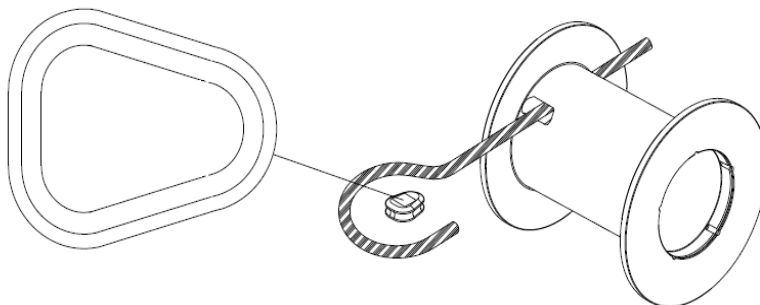


Figure 40: Installing hook load line, cable anchor assembly

4. Install the cable into the small slot and through the larger slot in the drum for the boom.
 - a. Start with inserting the cable anchor into the longer slot as far as allowed.
 - b. Make a loop with the end of the wire rope and insert the end into the slot past the cable anchor.
 - c. Pull the wire rope until the wire rope and anchor assembly are securely seated inside the slot.
5. Wind one half of the wire rope on the drum. Wind the wire rope evenly across the drum.
6. Install the hook load line from the winch drum onto the sheave blocks per the figure below:

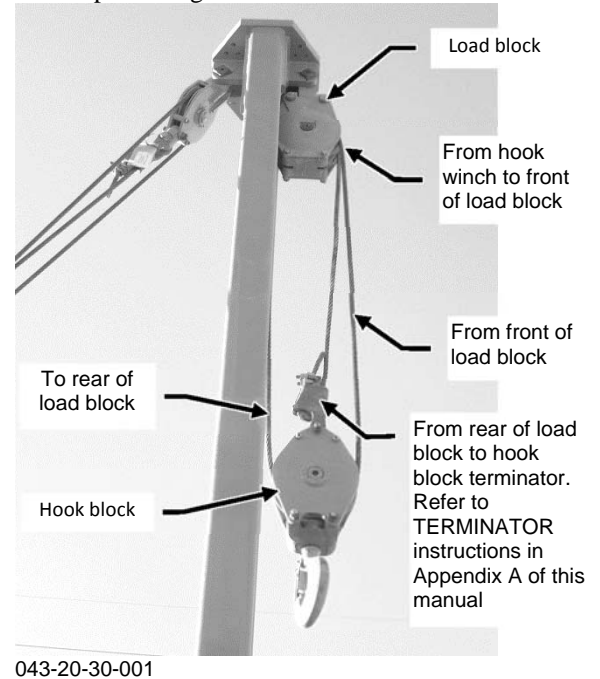
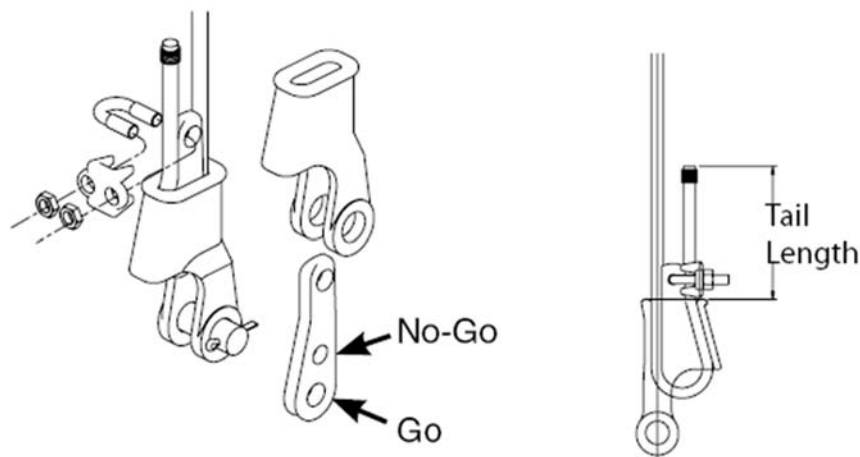


Figure 41: Installing hook load line

7. Secure the line to the line terminator on the Luff block, as per Terminator instructions outlined in the **Appendix A**.



NOTE: Do not clamp the loaded end of the wire rope and the tail end of the wire rope together. Refer to TERMINATOR instructions in Appendix A of this manual.

8. Apply a test first load in order to seat wedge.

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Hook Winch: Freefall, Brake, Gearbox oil - Change

! WARNING

Do not use EP type gear lubes in the brake section of this winch. EP lubes may prevent the brake-clutch from locking up, which, in turn causes the load to fall, resulting in property damage, personal injury, or death.

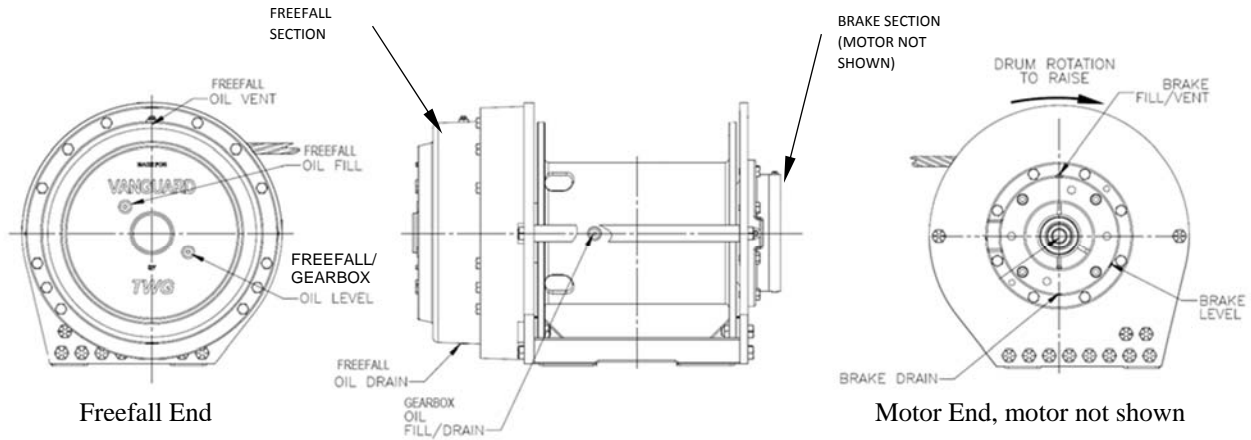


Figure 42: Hook Winch oil change Ports

FREEFALL/GEARBOX oil change:

- Drain the fluid from the FREEFALL section. Remove the freefall drain plug "FREEFALL DRAIN" (SAE # 6) at the bottom of the FREEFALL housing section.
- Drain the oil into a suitable container.
- After the fluid has drained, replace the plug "FREEFALL DRAIN".
- Examine the oil for significant signs of metallic particles and/or burning. Significant signs of particles/burning could indicate that additional winch servicing is required.
- Dispose of the used oil in a proper manner.
- Drain the fluid from the GEARBOX section. Rotate the winch drum so that the fill/drain plug "GEARBOX FILL/DRAIN" (SAE #6) is at the bottom. Remove the plug.
- Drain the oil into a suitable container.
- After the fluid is drained, rotate the drum so that the "GEARBOX FILL/DRAIN" is now at the top.
- Examine the oil for significant signs of metallic particles and/or burning. Significant signs of particles/burning could indicate that additional winch servicing is required.
- Remove the "FREEFALL FILL" plug (SAE # 6).
- Add the correct quantity and type of gearbox/freefall oil through the "FREEFALL FILL", see the Lubricant Viscosities and Lubricant Capacities sections in this manual for recommended oil type and grade for your application.
- Reinstall the "FREEFALL FILL" plug.
- Add the correct quantity and type of gearbox/freefall oil, through the "GEARBOX FILL/DRAIN", see the Lubricant Viscosities and Lubricant Capacities sections in this manual for recommended oil type and grade for your application.
- Reinstall the "GEARBOX FILL/DRAIN" plug.

FREEFALL/GEARBOX oil level:

- The "FREEFALL/GEARBOX LEVEL" plug on the freefall housing serves to monitor the oil level for both the drum and freefall cavities. The cavities are drained and filled separately due to the rate at which fluid traverses the sections, however they are not separate and can be monitored from the same "FREEFALL/GEARBOX LEVEL" port.
- The oil level should be just below the "FREEFALL/GEARBOX LEVEL" port.
- If the oil level drops frequently or oil leakage is detected during an inspection, maintenance should be performed to correct any problems.

BRAKE oil change:

- Drain the brake section by removing the drain plug "BRAKE DRAIN" under the motor along with the vent "BRAKE FILL/VENT" above the motor.
- Drain the oil into a suitable container.
- Reinstall the drain plug "BRAKE DRAIN".
- Inspect the oil for signs of metallic particles and/or burning. Significant signs of particles/burning could indicate that additional winch servicing is required.
- Add the correct quantity of non-EP oil, see the Lubricant Capacities section in this manual for recommended oil type and grade for your application.
- Reinstall the vent "BRAKE FILL/VENT".

BRAKE oil level:

- Monitor the brake oil level at the "BRAKE LEVEL" port. The oil level should be just below the port.
- If the oil level drops frequently or oil leakage is detected during an inspection, maintenance should be performed to correct any problems.

Boom Winch: Freefall, Brake, Gearbox oil - Change

! WARNING

Do not use EP type gear lubes in the brake section of this winch. EP lubes may prevent the brake-clutch from locking up, which, in turn causes the load to fall, resulting in property damage, personal injury, or death.

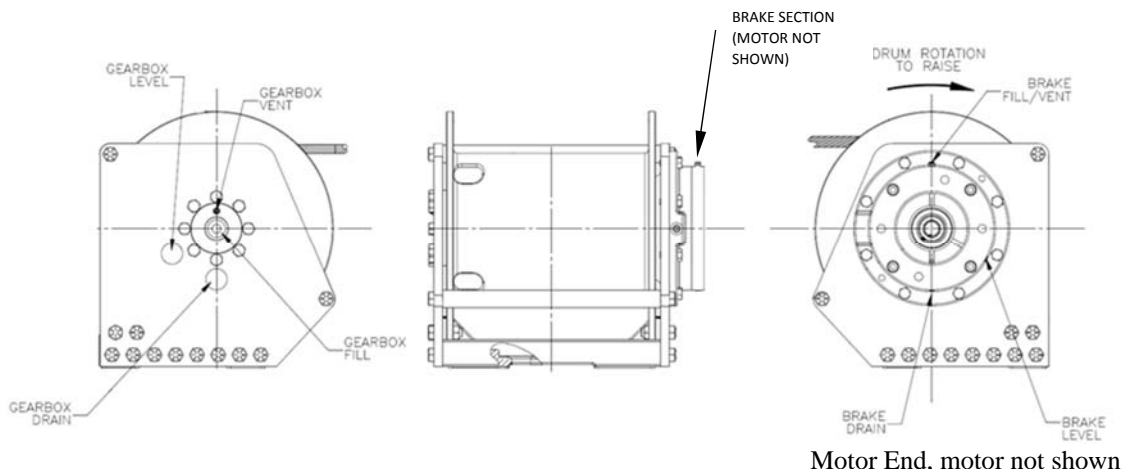


Figure 43: Hook Winch oil change Ports

GEARBOX oil change:

- Gearbox oil is drained by first removing the drain plug by rotating the drum so that the plug is visible through the lower hole in the side plate "GEARBOX DRAIN".
- Screw in a piece of 1" pipe to allow the oil to drain, and then with a hex wrench remove the drain plug located inside of the 1" pipe.
- Drain the oil into a suitable container.
- Examine the used oil for signs of significant metal deposits and then dispose of it in a proper manner.
- Remove the 1" pipe. Rotate the drum so that the port is visible through the upper hole in the side plate "GEARBOX LEVEL".
- With a hex wrench, remove the fill plug located in the center of the output shaft "GEARBOX FILL".
- Install a 1" pipe with elbow through the hole in the output shaft "GEARBOX FILL".
- Add the correct quantity and type of oil to the gearbox, see the Lubricant Capacities section in this manual for recommended oil type and grade for your application.
- Remove the pipe and elbow then replace all plugs "GEARBOX FILL" and "GEARBOX LEVEL".

GEARBOX oil level:

- Monitor the gearbox oil level at the "GEARBOX LEVEL" port. The oil level should be just below the port.
- If the oil level drops frequently or oil leakage is detected during an inspection, maintenance should be performed to correct any problems.

BRAKE oil change:

- Drain the brake section by removing the drain plug "BRAKE DRAIN" under the motor along with the vent "BRAKE FILL/VENT" above the motor.
- Drain the oil into a suitable container.
- Inspect the oil for signs of metallic particles and/or burning and reinstall the drain plug "BRAKE DRAIN".
- Add the correct quantity of non-EP oil, see the Lubricant Capacities section in this manual for recommended oil type and grade for your application.
- Reinstall the vent "BRAKE FILL/VENT".

BRAKE oil level:

- Monitor the brake oil level at the "BRAKE LEVEL" port. The oil level should be just below the port.
- If the oil level drops frequently or oil leakage is detected during an inspection, maintenance should be performed to correct any problems.

Hydraulic System Oil - Change

Refer to the specific tractor Operation and Maintenance Manual "Hydraulic System Oil - Change" for complete requirements and procedures.



At operating temperature, the hydraulic tank is hot and under pressure. Hot oil and components can cause personal injury. Do not allow hot oil or components to contact skin. Remove the filler cap only when the engine is stopped, and the filler cap is cool enough to touch with your bare hand. Remove the filler cap slowly in order to relieve pressure.

NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling and component containing fluids.

Dispose of all fluids according to local regulations and mandates.

Operate the machine in order to warm the oil.

Fully retract the counterweight

Park the machine on level ground. Engage the parking brake and stop the engine.

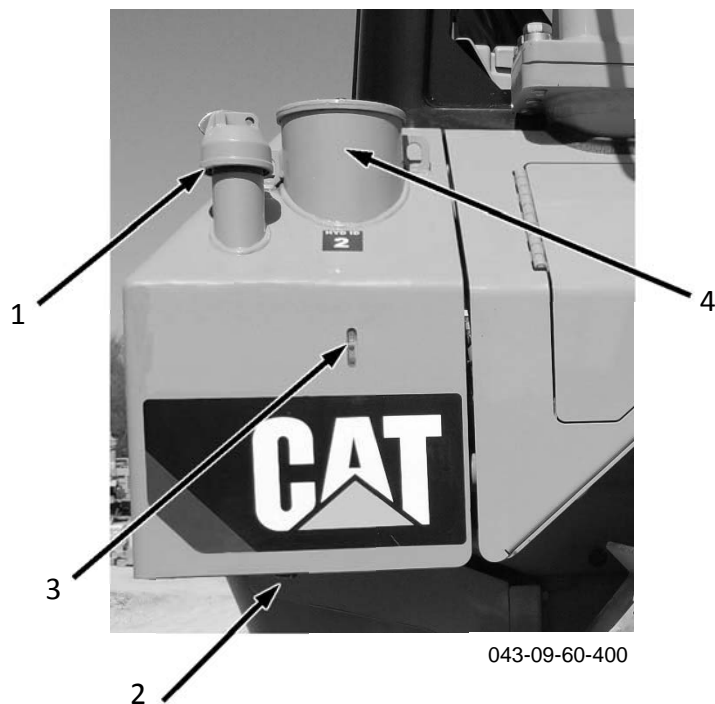


Figure 44: Hydraulic tank filler cap

Remove the hydraulic tank filler cap (1) slowly in order to relieve any pressure.

1. Wash the filler strainer and the filler cap in a clean non-flammable solvent.
2. Remove oil drain plug (2).
3. Attach a hose to a 1 inch NPT pipe nipple. This 1 inch NPT pipe nipple should have a length of 100 mm (4 inch).
4. Install the pipe nipple into the drain plug opening.
5. Rotate the pipe nipple clockwise in order to open the internal drain valve. Allow the oil to drain into a suitable container.
6. Remove the pipe nipple. The valve for the hydraulic tank will close.
7. Clean drain plug (2) and install drain plug (2). Tighten drain plug (2) to a torque of 68 ± 7 Nm (50 ± 5 lbft).
8. See the Operation and Maintenance Manual, Maintenance and Lubrication section, "Hydraulic System Oil Filters – Replace". Change the hydraulic system filter (4).



Figure 45: Winch Drains and Case Drain Filter

9. See the Operation and Maintenance Manual, Maintenance and Lubrication section, “Hydraulic System Case Drain Filter – Replace”. Change the hydraulic system case drain filter (5).
10. See the Operation and Maintenance Manual, Maintenance and Lubrication section, “Steering Charge Filter - Replace”. Change the steering system charge filter (6).
11. Install the filler strainer.
12. See the Operation and Maintenance Manual, “Lubricant Capacities (Refill) in order to determine the amount of hydraulic oil that is needed to fill the hydraulic oil tank. Fill the hydraulic oil tank.
13. Inspect the filler cap gasket. Install a new gasket if damage or wear is evident. Install the filler cap.
14. Start the engine. Run the engine for a few minutes. Check for leaks.
15. Maintain the oil level to the “FULL” mark in sight gauge (3). Add oil, if necessary. Stop the engine.

Hydraulic System Oil Filter - Replace

⚠ WARNING

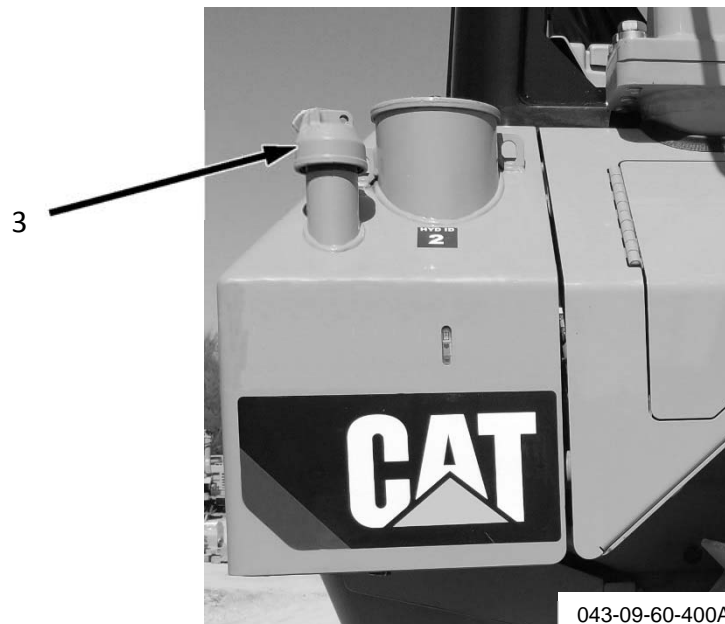
At operating temperature, the hydraulic tank is hot and under pressure. Hot oil and components can cause personal injury. Do not allow hot oil or components to contact skin. Remove the filler cap only when the engine is stopped, and the filler cap is cool enough to touch with your bare hand. Remove the filler cap slowly in order to relieve pressure.

1. Slowly remove the hydraulic tank filler cap (3) in order to relieve the system pressure.
2. Open the access door that is located on the right side of the machine next to the filler cap as shown in Figure 48.
3. Open the rear access door as shown in Figure 46.



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Figure 46: Transmission and Case Drain Filter locations



043-09-60-400A

Figure 47: Filter locations



Figure 48: Filter location

- (1) Transmission oil filter
- (2) Hydraulic system filter
- (3) Hydraulic Tank filler cap
- (4) Case drain filter pipelayer
- (5) Steering Charge Filter

4. Remove filter (1, 2, 4, and 5).

Note: Remove case drain hydraulic filter (1). Discard the used filter. Remove the hydraulic system filter (2). Discard used filter. Replace both of the filters at the same time.

- 5. Inspect the seal on the filter housings for filter (1, 2, 4, and 5). If the seals are damaged or worn, install new seals. Install a new filter element into the filter housing for (1, 2, 4, and 5).**

Hydraulic System Oil Level – Check



At operating temperature, the hydraulic tank is hot and under pressure. Hot oil and components can cause personal injury. Do not allow hot oil or components to contact skin. Remove the filler cap only when the engine is stopped, and the filler cap is cool enough to touch with your bare hand. Remove the filler cap slowly in order to relieve pressure.

The hydraulic tank is on the right rear corner of the machine.

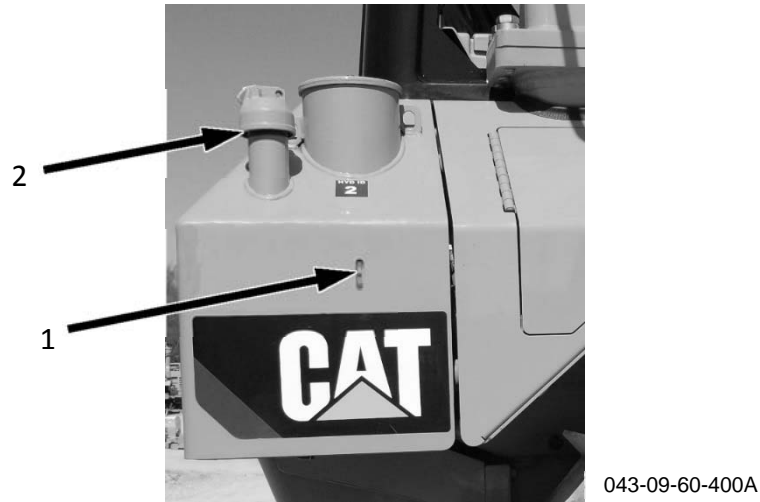


Figure 49: Hydraulic Tank

1. The counterweight should be fully retracted when you check the oil level.
2. Maintain the oil level to the “FULL” mark in sight gauge (1).
3. If the hydraulic system requires additional hydraulic oil, remove filler cap (2) and add oil. Clean filler cap (2) and install filler cap (2).

Hydraulic System Oil Sampling

Refer to the tractor's operation and maintenance manual for the specific procedures regarding Hydraulic System Sampling.

Oil Filter Inspection

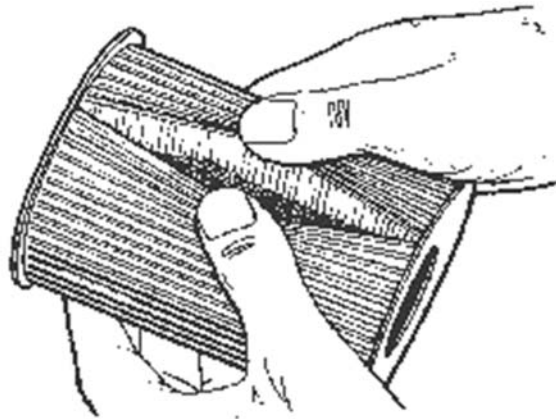


Figure 50: Oil filter.

Use a Filter Cutter - CAT# 4C-5084, or similar to cut the filter element open. Spread apart the pleats and inspect the element for metal and other debris. An excessive amount of debris in the filter element can indicate a possible failure.

If metals are found in the filter element, a magnet can be used to differentiate between ferrous metals and nonferrous metals. Ferrous metals would indicate wear on steel parts and on cast iron parts. Non-ferrous metals would indicate wear of the brass or aluminum part of the hydraulics such as main bearings, pump sleeves, etc.

Small amounts of debris may be found in the filter element. This could be caused by friction and normal wear. Consult your Caterpillar dealer in order to arrange for further analysis if an excessive amount of debris is found.

Using an oil filter element that is not recommended by Caterpillar could result in severe damage. This could result in larger particles in unfiltered oil. These particles could enter the system and cause damage.

Sheave Block Bearing - Lubricate

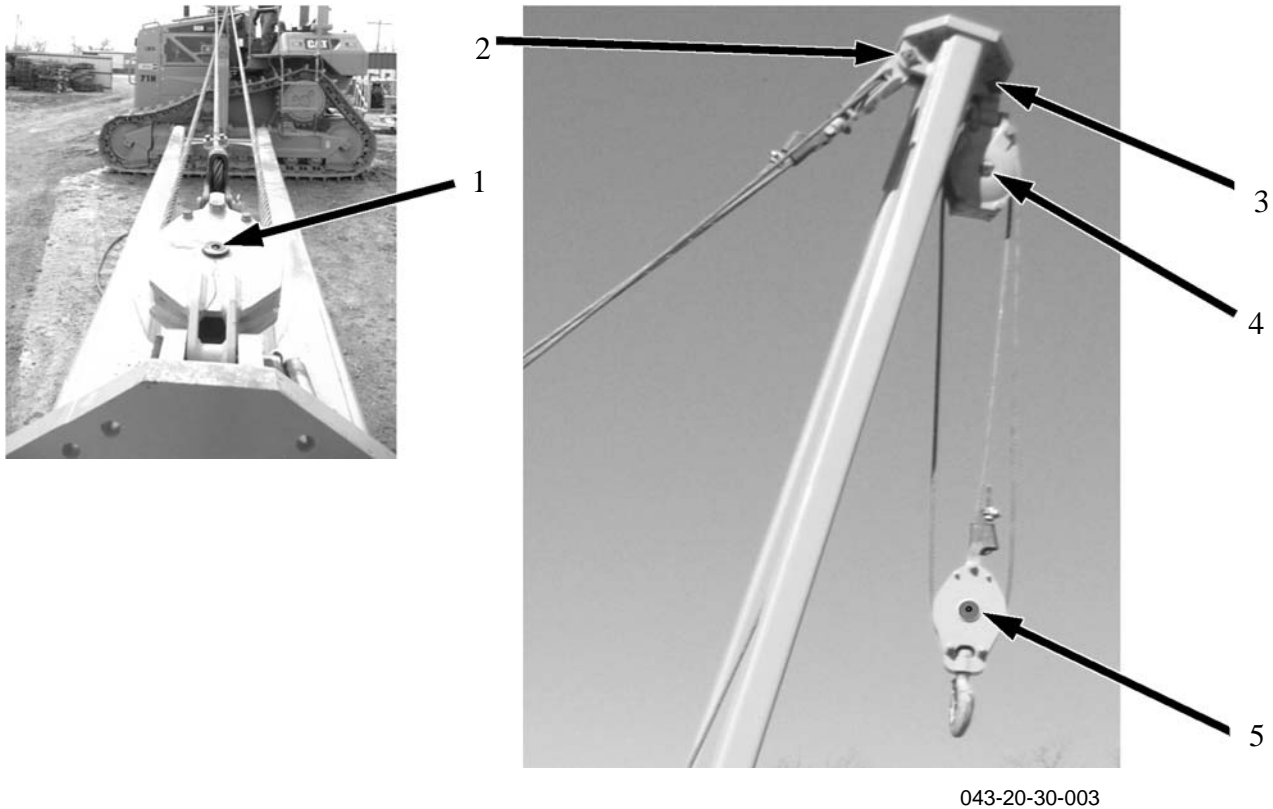


Figure 51: Rigging Grease Nipples

Lubricate (1) in the luff block.

Lubricate fitting in the pins for boom luff block (2) and load block (3).

Lubricate pin (4) in load sheave block and the pin (5) in the hook sheave block.

Lubricate pins (6) & (7) on tail block.

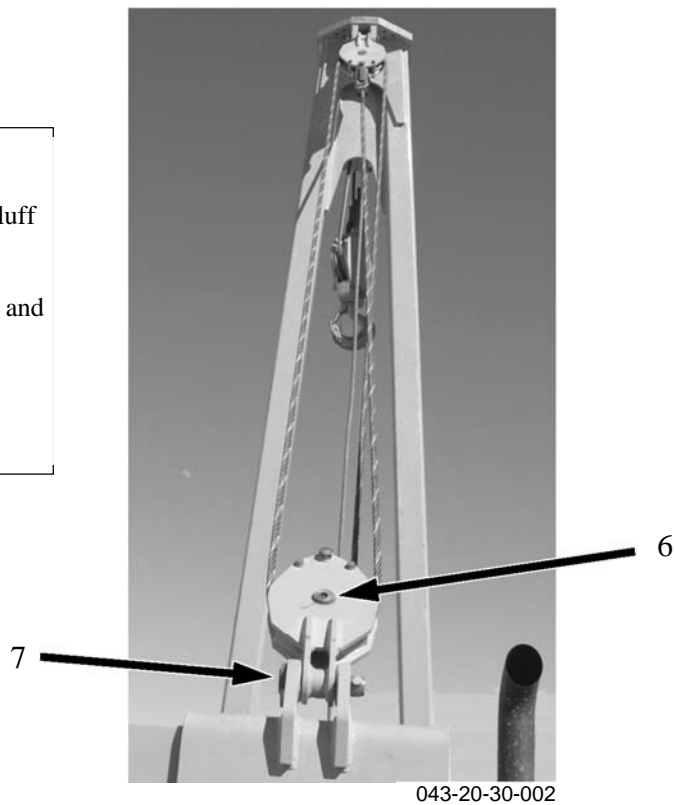


Figure 52: Rigging Grease Nipples – Tail Block

Tractor Maintenance

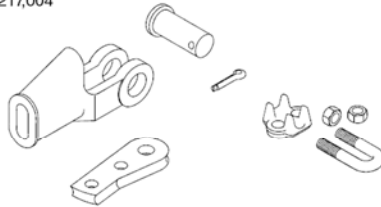
Refer to the tractor's operation and maintenance manual for the specific procedures regarding complete Tractor Maintenance.

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Appendix A - Terminator Instructions

TERMINATOR™ WARNINGS AND APPLICATION INSTRUCTIONS

Extended Wedge Socket Assembly U.S. Patent No. 5,553,360 and Canada Patent No. 2,217,004

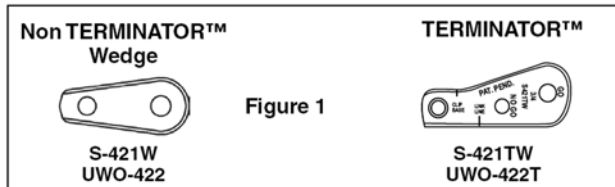


**S-421T / US-422T
"TERMINATOR"™**

NOTE: The design of the basket for the S-421T 1-1/4" TERMINATOR™ Wedge Socket does not allow proper fit to the old style Crosby S-421W wedge (see Fig. 1). **Do not assemble or use.**

The design of the basket for each US-422T TERMINATOR™ Wedge Socket does not allow proper fit to the old style UWO-422 wedge (See Fig. 1). **Do not assemble or use.**

All S-421T and US-422T TERMINATOR™ baskets are marked with a capital "T" or TERMINATOR™.



QUIC-CHECK® "Go" and "No-Go" features cast into wedge. The proper size wire rope is determined when the following criteria are met:

1. The wire rope shall pass thru the "Go" hole in the wedge.
2. The wire rope shall NOT pass thru the "No-Go" hole in the wedge.



Important Safety Information – Read and Follow Inspection/Maintenance Safety

- Always inspect socket, wedge and pin before using.
- Do not use part showing cracks.
- Do not use modified or substitute parts.
- Repair minor nicks or gouges to socket or pin by lightly grinding until surfaces are smooth. Do not reduce original dimension more than 10%. Do not repair by welding.
- Inspect permanent assemblies annually, or more often in severe operating conditions.
- Do not mix and match wedges or pins between models or sizes.
- Always select the proper wedge and socket for the wire rope size.

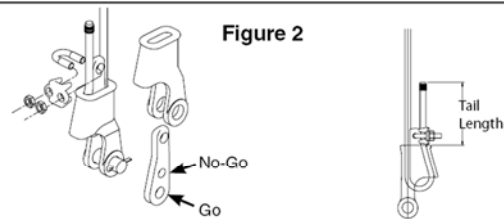
Assembly Safety

- Use only with standard 6 to 8 strand wire rope of designated size. For intermediate size rope, use next larger size socket. For example: When using 9/16" diameter wire rope use a 5/8" size Wedge Socket Assembly. Welding of the tail on standard wire rope is not recommended. Seizing of the tail is preferred following the recommended practices of the wire rope manufacturer. The tail length of the dead end should be a minimum of 6 rope diameters but not less than 6" (See Figure 2).
- **To use with Rotation Resistant wire rope** (special wire rope constructions with 8 or more outer strands) ensure that the dead end is welded, brazed or seized before inserting the wire rope into the wedge socket to prevent core slippage or loss of rope lay. Seizing of the tail is preferred following the recommended practices of the wire rope manufacturer. The tail length of the dead end should be a minimum of 20 rope diameters but not less than 6" (See Figure 2).
- Properly match socket, wedge and clip (See Table 1) to wire rope size.

- Align live end of rope, with center line of pin. (See Figure 2)
- Secure dead end section of rope. (See Figure 2)
- Tighten nuts on clip to recommended torque. (See Table 1)
- Do not attach dead end to live end or install wedge backwards (See Fig. 3).
- Use a hammer to seat Wedge and Rope as deep into socket as possible before applying first load.

WARNING

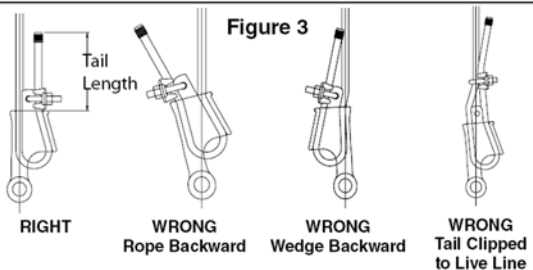
- **Loads may slip or fall if the Wedge Socket is not properly installed.**
- **Load misapplied in direct contact with the wedge can dislodge the wedge and cause loss of load.**
- **A falling load can seriously injure or kill.**
- **Read and understand these instructions before installing the Wedge Socket.**
- **Do not side load the Wedge Socket.**
- **Apply first load to fully seat the Wedge and Wire Rope in the socket. This load should be of equal or greater weight than loads expected in use.**
- **Do not interchange wedges between S-421T and US422T or between sizes.**
- **Do not assemble an old style 1-1/4" (30-32mm) S-421W wedge into an S-421T 1-1/4" (30-32mm) TERMINATOR™ basket.**
- **Do not assemble an old style UWO-422 wedge into a US-422T TERMINATOR™ basket.**



*Tail Length	
Standard 6 to 8 Strand Wire Rope	Rotation Resistant Wire Rope
A minimum of 6 rope diameters, but not less than 6"	A minimum of 20 rope diameters, but not less than 6"

TABLE 1								
Rope Size (in.)	3/8	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4
Clip Size (in.)	3/8	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4
* Torque Ft./lbs.	45	65	95	130	225	225	225	360

* The tightening torque values shown are based upon the threads being clean, dry, and free of lubrication.



Operating Safety

- Apply first load to fully seat the Wedge and Wire Rope in the socket. This load should be of equal or greater weight than loads expected in use.
- Efficiency rating of the Wedge Socket termination is based upon the catalog breaking strength of Wire Rope. The efficiency of a properly assembled Wedge Socket is 80%.
- During use, do not strike the dead end section or wedge with any other elements of the rigging (Called two blocking).
- Do not allow a direct load to contact the wedge.

Appendix B – CCTV Monitor Instructions

Operating Instructions



7" COLOR LCD QUAD MONITOR WITH TOUCH-SCREEN

Please read this manual thoroughly before operating the unit,
and keep it for future reference.

V1.6

Contents

1. Precautions	1
2. Products	3
3. Monitor Installation	5
4. Connections	6
5. Monitor Operations	7
6. Remote Operations	8
7. Menu and Touch-Screen Operations	10
8. Specifications	16
9. Troubleshooting	17

1. Precautions

● Storage and Keeping

1. Do not expose the monitor to excessive heat or cold. The storage temperature of this device is -30~+80°C, and the operating temperature is -20~+70 °C. The humidity is Rh90%.
2. Never use this device where it is damp, such as close to wash basin, kitchen, swimming pool and the like (except for monitor designed to be weatherproof).
3. Never use this device in a dusty or smoky condition.
4. Avoid dropping or striking this device.
5. Avoid using this device in enclosed spaces, areas with excessive vibration or subject to severe impacts.
6. Never puncture, scratch or use abrasive cleaning materials on this device.
7. Do not place cables where they may be pinched or stepped on.
8. Leave at least a 2" space between the monitor and walls, cabinets or other objects to allow adequate air circulation around the unit.

● Operating Precautions

1. The device may be powered by a 12 or 24 volt automotive battery or vehicle electrical system
2. Make sure all cables are connected properly. Observe polarity. Improper cable connections may damage the monitor. Remove the power cable connections when you do not intend to use the unit.



Warning!

1. High voltage is inside. The enclosure shall not be opened unless by professionals.
2. Do not watch the video while driving unless you are backing up the vehicle.

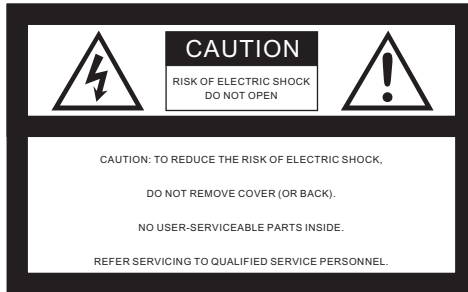


Special Notice

Occasionally, a few highlights or dark spots may occur on the LCD screen. This is a very common phenomenon in active matrix display technology, and doesn't necessarily indicate any defects or faults. Never try to repair this device by yourself. In case of any problems, please turn off the display at once and notify our company or authorized dealer. The monitor is a complex device. Any disassembly or modification may lead to damage and void the warrantee.

● Maintenance

1. Remove all the cable connections from the monitor before cleaning the unit.
 2. Use a mild household detergent and clean the unit with a slightly damp, soft cloth.
- Never use strong solvents such as thinner or benzene, as they might damage the finish of the device.



This symbol is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute risk of electric shock to persons.



This symbol is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.



This symbol is intended to alert the user not to waste electrical and electronic equipment.

CAUTION

You are cautioned that any changes or modifications not expressly approved in this manual could void your warranty and necessitate expensive repairs.

● Declaration of conformity

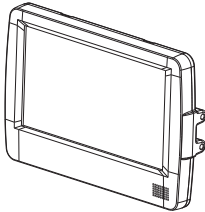
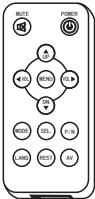
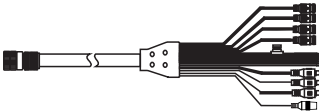
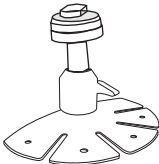
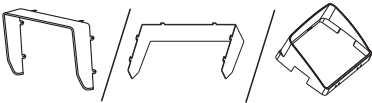
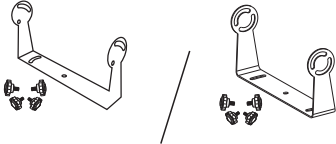
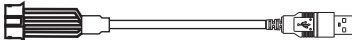
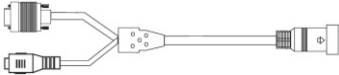


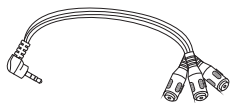
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference.
- (2) This device must accept any interference received, including interference that may cause undesired operation.



2. Products

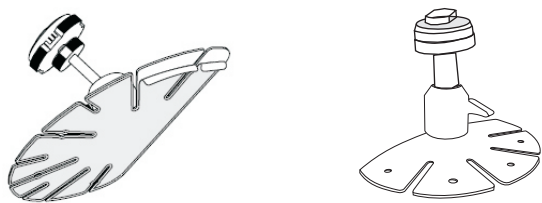
	
Monitor	IR Remote Control
	
AV and Power Supply Conversion Cable	Center Mount Bracket
	
Sun Shield	U-Support Bracket & Angle Adjustment Screws
	
USB sync.cable (Connects to computer for touch operation) ^①	RCA connector VGA cable ^①



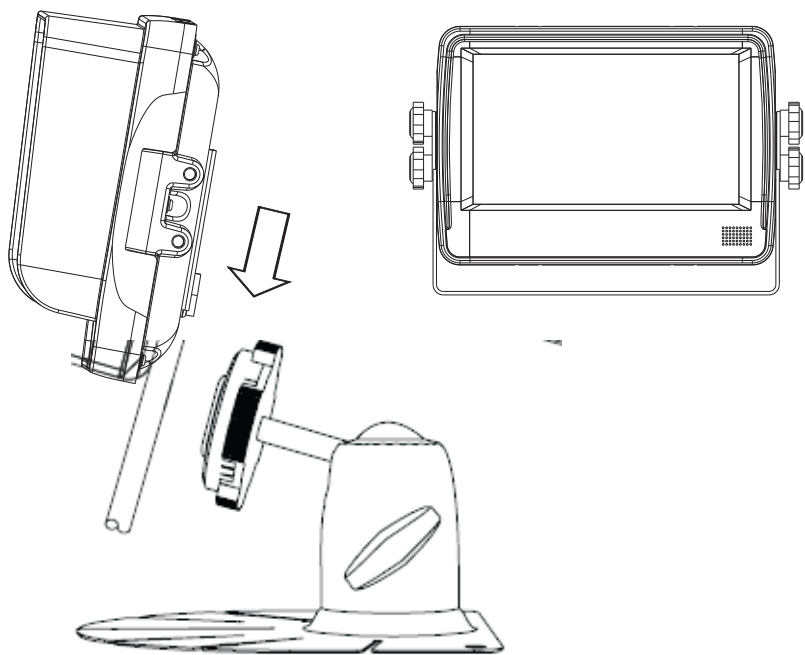
Front Panel AV Input Adapter[Ⓢ]

- Ⓢ Only for the monitor with VGA input.
Support Resolution 1024*768 / 800*600 / 640 * 480 (60Hz)
- Ⓢ Only for the monitor with AV input.

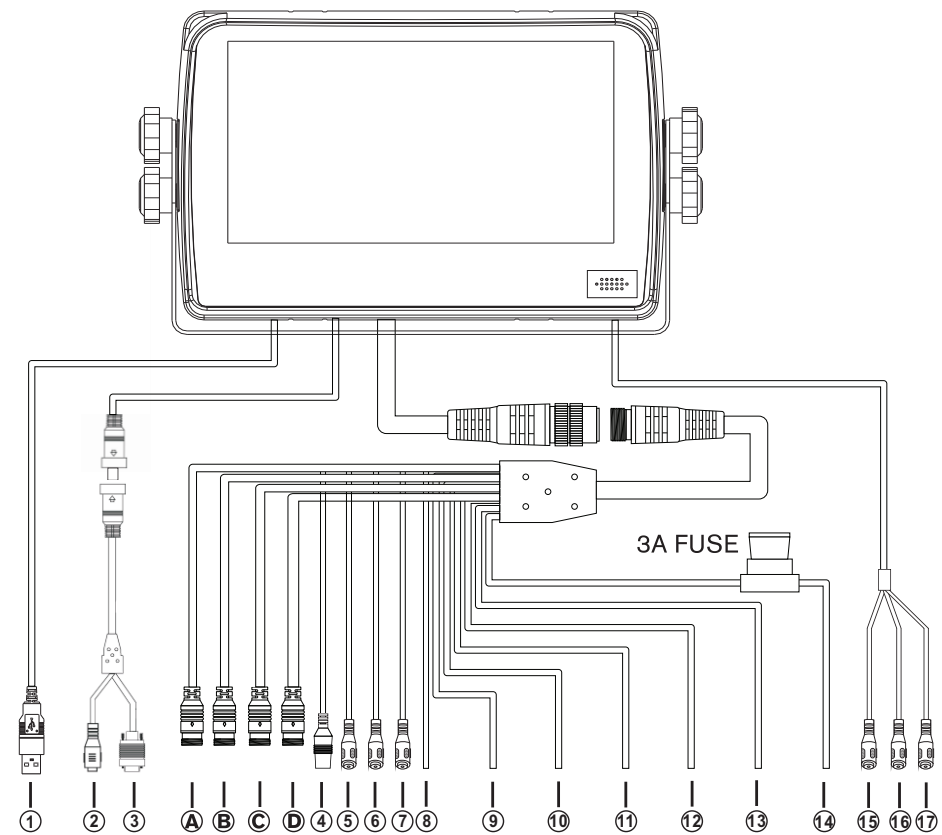
3. Monitor installation



Center Mount Bracket



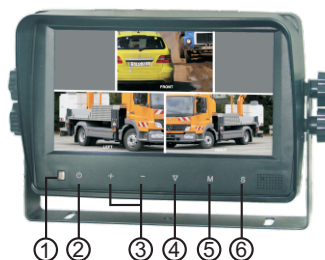
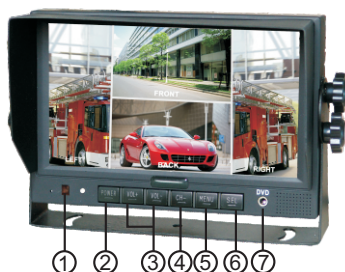
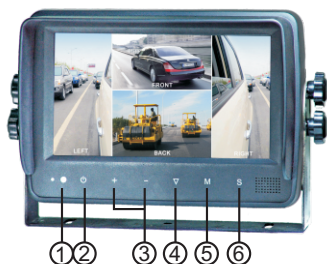
4. Connections



- | | | | |
|---|----------------------------------|--|-------------------|
| Ⓐ Camera 4 | Ⓑ Camera 3 | Ⓒ Camera 2 | Ⓓ Camera 1 |
| ① USB sync.cable [Ⓞ] | ② VGA audio input [Ⓞ] | ③ VGA signal input [Ⓞ] | |
| ④ AUX audio input | ⑤ Green: Rec. V. output | ⑥ Yellow: Live V. output | |
| ⑦ White: Audio output | ⑧ White: Trigger 1 | ⑨ Blue: Trigger 2 | |
| ⑩ Green: Trigger 3 | ⑪ Brown: Trigger 4 | ⑫ Yellow: Split trigger | |
| ⑬ Black: Ground | ⑭ Red: Power | ⑮ DVD video input [Ⓞ]
(yellow RCA) | |
| ⑯ DVD audio input [Ⓞ]
(white RCA) | ⑰ Null [Ⓞ]
(red RCA) | | |

Ⓞ Only for the monitor with VGA input.
 Ⓞ Only for the monitor with AV input.

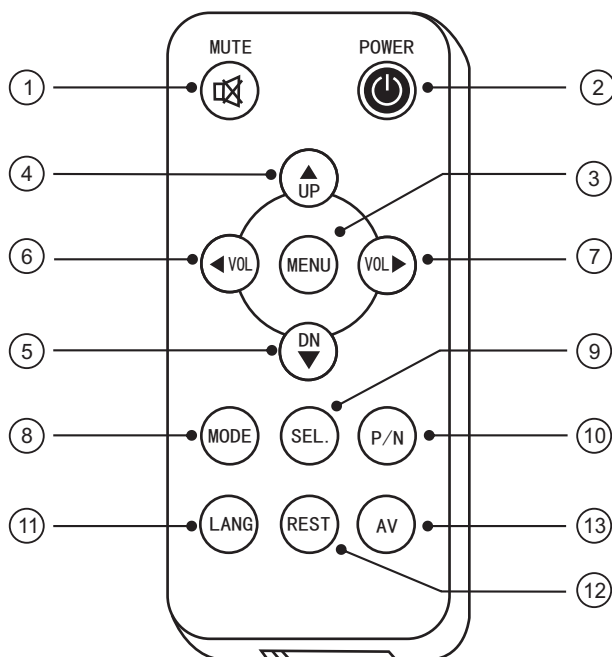
5. Monitor Operations



- ① Remote signal receiver window
- ② Power off/on button
- ③ To increase / decrease the volume and switch between values of each sub-menu
- ④ Menu selection and display mode (single, dual, triple, quad-view, PIP image) selection
- ⑤ Menu control button
- ⑥ Jump key selector. Fast jump to the display mode specified by SYSTEM SETUP - JUMP KEY^①
- ⑦ DVD A/V input (Not applicable to touch-button monitor)

^① For the monitor with VGA input, Fast jump to the display mode specified by SYSTEM SETUP - JUMP KEY, VGA mode and camera mode.

6. Remote Operations



WARNING

1. Please align the remote control with the remote signal receiver window to operate.
2. Never disassemble the remote control or allow it to drop, or get wet.

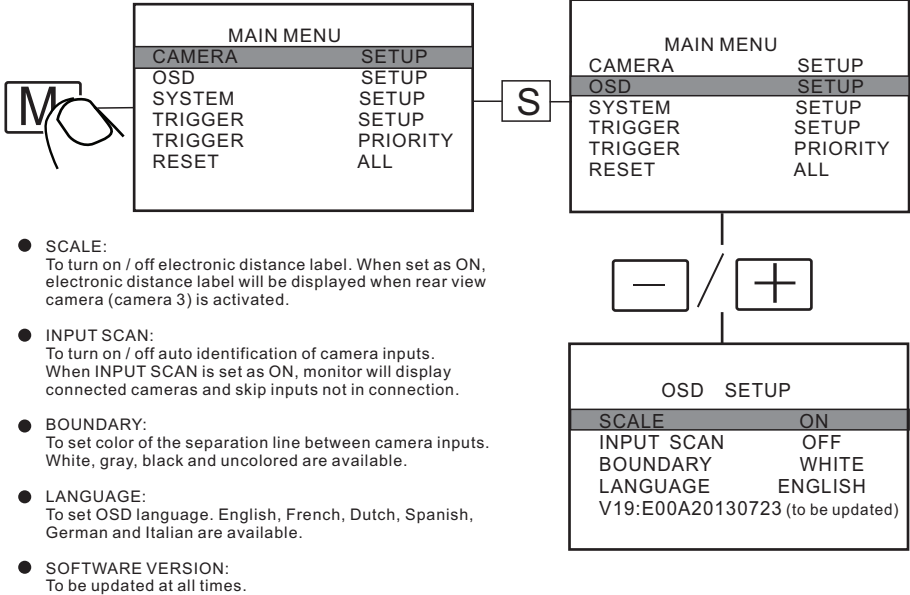
- ① **MUTE**
To mute / unmute the volume
- ② **POWER**
Power off/on button
- ③ **MENU**
Menu control button
- ④ **UP**
Menu selection up
- ⑤ **DN**
Menu selection and display mode (single, dual, triple, quad-view, PIP image) selection
- ⑥ **VOL-**
To decrease the volume and switch between values of each sub-menu
- ⑦ **VOL+**
To increase the volume and switch between values of each sub-menu
- ⑧ **MODE**
Menu selection and display mode (single, dual, triple, quad-view, PIP image) selection
- ⑨ **SEL.**
Jump key selector. Fast jump to the display mode specified by SYSTEM SETUP - JUMP KEY[Ⓞ]
- ⑩ **P/N**
PAL/NTSC TV system selector
- ⑪ **LANG**
Language selection
- ⑫ **REST**
To restore factory settings
- ⑬ **AV**
To go to / leave DVD channel[Ⓞ]

Ⓞ For the monitor with VGA input, Fast jump to the display mode specified by SYSTEM SETUP - JUMP KEY, VGA mode and camera mode.

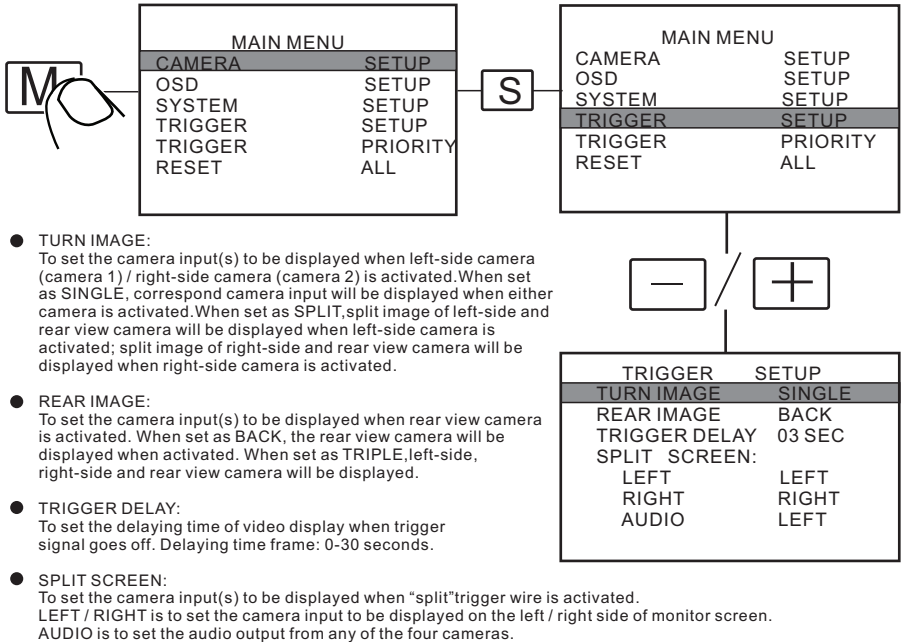
Ⓞ Only for the monitor with AV input.
For the monitor without AV input, the AV button works as JUMP KEY.

7. Menu and Touch-Screen Operations

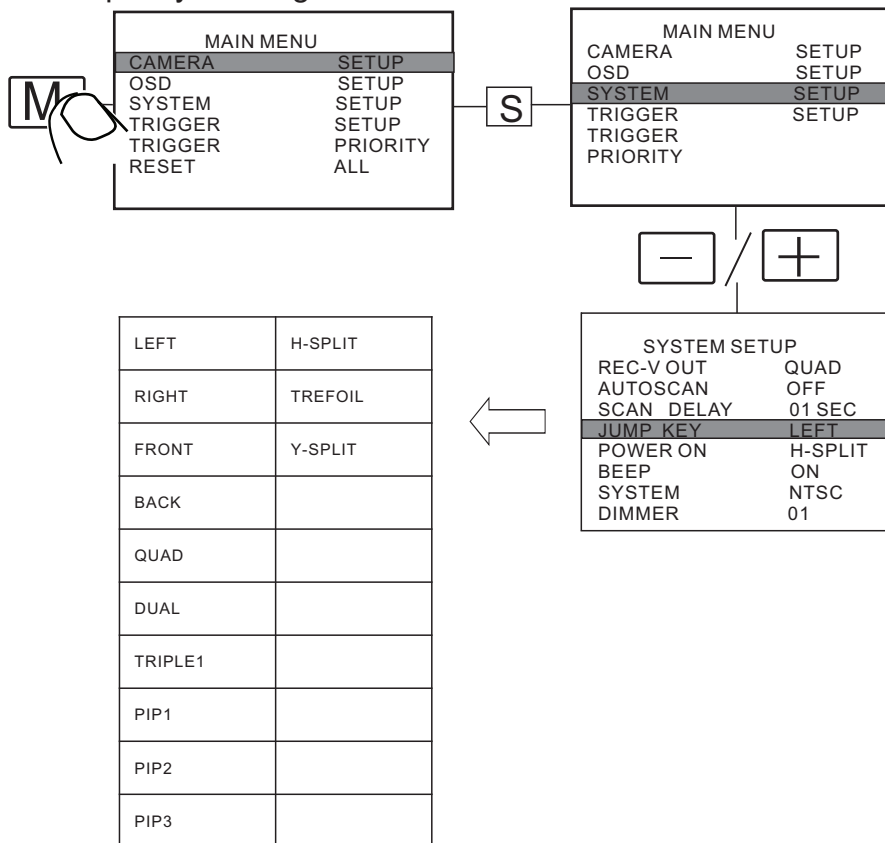
7.1 OSD Setting



7.2 Trigger Setting



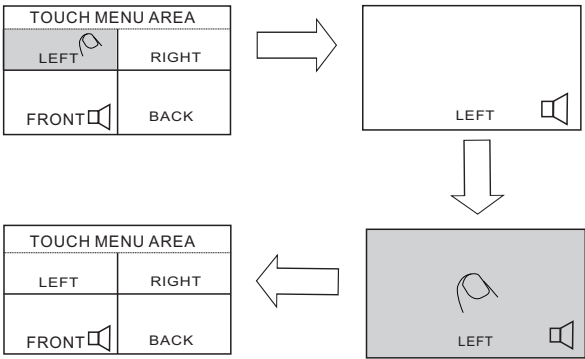
7.3 Jump Key Setting



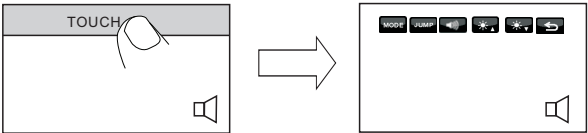
- **REC-V OUT:**
To set the camera input(s) to be recorded when connected to DVR via the green RCA wire. Left-side, right-side, front view, rear view camera and quad view image can be selected.
- **AUTOSCAN:**
To set the auto scanning function. When AUTOSCAN is set as ON, monitor will automatically switch between connected camera inputs and quad image.
- **SCAN DELAY:**
To set the switching time of AUTOSCAN. Switching time frame: 0-60 seconds.
- **JUMP KEY:**
To set the shortcut display mode from the 13 modes to the left. It can be activated by jump key selector.
- **POWER ON:**
To set the default display display model from the 13 modes to the left or STANDBY mode.
- **BEEP:**
To turn on / off the warning tone. Default setting is ON and there will be a beeping sound when menu is being operated.
- **SYSTEM:**
To set TV system: PAL / NTSC/AUTO.
- **DIMMER:**
To set backlighting brightness level of screen. Five levels and AUTO option are available; the higher the level, the brighter. When set as AUTO, backlighting automatically adjusts in accordance with the outer brightness.





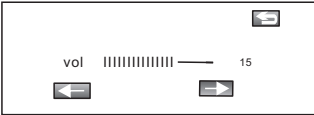


7.4 Touch-Screen Operations

7.4.1 Switch to full screen by touching any channel in multi-viewing mode

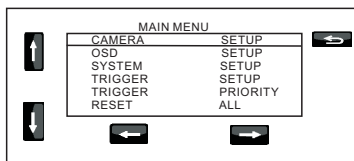


7.4.2 Buttons function of touch menu (not available in DVD/VGA/aux channel or when auto scan is on)

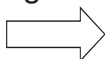


- (1) **MODE** Touch → 
- (2) **JUMP** Touch →  / 
- (3)  Touch → 
- (4)   Brightness increase / decrease

(5) Touch



Touch



again

The previous display
mode

(6)



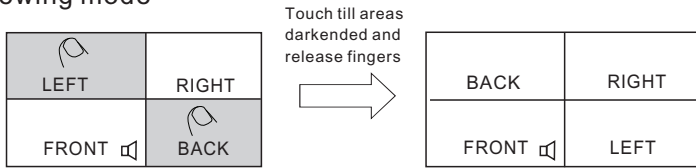
Menu selection up/down

(7)

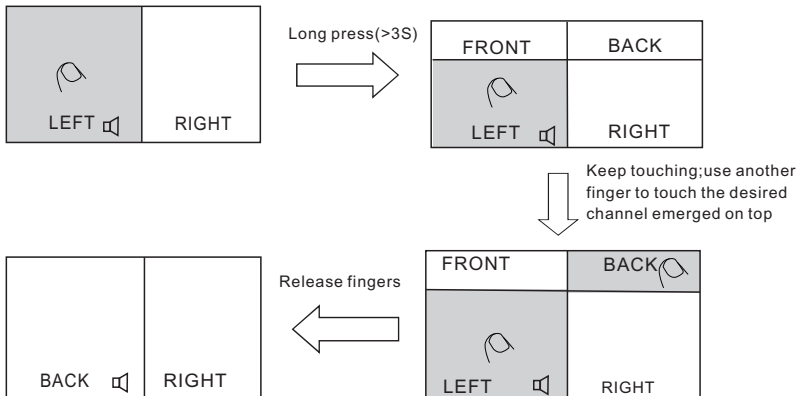


Switches between values of each sub-menu

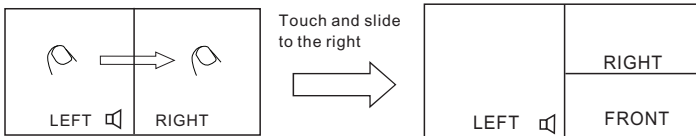
7.4.3 Exchange picture locations of any two cameras displayed in multi-viewing mode



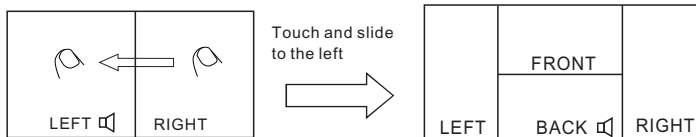
7.4.4 Exchange picture locations of two cameras in dual / triple-viewing mode (1 displayed, 1 hidden)



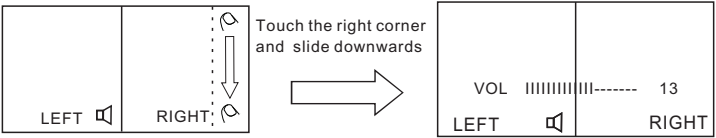
7.4.5 Switch to the next display mode



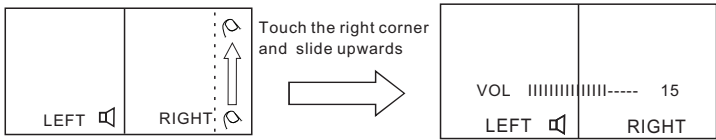
7.4.6 Switch to the previous display mode



7.4.7 Decrease the volume



7.4.8 Increase the volume



8. Specifications

Dimension	7"
TV System	NTSC/PAL
Resolution	800 (W) × 3 (RGB) × 480 (H)
Brightness	400cd/m ²
Contrast	500:1
Viewing Angle	U: 50, D: 70, L: 70, R: 70
Aspect Ratio	16:9
Pixel Pitch (mm)	0.0642 (W) x 0.1790 (H)
Operating Temperature	-20 °C ~ +70 °C
Storage Temperature	-30 °C ~ +80 °C
Power Consumption	Max. 25W
Power Output to Camera	Max. 4 × 300mA, 12V
Power Supply	10V~32V
Video Input	4 video inputs for camera - peak value: 1Vp-p, impedance: 75 ohm 1 DVD input - peak value: 1Vp-p, impedance: 75 ohm [Ⓞ]
Audio Input	4 audio inputs for camera - peak value: 1Vp-p, impedance: 4.7K ohm 1 AUX audio input - peak value: 1Vp-p, impedance: 4.7K ohm 1 DVD audio input - peak value: 1Vp-p, impedance: 4.7K ohm [Ⓞ]
Video Output	1 REC Video output - peak value: 1Vp-p, impedance: 75 ohm 1 LIVE Video output - peak value: 1Vp-p, impedance: 75 ohm
Audio Output	1 REC audio output - peak value: 1Vp-p, impedance: 4.7K ohm

Ⓞ Only for the monitor with AV input.

9. Troubleshooting

The symptoms described below do not necessarily mean a failure within the display. Please check the following items before you initiate request for repair.

Symptom	Possible Causes/Solutions
No picture, no sound	Improper connection of automobile adapter. Use of unauthorized power supply. Power switch is on OFF position.
No picture	Check whether AV cable is properly connected.
No sound	Check whether audio wire is properly connected or the sound volume is turned off or set too low.
Dark picture	Check whether brightness and contrast are adjusted correctly; Check whether the environmental temperature is too low.
No color	Adjust the color settings.
Upside down or lateral inverted picture	Use the remote control horizontal /vertical selection switch to set proper orientation
No reverse gear activated screen(i.e. Picture)	if the reverse gear is activated but no back-up image is shown on the display, please check whether the reversing trigger is loose (not connected well with the reverse light).

WARNING

Monitor systems are strictly intended to be installed as a supplement and not intended for use as substitutes for rear-view mirror devices, or for any other standard motor vehicle equipment required to be installed on vehicles by law. Our products are no substitute for proper defensive driving techniques, observance of traffic laws and motor vehicle safety regulations.

Serial No:

Stock code:

