



Operation and Maintenance Manual

330 Excavator

LHW 1-UP (330)
PFN 1-UP (330)
WCH 1-UP (330)
XNB 1-UP (330)

Important Safety Information

Most accidents that involve product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards, including human factors that can affect safety. This person should also have the necessary training, skills and tools to perform these functions properly.

Improper operation, lubrication, maintenance or repair of this product can be dangerous and could result in injury or death.

Do not operate or perform any lubrication, maintenance or repair on this product, until you verify that you are authorized to perform this work, and have read and understood the operation, lubrication, maintenance and repair information.

Safety precautions and warnings are provided in this manual and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or to other persons.

The hazards are identified by the "Safety Alert Symbol" and followed by a "Signal Word" such as "DANGER", "WARNING" or "CAUTION". The Safety Alert "WARNING" label is shown below.



The meaning of this safety alert symbol is as follows:

Attention! Become Alert! Your Safety is Involved.

The message that appears under the warning explains the hazard and can be either written or pictorially presented.

A non-exhaustive list of operations that may cause product damage are identified by "NOTICE" labels on the product and in this publication.

Caterpillar cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are, therefore, not all inclusive. You must not use this product in any manner different from that considered by this manual without first satisfying yourself that you have considered all safety rules and precautions applicable to the operation of the product in the location of use, including site-specific rules and precautions applicable to the worksite. If a tool, procedure, work method or operating technique that is not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and for others. You should also ensure that you are authorized to perform this work, and that the product will not be damaged or become unsafe by the operation, lubrication, maintenance or repair procedures that you intend to use.

The information, specifications, and illustrations in this publication are on the basis of information that was available at the time that the publication was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service that is given to the product. Obtain the complete and most current information before you start any job. Cat dealers have the most current information available.

NOTICE

When replacement parts are required for this product Caterpillar recommends using original Caterpillar® replacement parts.

Other parts may not meet certain original equipment specifications.

When replacement parts are installed, the machine owner/user should ensure that the machine remains in compliance with all applicable requirements.

In the United States, the maintenance, replacement, or repair of the emission control devices and systems may be performed by any repair establishment or individual of the owner's choosing.

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Foreword

California Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.



WARNING – This product can expose you to chemicals including ethylene glycol, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to:

www.P65Warnings.ca.gov

Do not ingest this chemical. Wash hands after handling to avoid incidental ingestion.



WARNING – This product can expose you to chemicals including lead and lead compounds, which are known to the State of California to cause cancer, birth defects, or other reproductive harm. For more information go to:

www.P65Warnings.ca.gov

Wash hands after handling components that may contain lead.

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.

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. Read, study, and keep this manual with the machine.

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

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.

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, machine controls, attachment 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 the calendar intervals provide more convenient servicing schedules and approximate the indicated service hour meter reading. Perform the recommended service at the interval that occurs first.

Under 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.

Certified Engine Maintenance

Proper maintenance and repair are essential to keep the engine and machine systems operating correctly. As the heavy-duty off-road diesel engine owner, you are responsible for the performance of the required maintenance listed in the Owner Manual, Operation and Maintenance Manual, and Service Manual.

It is prohibited for any person engaged in the business of repairing, servicing, selling, leasing, or trading engines or machines to remove, alter, or to render inoperative, any emission-related device or element of design installed on or in an engine or machine that is in compliance with all applicable regulations of the intended country to which it has been shipped. Certain elements of the machine and engine such as the exhaust system, fuel system, electrical system, intake air system, and cooling system may be emission-related and should not be altered unless approved by Caterpillar.

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 Cat dealer for further information.

Product Identification Number

Effective First Quarter 2001 the Product Identification Number (PIN) has changed from 8 to 17 characters. To provide uniform equipment identification, construction equipment manufacturers are moving to comply with the latest version of the product identification numbering standard. Non-road machine PINs are defined by ISO 10261. The new PIN format will apply to all machines and generator sets. The PIN plates and frame marking will display the 17 character PIN. The new format will look like the following:

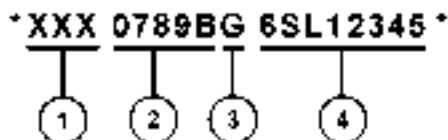


Illustration 1

g03891925

Where:

1. World Manufacturing Code (characters 1-3)

2. Machine Descriptor (characters 4-8)

3. Check Character (character 9)

4. Machine Indicator Section (MIS) or Product Sequence Number (characters 10-17). These were previously referred to as the Serial Number.

Machines and generator sets produced before First Quarter 2001 will maintain their 8 character PIN format.

Components such as engines, transmissions, axles, and work tools will continue to use an 8 character Serial Number (S/N).

Safety Section

i07473534

Safety Messages

SMCS Code: 7000; 7405

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 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 message. Loose adhesive will allow the safety message to fall.

Replace any safety message that is damaged, or missing. If a safety message is attached to a part that is replaced, install a safety message on the replacement part. Any Cat dealer can provide new safety messages.

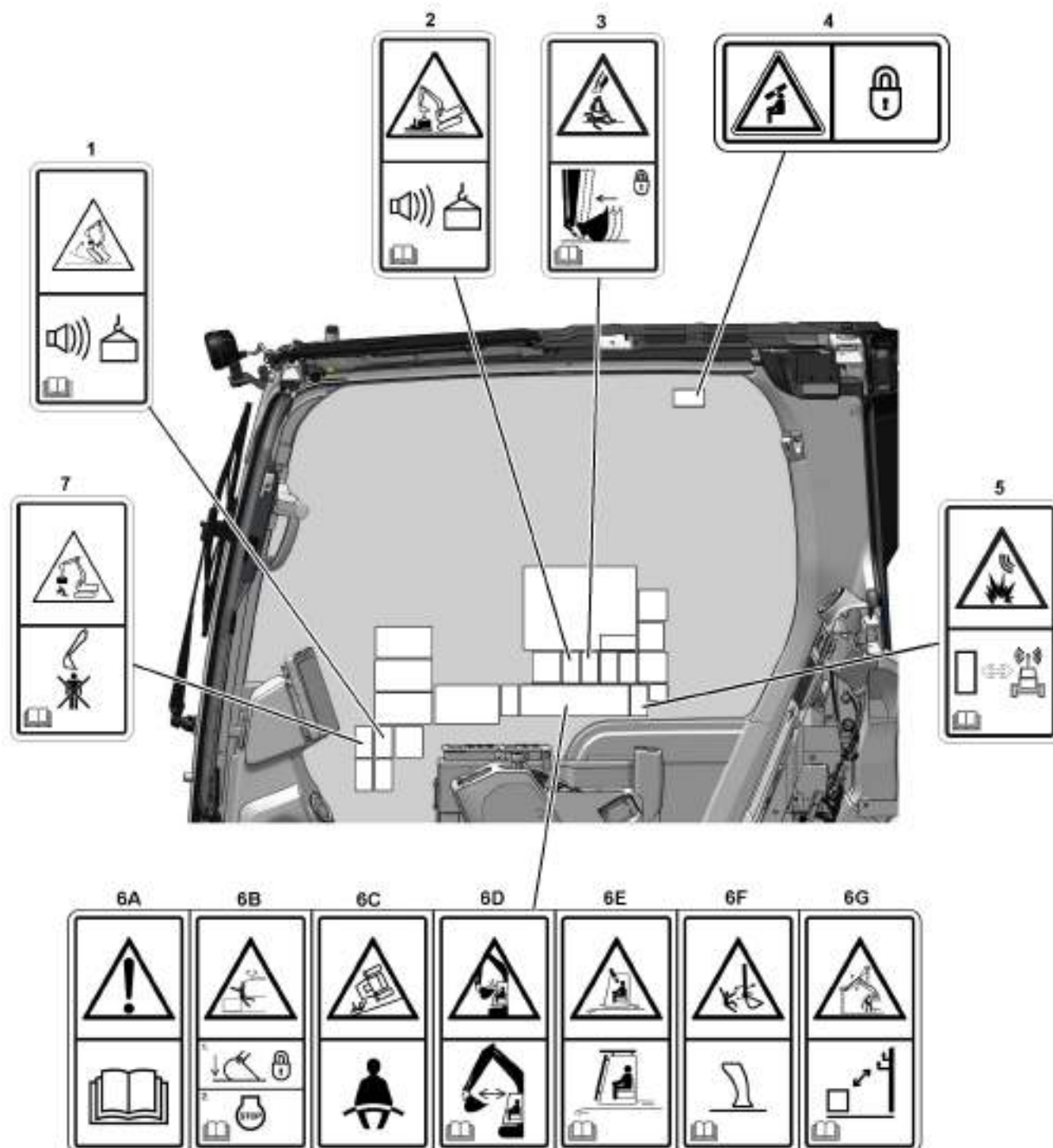


Illustration 2

g06224994

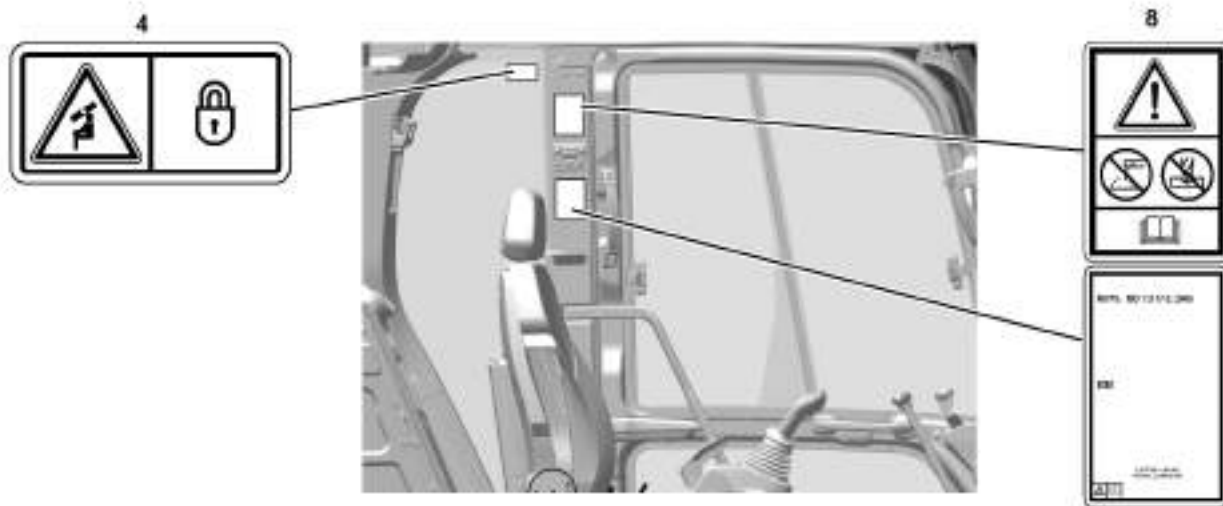


Illustration 3

g06188729

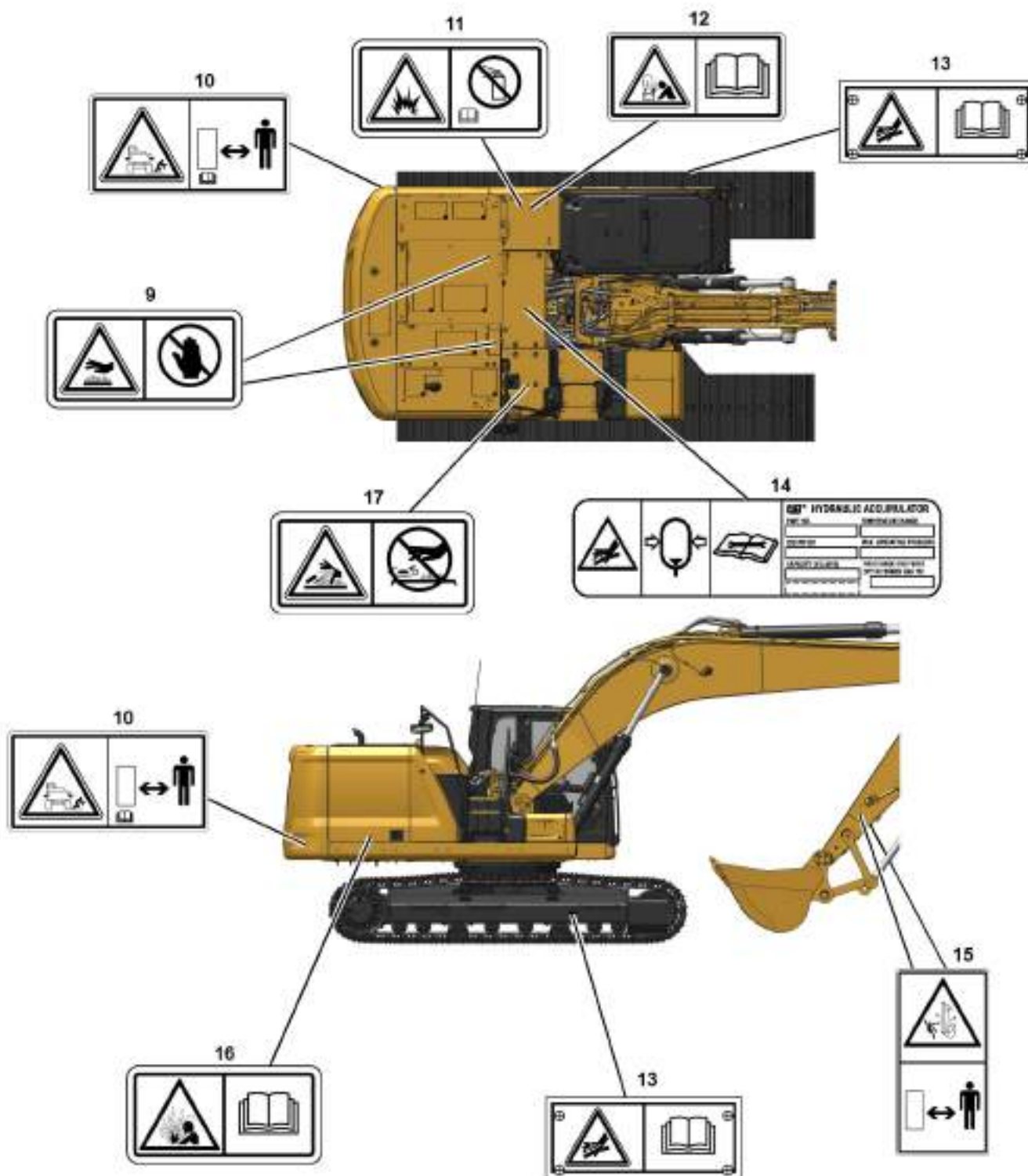


Illustration 4

g06331487

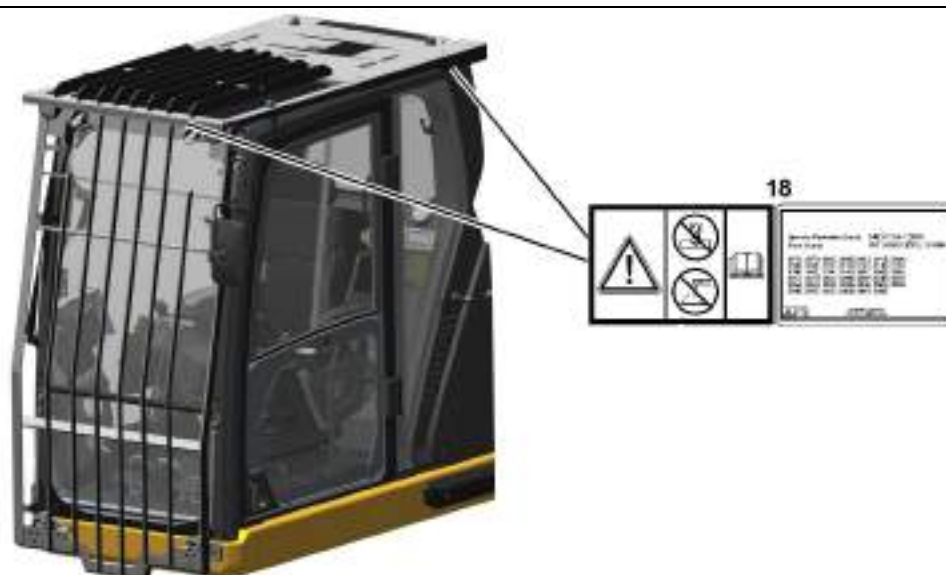


Illustration 5

g06332249

Lifting Level Warning (1)

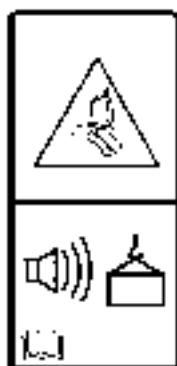


Illustration 6

g06188532

Overload Warning Device (2)

If equipped, this safety message is located in the cab on the right side window.



Illustration 7

g06224998

WARNING

Overloading the machine could impact the machine's stability which could result in a tipover hazard. A tipover hazard could result in serious injury or death. Always activate the overload warning device before you handle or lift objects.

Refer to Operation and Maintenance Manual, "Operator Controls" for further information.

Crushing Injury (3)

If equipped, this safety message is located in the cab on the right side window.



Illustration 8

g06188540

WARNING

Crush injury. Could cause serious injury or death. Always confirm that the quick coupler is engaged onto the pins. Read the Operator's Manual.

Refer to Operation and Maintenance Manual, "Quick Coupler Operation" for further information.

Crushing Hazard (4)

These safety messages are on the left and right side cab windows.



Illustration 9

g02061339

WARNING

Personal injury can result if the window is not latched in the overhead position; ensure the auto lock is engaged.

Refer to Operation and Maintenance Manual, "Window (Front)" for further information.

Product Link (5)

If equipped, this safety message is located in the cab on the right side window.



Illustration 10

g06188657

WARNING

This machine is equipped with a Caterpillar Product Link communication device. When electric detonators are used, this communication device should be deactivated within 12 m (40 ft) of a blast site for satellite-based systems and within 3 m (10 ft) of a blast site for cellular based systems, or within the distance mandated under applicable legal requirements. Failure to do so could cause interference with blasting operations and result in serious injury or death.

In cases where the type of Product Link module cannot be identified, Caterpillar recommends that the device be disabled no less than 12 m (40 ft) from the blast perimeter.

Refer to Operation and Maintenance Manual, "Product Link" for further information.

Do Not Operate (6A)

This safety message is located in the cab on the right side window.

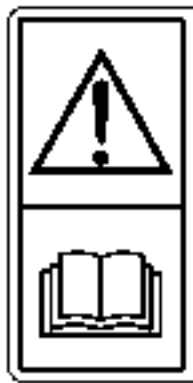


Illustration 11

g06188661

⚠ WARNING

Do not operate or work on this machine 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 any Caterpillar dealer for replacement manuals. Proper care is your responsibility.

Crushing Hazard (6B)

If equipped, this safety message is located in the cab on the right side window.



Illustration 12

g02282255

⚠ WARNING

Crush Hazard! A machine may move unexpectedly and without warning resulting in personal injury or death.

Before leaving the machine lower the work tool to the ground, lock operator controls, shut off the engine and remove the key.

Seat Belt (6C)

This safety message is located in the cab on the right side window.



Illustration 13

g06188642

WARNING

A seat belt should be worn at all times during machine operation to prevent serious injury or death in the event of an accident or machine overturn. Failure to wear a seat belt during machine operation may result in serious injury or death.

Crushing Hazard (6D)

This safety message is located in the cab on the right side window.



Illustration 14

g06188644

WARNING

Crushing Hazard! Certain machine front linkage combinations (boom, stick, quick coupler, work tool) may require keeping the work tool away from the cab during operation. Personal injury or death may result if the work tool contacts the cab during operation.

Crushing Hazard (6E)

This safety message is located in the cab on the right side window.



Illustration 15

g06188652

WARNING

The impact from objects that strike the front of the cab or the top of the cab could result in a crushing hazard with the potential for personal injury or death.

The front guard and the top guard should be installed on the cab for applications where the hazard of falling objects exist. Read the Operation and Maintenance Manual.

Refer to Operation and Maintenance Manual, "Guards" for further information.

Joystick Controls Alternate Patterns (6F)

If equipped, this safety message is located in the cab on the right side window.



Illustration 16

g06188665

WARNING

Crush Hazard. Improper joystick setting could cause possible unexpected movement of the boom, stick, or worktool which could result in serious injury or death. Confirm that the joystick settings are properly configured before you operate the machine. Read the Operation and Maintenance Manual.

Refer to Operation and Maintenance Manual, "Joystick Controls Alternate Patterns" for further information.

Electrical Power Lines (6G)

This safety message is located in the cab.



Illustration 17

g06188667

DANGER

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

Refer to Operation and Maintenance Manual, "Specifications" for further information.

Do Not Lift Over Personnel (7)

This safety message is located in the cab on the right side window.



Illustration 18

g06188697

Do not lift

Do Not Weld or Drill on ROPS (8)

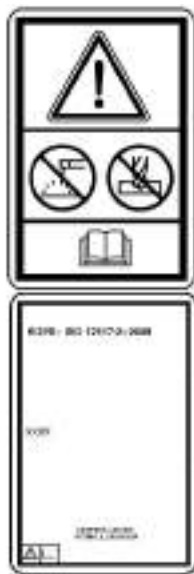


Illustration 19

g06207749

If equipped, this safety message is on the left side pillar in the cab.

WARNING

Structural damage, an overturn, modification, alteration, or improper repair, can impair this structure's protective capability thereby voiding this certification. Do not weld on or drill holes in the structure. Consult a Caterpillar dealer to determine this structure's limitations without voiding its certification.

This machine has been certified to the standards that are listed on the certification plate. The maximum mass of the machine, which includes the operator and the attachments without a payload, should not exceed the mass on the certification plate.

Refer to Operation and Maintenance Manual, "Guards (Operator Protection)" for more information.

Hot Surface (9)

This message is on the outside of the engine hood and on the inside of the engine hood.



Illustration 20

g01372256

WARNING

Engine hood and engine hood parts can be hot while engine is running or immediately after engine shutdown. Hot parts or hot components can cause burns or personal injury. Do not allow these parts to contact your skin, when engine is running or immediately after engine shutdown. Use protective clothing or protective equipment to protect your skin.

Crushing Hazard (10)

This safety message is on each side of the rear of the machine.

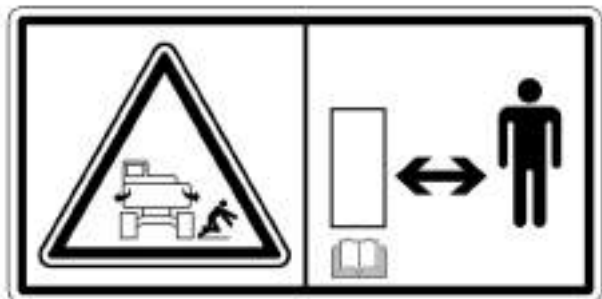


Illustration 21

g06219420



Aerosol Starting Aid (11)

This safety message is located near the precleaner. The following information is not applicable to machines that are equipped with an ether starting aid.



Illustration 22

g01372254



Refer to Operation and Maintenance Manual, "Engine Starting" for the proper starting procedure.

Jump-Start Cables (12)

This safety message is positioned on the circuit breaker panel.

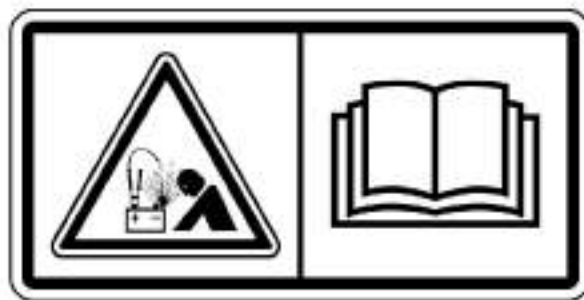
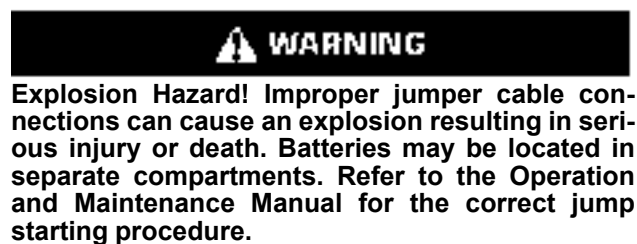


Illustration 23

g01370909



Refer to Operation and Maintenance Manual, "Engine Starting with Jump-Start Cables" for further information.

High-Pressure Cylinder (13)

This safety message is on the back of both the track adjuster covers.

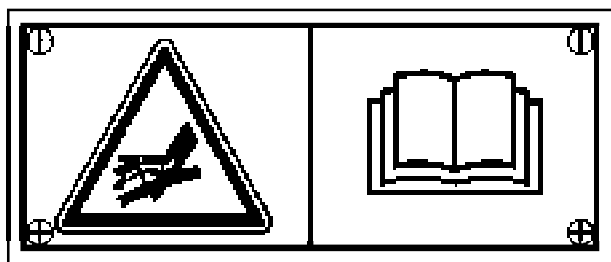


Illustration 24

g01076729

WARNING

Personal injury or death can result from grease under pressure.

Grease coming out of the relief valve under pressure can penetrate the body causing injury or death.

Do not watch the relief valve to see if grease is escaping. Watch the track or track adjustment cylinder to see if the track is being loosened.

Loosen the relief valve one turn only.

If track does not loosen, close the relief valve and contact your Cat dealer.

WARNING

Recoil system contains high-pressure nitrogen cylinder. Parts can separate with explosive force if proper care is not used during disassembly.

This action can cause serious injury or death.

Do not disassemble any part of this cylinder until you have read and understand the instructions given in the service manual. Observe the instructions given in the service manual.

High-Pressure Gas (14)

This safety message is positioned on the accumulator.

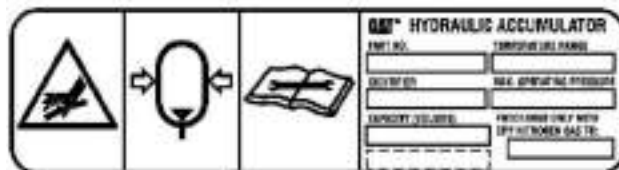


Illustration 25

g06236155

WARNING

Pressurized System!

Hydraulic accumulators contain gas and oil under high pressure. DO NOT disconnect lines or disassemble any component of a pressurized accumulator. All gas pre-charge must be removed from the accumulator as instructed by the service manual before servicing or disposing of the accumulator or any accumulator component.

Failure to follow the instructions and warnings could result in personal injury or death.

Only use dry nitrogen gas to recharge accumulators. See your Cat dealer for special equipment and detailed information for accumulator service and charging.

Refer to Operation and Maintenance Manual, "Equipment Lowering with Engine Stopped" for further information.

Crushing Hazard (15)

This safety message is on both sides of the stick.

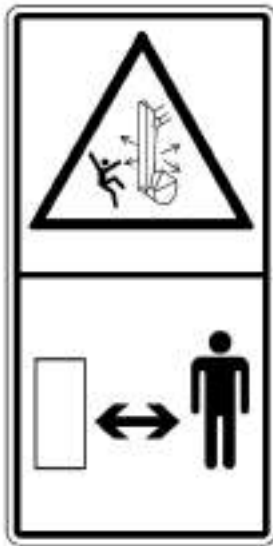


Illustration 26

g01385579

WARNING

A crushing hazard exists when the stick and boom are in motion and when the machine is being used in object handling applications. Failure to stay clear of the stick and boom when the machine is in operation can result in personal injury or death. Stay clear of the stick and boom when the machine is in operation.

Vapor Explosion (16) (If Equipped)

If equipped, this safety message is inside the rear storage compartment on the right side, near the fuel transfer pump.

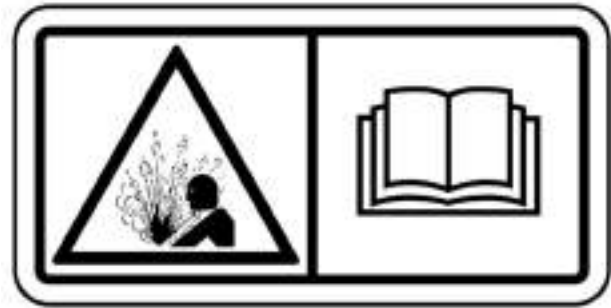


Illustration 27

g01407639

WARNING

Explosion hazard! Fuel vapors can accumulate in the refueling pump compartment and can be ignited by improper operation of the refueling pump. Failure to follow the operating instructions for the refueling pump could result in personal injury or death. Read and follow the operating instructions for the refueling pump in the Operation and Maintenance Manual.

Refer to Operation and Maintenance Manual, "Fuel Transfer Pump (Refueling)" for further information.

Relieve Hydraulic Tank Pressure (17)

This safety message is on top of the hydraulic tank.



Illustration 28

g01371640



Hot Fluid Under Pressure!

Do NOT remove pressure cap when hot. Hot oil could cause serious injury or death.

Falling Object Guard Structure (18)

If equipped, this safety message is on top of the front falling object guard structure. This safety message is also on the left side of the falling object guard structure on the top of the cab.



Illustration 29

g02428757



Structural damage, an overturn, modification, alteration, or improper repair can impair this structure's protection capability thereby voiding this certification. Do not weld on or drill holes in the structure. Consult a Caterpillar dealer to determine this structure's limitations without voiding its certification.

i07956618

Additional Messages

SMCS Code: 7000; 7405

There are several specific messages on this machine. The exact location of the messages and the description of the information are reviewed in this section. Become familiar with all messages.

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

Replace any message that is damaged, or missing. If a message is attached to a part that is replaced, install a message on the replacement part. Any Cat dealer can provide new messages.

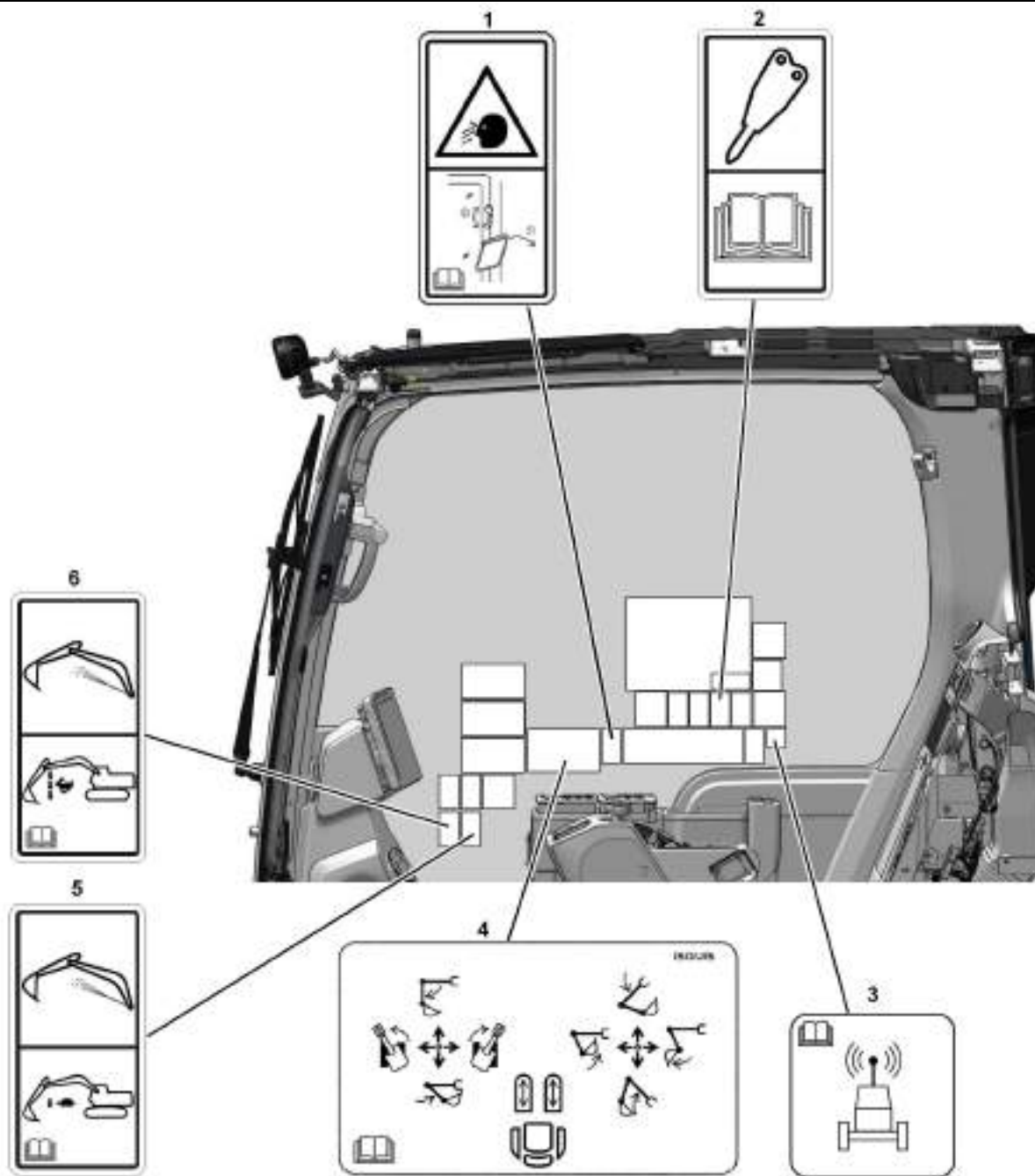


Illustration 30

g06187617

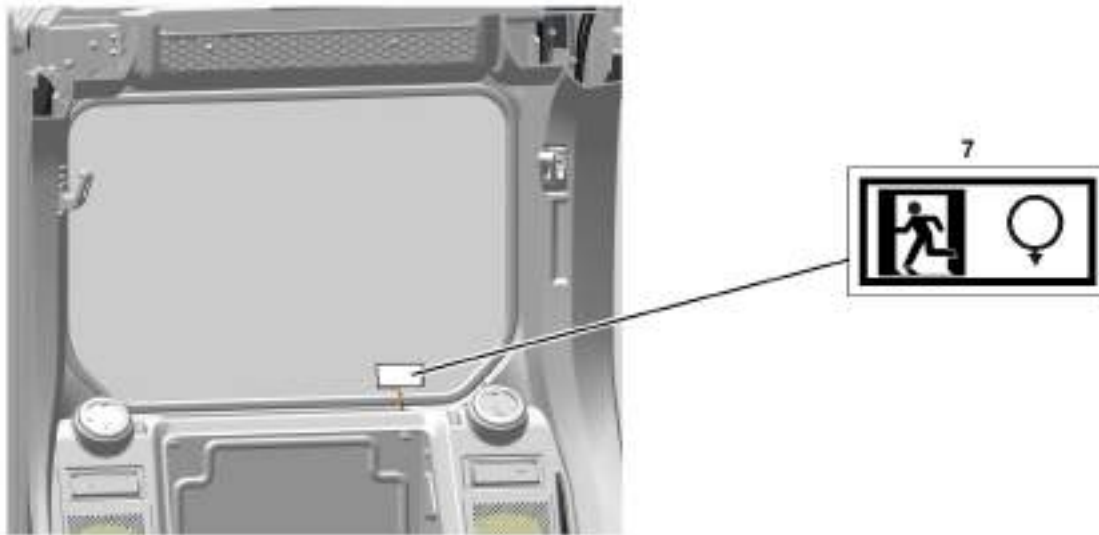


Illustration 31

g06189121

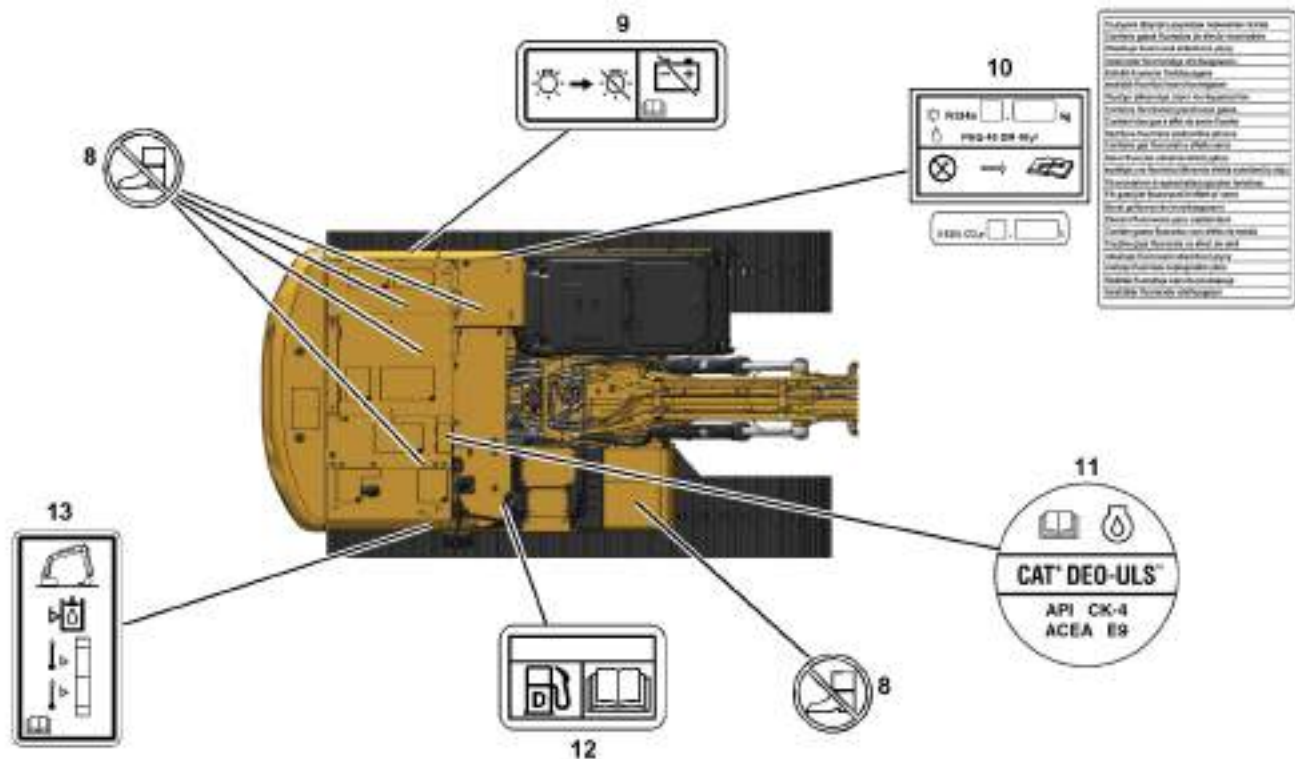


Illustration 32

g06491287

Front Window Usage (1)

For machines equipped with the Cat Grade Control monitor, the monitor must be moved downward before lifting or lowering the front window. The monitor is in the path of the window track in its normal position.



Illustration 33

g06214810

Hammer Operation(2)

This message is on the window on the right side of the cab.

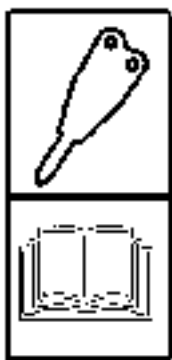


Illustration 34

g06189240

See Operation and Maintenance Manual, "Hammer Operation" within Operation and Maintenance Manual, "Work Tool Control (One-Way Flow)" for instructions on hammer operation.

Also, see Operation and Maintenance Manual, "Hydraulic Hammer Control (Foot Switch)" within Operation and Maintenance Manual, "Work Tool Control (One-Way Flow)" for instructions on hammer operation.

Data Privacy (3)

Illustration 35

g01418953

The Product Link System is a satellite communication device that transmits information regarding the machine back to Caterpillar and Cat dealers and customers. All logged events and diagnostic codes that are available to the Cat Electronic Technician (ET) on the Cat data link can be sent to the satellite. Information can also be sent to the Product Link System. The information is used to improve Cat products and Cat services.

Refer to Operation and Maintenance Manual, "Product Link" for more information.

Joystick Controls Alternate Patterns (4)

If equipped, this message is on the right side window of the cab.

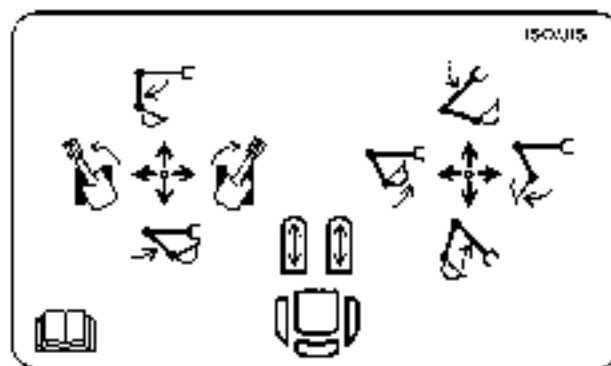


Illustration 36

g06214805

Refer to Operation and Maintenance Manual, "Joystick Controls Alternate Patterns" for further information.

Hose Burst (5)

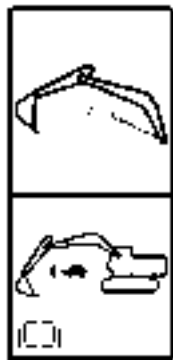


Illustration 37

g06189238

Hose Burst (6)

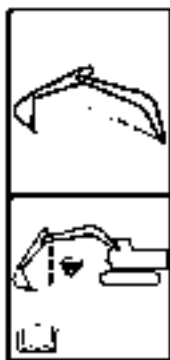


Illustration 38

g06189239

Alternate Exit (7)

If equipped, this message is on the rear window of the cab in the lower left-hand corner.



Illustration 39

g06189112

Pull the ring to pull out the seal. Push the window out of the cab and exit through the opening.

Refer to Operation and Maintenance Manual, "Alternate Exit" for further information.

No Step (8)

This message is on various places on the upper structure and covers. It is also on the engine valve cover.

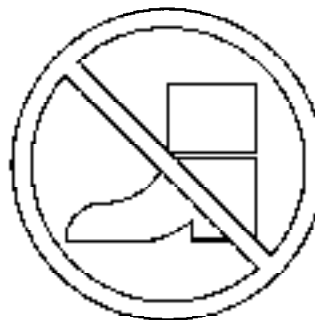


Illustration 40

g00911158

Do not step in this area.

DEF Purge Indicator Lamp (9)

This message is located behind the cab near the disconnect switch and pertains to the Diesel Exhaust Fluid (DEF) system.

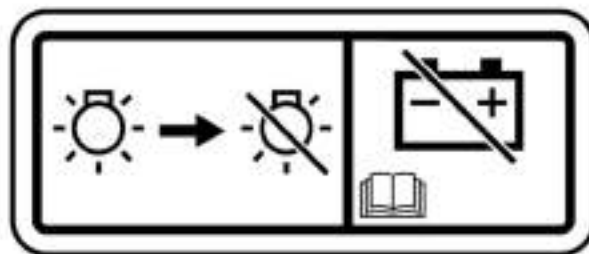


Illustration 41

g03408962

NOTICE

After the engine is shutdown apply the battery disconnect switch. Applying the battery disconnect too soon will prevent the DEF system from being purged and could cause DEF to freeze in the lines.

Air Conditioner (10)

These messages are positioned on the left door behind the cab.

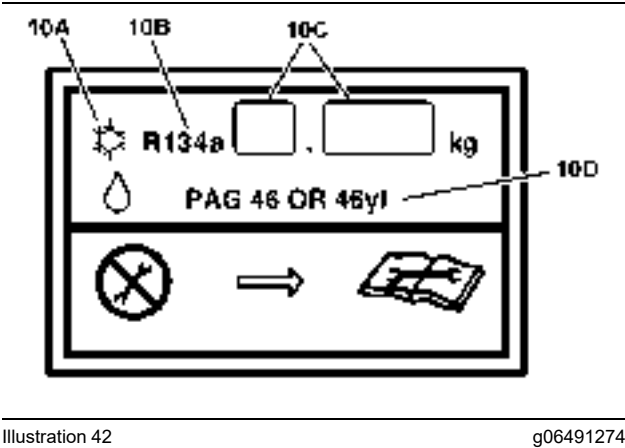


Illustration 42 g06491274

(10A) Air conditioning symbol
(10B) R134a (Refrigerant type common name)
(10C) Refrigerant quantity
(10D) PAG (polyalkylene glycol) lubricating oil type

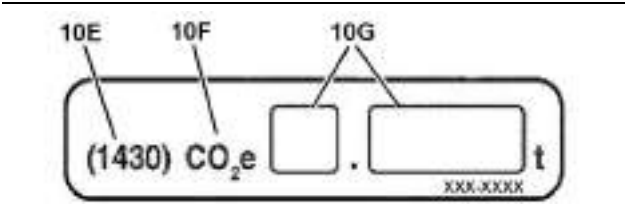


Illustration 43 g06214938

If equipped, this plate provides the below additional European Union required greenhouse gas information.

(10E) (1430) - This is the Global Warming Potential of R134a
(10F) CO₂ equivalent
(10G) The system contains 1.430 metric tonne of CO₂ equivalent

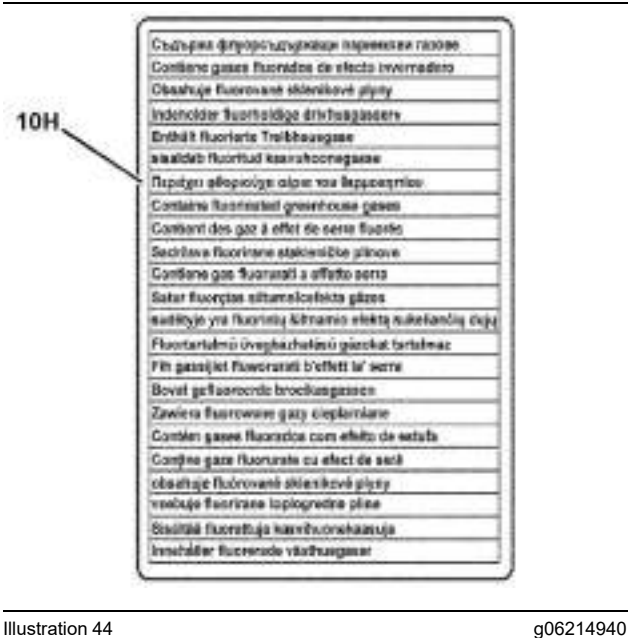


Illustration 44 g06214940

(10H) If equipped, this film provides the required language translations of the text "Contains fluorinated greenhouse gases" for the European Union greenhouse gas regulation.

These messages for the air conditioner system have the appropriate information for the following services: the air conditioner lubricant, the refrigerant charge, and the refrigerant capacity.

Engine Oil Requirements (11)

This message is on top of the engine.



Illustration 45 g06208149

Refer to Operation and Maintenance Manual, "Lubricant Viscosities".

Diesel Fuel Requirements (12)

This message is located by the fuel tank.

i07746355

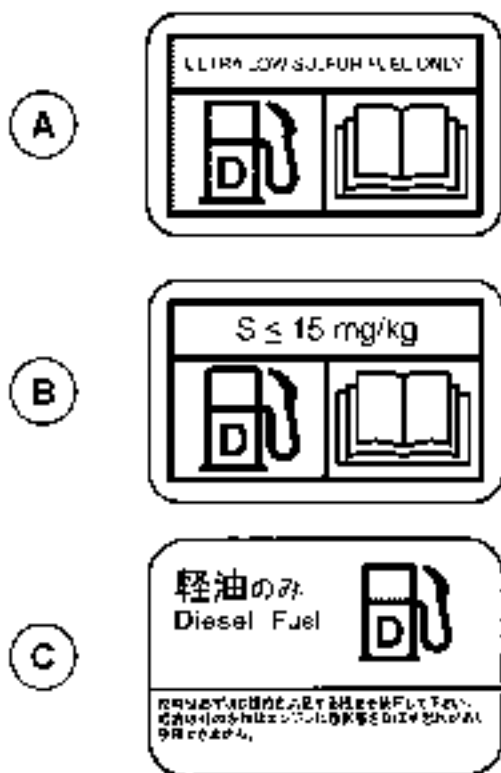


Illustration 46

g03218956

- (A) North America film
(B) Europe, Africa, Middle East film
(C) Japan film

Hydraulic Oil Level Check (13)

This message is located in the right access compartment next to the sight gauge for the hydraulic oil.

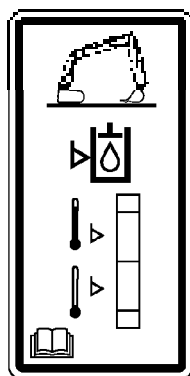


Illustration 47

g01069075

Check hydraulic oil level daily. See Operation and Maintenance Manual, "Hydraulic System Oil Level - Check" for details.

General Hazard Information

SMCS Code: 7000

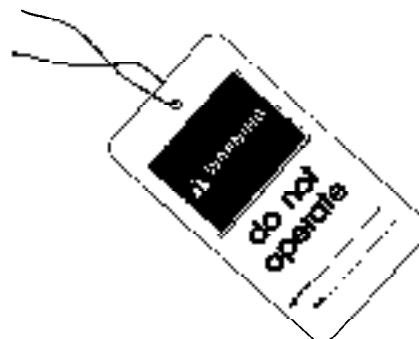


Illustration 48

g00104545

Typical example

Attach a "Do Not Operate" warning tag or a similar warning tag to the start switch or to the controls. Attach the warning tag before you service the equipment or before you repair the equipment. Warning tag SEHS7332 is available from your Cat dealer.

WARNING

Operating the machine while distracted can result in the loss of machine control. Use extreme caution when using any device while operating the machine. Operating the machine while distracted can result in personal injury or death.

Know the width of your equipment to maintain proper clearance when you operate the equipment near fences or near boundary obstacles.

Be aware of high-voltage power lines and power cables that are buried. If the machine comes in contact with these hazards, serious injury or death may occur from electrocution.

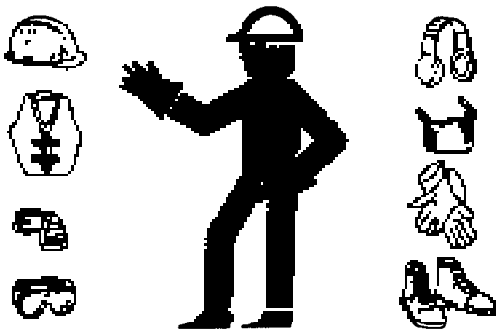


Illustration 49

g00702020

Wear a hard hat, protective glasses, and other protective equipment, as required.

Do not wear loose clothing or jewelry that can snag on controls or on other parts of the equipment.

Make sure that all protective guards and all covers are secured in place on the equipment.

Keep the equipment free from foreign material. Remove debris, oil, tools, and other items from the deck, from walkways, and from steps.

Secure all loose items such as lunch boxes, tools, and other items that are not a part of the equipment.

Know the appropriate work site hand signals and the personnel that are authorized to give the hand signals. Accept hand signals from one person only.

Do not smoke when you service an air conditioner. Also, do not smoke if refrigerant gas may be present. Inhaling the fumes that are released from a flame that contacts air conditioner refrigerant can cause bodily harm or death. Inhaling gas from air conditioner refrigerant through a lighted cigarette can cause bodily harm or death.

Never put maintenance fluids into glass containers. Drain all liquids into a suitable container.

Obey all local regulations for the disposal of liquids.

Use all cleaning solutions with care. Report all necessary repairs.

Do not allow unauthorized personnel on the equipment.

Unless you are instructed otherwise, perform maintenance with the equipment in the servicing position. Refer to Operation and Maintenance Manual for the procedure for placing the equipment in the servicing position.

When you perform maintenance above ground level, use appropriate devices such as ladders or man lift machines. If equipped, use the machine anchorage points and use approved fall arrest harnesses and lanyards.

Pressurized Air and Water

Pressurized air and/or water can cause debris and/or hot water to be blown out. The debris and/or hot water could result in personal injury.

When pressurized air and/or pressurized water is used for cleaning, wear protective clothing, protective shoes, and eye protection. Eye protection includes goggles or a protective face shield.

The maximum air pressure for cleaning purposes must be reduced to 205 kPa (30 psi) when the nozzle is deadheaded and the nozzle is used with an effective chip deflector and personal protective equipment. The maximum water pressure for cleaning purposes must be below 275 kPa (40 psi).

Avoid direct spraying of water on electrical connectors, connections, and components. When using air for cleaning, allow the machine to cool to reduce the possibility of fine debris igniting when re-deposited on hot surfaces.

Trapped Pressure

Pressure can be trapped in a hydraulic system. Releasing trapped pressure can cause sudden machine movement or attachment movement. Use caution if you disconnect hydraulic lines or fittings. High-pressure oil that is released can cause a hose to whip. High-pressure oil that is released can cause oil to spray. Fluid penetration can cause serious injury and possible death.

Fluid Penetration

Pressure can be trapped in the hydraulic circuit long after the machine has been stopped. The pressure can cause hydraulic fluid or items such as pipe plugs to escape rapidly if the pressure is not relieved correctly.

Do not remove any hydraulic components or parts until pressure has been relieved or personal injury may occur. Do not disassemble any hydraulic components or parts until pressure has been relieved or personal injury may occur. Refer to the Service Manual for any procedures that are required to relieve the hydraulic pressure.

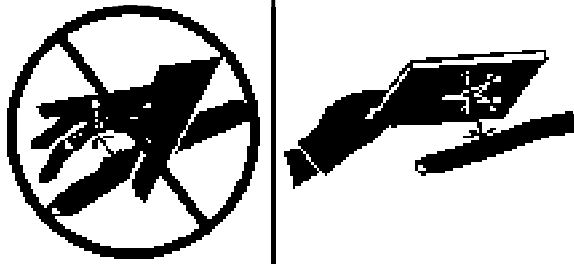


Illustration 50

g00687600

Always use a board or cardboard when you check for a leak. Leaking fluid that is under pressure can penetrate body tissue. Fluid penetration can cause serious injury and possible death. A pin hole leak can cause severe injury. If fluid is injected into your skin, you must get treatment immediately. Seek treatment from a doctor that is familiar with this type of injury.

Containing Fluid Spillage

Care must be taken in order to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting, and repair of the equipment. Prepare to collect the fluid with suitable containers before opening any compartment or disassembling any component that contains fluids.

Refer to Special Publication, NENG2500, "Cat dealer Service Tool Catalog" for the following items:

- Tools that are suitable for collecting fluids and equipment that is suitable for collecting fluids
- Tools that are suitable for containing fluids and equipment that is suitable for containing fluids

Obey all local regulations for the disposal of liquids.

Inhalation



Illustration 51

g02159053

Exhaust

Use caution. Exhaust fumes can be hazardous to your health. If you operate the machine in an enclosed area, adequate ventilation is necessary.

Asbestos Information

Cat equipment and replacement parts that are shipped from Caterpillar are asbestos free. Caterpillar recommends the use of only genuine Cat replacement parts. Use the following guidelines when you handle any replacement parts that contain asbestos or when you handle asbestos debris.

Use caution. Avoid inhaling dust that might be generated when you handle components that contain asbestos fibers. Inhaling this dust can be hazardous to your health. The components that may contain asbestos fibers are brake pads, brake bands, lining material, clutch plates, and some gaskets. The asbestos that is used in these components is bound in a resin or sealed in some way. Normal handling is not hazardous unless airborne dust that contains asbestos is generated.

If dust that may contain asbestos is present, there are several guidelines that should be followed:

- Never use compressed air for cleaning.
- Avoid brushing materials that contain asbestos.
- Avoid grinding materials that contain asbestos.
- Use a wet method in order to clean up asbestos materials.
- A vacuum cleaner that is equipped with a high efficiency particulate air filter (HEPA) can also be used.

- Use exhaust ventilation on permanent machining jobs.
- Wear an approved respirator if there is no other way to control the dust.
- Comply with applicable rules and regulations for the work place. In the United States, use Occupational Safety and Health Administration (OSHA) requirements. These OSHA requirements can be found in “29 CFR 1910.1001”. In Japan, use the requirements found in the “Ordinance on Prevention of Health Impairment due to Asbestos” in addition to the requirements of the Industrial Safety and Health Act.
- Obey environmental regulations for the disposal of asbestos.
- Stay away from areas that might have asbestos particles in the air.

Dispose of Waste Properly

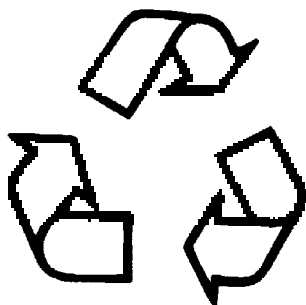


Illustration 52

g00706404

Improperly disposing of waste can threaten the environment. Potentially harmful fluids should be disposed of according to local regulations.

Always use leakproof containers when you drain fluids. Do not pour waste onto the ground, down a drain, or into any source of water.

i01359664

Crushing Prevention and Cutting Prevention

SMCS Code: 7000

Support the equipment properly before you perform any work or maintenance beneath that equipment. Do not depend on the hydraulic cylinders to hold up the equipment. Equipment can fall if a control is moved, or if a hydraulic line breaks.

Do not work beneath the cab of the machine unless the cab is properly supported.

Unless you are instructed otherwise, never attempt adjustments while the machine is moving or while the engine is running.

Never jump across the starter solenoid terminals in order to start the engine. Unexpected machine movement could result.

Whenever there are equipment control linkages the clearance in the linkage area will change with the movement of the equipment or the machine. Stay clear of areas that may have a sudden change in clearance with machine movement or equipment movement.

Stay clear of all rotating and moving parts.

If it is necessary to remove guards in order to perform maintenance, always install the guards after the maintenance is performed.

Keep objects away from moving fan blades. The fan blade will throw objects or cut objects.

Do not use a kinked wire cable or a frayed wire cable. Wear gloves when you handle wire cable.

When you strike a retainer pin with force, the retainer pin can fly out. The loose retainer pin can injure personnel. Make sure that the area is clear of people when you strike a retainer pin. To avoid injury to your eyes, wear protective glasses when you strike a retainer pin.

Chips or other debris can fly off an object when you strike the object. Make sure that no one can be injured by flying debris before striking any object.

i07746334

Burn Prevention

SMCS Code: 7000

Do not touch any part of an operating engine. Allow the engine to cool before any maintenance is performed on the engine. Relieve all pressure in the air system, in the oil system, in the lubrication system, in the fuel system, or in the cooling system before any lines, fittings, or related items are disconnected.

Coolant

When the engine is at operating temperature, the engine coolant is hot. The coolant is also under pressure. The radiator and all lines to the heaters or to the engine contain hot coolant.

Any contact with hot coolant or with steam can cause severe burns. Allow cooling system components to cool before the cooling system is drained.

Check the coolant level only after the engine has been stopped.

Ensure that the filler cap is cool before removing the filler cap. The filler cap must be cool enough to touch with a bare hand. Remove the filler cap slowly to relieve pressure.

Cooling system conditioner contains alkali. Alkali can cause personal injury. Do not allow alkali to contact the skin, the eyes, or the mouth.

Oils

Hot oil and hot components can cause personal injury. Do not allow hot oil to contact the skin. Also, do not allow hot components to contact the skin.

Remove the hydraulic tank filler cap only after the engine has been stopped. The filler cap must be cool enough to touch with a bare hand. Follow the standard procedure in this manual to remove the hydraulic tank filler cap.

Batteries

The liquid in a battery is an electrolyte. Electrolyte is an acid that can cause personal injury. Do not allow electrolyte to contact the skin or the eyes.

Do not smoke while checking the battery electrolyte levels. Batteries give off flammable fumes which can explode.

Always wear protective glasses when you work with batteries. Wash hands after touching batteries. The use of gloves is recommended.

i06179517

Fire Prevention and Explosion Prevention

SMCS Code: 7000



Illustration 53

g00704000

Regeneration

The exhaust gas temperatures during regeneration will be elevated. Follow proper fire prevention instructions and use the disable regeneration function (if equipped) when appropriate.

General

All fuels, most lubricants, and some coolant mixtures are flammable.

To minimize the risk of fire or explosion, Caterpillar recommends the following actions.

Always perform a Walk-Around Inspection, which may help you identify a fire hazard. Do not operate a machine when a fire hazard exists. Contact your Cat dealer for service.

Understand the use of the primary exit and alternative exit on the machine. Refer to Operation and Maintenance Manual, "Alternative Exit".

Do not operate a machine with a fluid leak. Repair leaks and clean up fluids before resuming machine operation. Fluids that are leaking or spilled onto hot surfaces or onto electrical components can cause a fire. A fire may cause personal injury or death.

Remove flammable material such as leaves, twigs, papers, trash, and so on. These items may accumulate in the engine compartment or around other hot areas and hot parts on the machine.

Keep the access doors to major machine compartments closed and access doors in working condition in order to permit the use of fire suppression equipment, in case a fire should occur.

Clean all accumulations of flammable materials such as fuel, oil, and debris from the machine.

Do not operate the machine near any flame.

Keep shields in place. Exhaust shields (if equipped) protect hot exhaust components from oil spray or fuel spray in a break in a line, in a hose, or in a seal. Exhaust shields must be installed correctly.

Do not weld or flame cut on tanks or lines that contain flammable fluids or flammable material. Empty and purge the lines and tanks. Then clean the lines and tanks with a nonflammable solvent prior to welding or flame cutting. Ensure that the components are properly grounded in order to avoid unwanted arcs.

Dust that is generated from repairing nonmetallic hoods or fenders may be flammable and/or explosive. Repair such components in a ventilated area away from open flames or sparks. Use suitable Personal Protection Equipment (PPE).

Inspect all lines and hoses for wear or deterioration. Replace damaged lines and hoses. The lines and the hoses should have adequate support and secure clamps. Tighten all connections to the recommended torque. Damage to the protective cover or insulation may provide fuel for fires.

Store fuels and lubricants in properly marked containers away from unauthorized personnel. Store oily rags and flammable materials in protective containers. Do not smoke in areas that are used for storing flammable materials.



Illustration 54

g03839130

Use caution when you are fueling a machine. Do not smoke while you are fueling a machine. Do not fuel a machine near open flames or sparks. Do not use cell phones or other electronic devices while you are refueling. Always stop the engine before fueling. Fill the fuel tank outdoors. Properly clean areas of spillage.

Avoid static electricity risk when fueling. Ultra low sulfur diesel (ULSD) poses a greater static ignition hazard than earlier diesel formulations with a higher sulfur content. Avoid death or serious injury from fire or explosion. Consult with your fuel or fuel system supplier to ensure that the delivery system is in compliance with fueling standards for proper grounding and bonding practices.

Never store flammable fluids in the operator compartment of the machine.

Battery and Battery Cables



Illustration 55

g03839133

Caterpillar recommends the following in order to minimize the risk of fire or an explosion related to the battery.

Do not operate a machine if battery cables or related parts show signs of wear or damage. Contact your Cat dealer for service.

Follow safe procedures for engine starting with jump-start cables. Improper jumper cable connections can cause an explosion that may result in injury. Refer to Operation and Maintenance Manual, "Engine Starting with Jump Start Cables" for specific instructions.

Do not charge a frozen battery. This may cause an explosion.

Gases from a battery can explode. Keep any open flames or sparks away from the top of a battery. Do not smoke in battery charging areas. Do not use cell phones or other electronic devices in battery charging areas.

Never check the battery charge by placing a metal object across the terminal posts. Use a voltmeter in order to check the battery charge.

Daily inspect battery cables that are in areas that are visible. Inspect cables, clips, straps, and other restraints for damage. Replace any damaged parts. Check for signs of the following, which can occur over time due to use and environmental factors:

- Fraying

- Abrasion
- Cracking
- Discoloration
- Cuts on the insulation of the cable
- Fouling
- Corroded terminals, damaged terminals, and loose terminals

Replace damaged battery cable(s) and replace any related parts. Eliminate any fouling, which may have caused insulation failure or related component damage or wear. Ensure that all components are reinstalled correctly.

An exposed wire on the battery cable may cause a short to ground if the exposed area comes into contact with a grounded surface. A battery cable short produces heat from the battery current, which may be a fire hazard.

An exposed wire on the ground cable between the battery and the disconnect switch may cause the disconnect switch to be bypassed if the exposed area comes into contact with a grounded surface. This may result in an unsafe condition for servicing the machine. Repair components or replace components before servicing the machine.

WARNING

Fire on a machine can result in personal injury or death. Exposed battery cables that come into contact with a grounded connection can result in fires. Replace cables and related parts that show signs of wear or damage. Contact your Cat dealer.

Wiring

Check electrical wires daily. If any of the following conditions exist, replace parts before you operate the machine.

- Fraying
- Signs of abrasion or wear
- Cracking
- Discoloration
- Cuts on insulation
- Other damage

Make sure that all clamps, guards, clips, and straps are reinstalled correctly. This will help to prevent vibration, rubbing against other parts, and excessive heat during machine operation.

Attaching electrical wiring to hoses and tubes that contain flammable fluids or combustible fluids should be avoided.

Consult your Cat dealer for repair or for replacement parts.

Keep wiring and electrical connections free of debris.

Lines, Tubes, and Hoses

Do not bend high-pressure lines. Do not strike high-pressure lines. Do not install any lines that are bent or damaged. Use the appropriate backup wrenches in order to tighten all connections to the recommended torque.

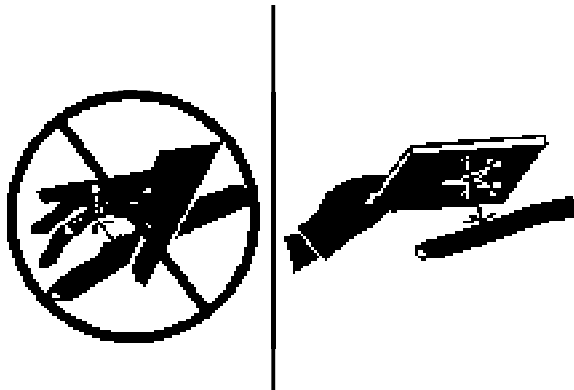


Illustration 56

g00687600

Check lines, tubes, and hoses carefully. Wear Personal Protection Equipment (PPE) in order to check for leaks. Always use a board or cardboard when you check for a leak. Leaking fluid that is under pressure can penetrate body tissue. Fluid penetration can cause serious injury and possible death. A pin hole leak can cause severe injury. If fluid is injected into your skin, you must get treatment immediately. Seek treatment from a doctor that is familiar with this type of injury.

Replace the affected parts if any of the following conditions are present:

- End fittings are damaged or leaking.
- Outer coverings are chafed or cut.
- Wires are exposed.
- Outer coverings are swelling or ballooning.
- Flexible parts of the hoses are kinked.
- Outer covers have exposed embedded armoring.
- End fittings are displaced.

Make sure that all clamps, guards, and heat shields are installed correctly. During machine operation, this will help to prevent vibration, rubbing against other parts, excessive heat, and failure of lines, tubes, and hoses.

Do not operate a machine when a fire hazard exists. Repair any lines that are corroded, loose, or damaged. Leaks may provide fuel for fires. Consult your Cat dealer for repair or for replacement parts. Use genuine Cat parts or the equivalent, for capabilities of both the pressure limit and temperature limit.

Ether

Ether (if equipped) is commonly used in cold-weather applications. Ether is flammable and poisonous.

Only use approved Ether canisters for the Ether dispensing system fitted to your machine, do not spray Ether manually into an engine, follow the correct cold engine starting procedures. Refer to the section in the Operation and Maintenance Manual with the label "Engine Starting".

WARNING

Manually spraying Ether into an engine with a Diesel Particulate Filter (DPF) may result in the accumulation of Ether in the DPF and an explosion. This in conjunction with other factors may result in an injury or death.

Use ether in ventilated areas. Do not smoke while you are replacing an ether cylinder.

Do not store ether cylinders in living areas or in the operator compartment of a machine. Do not store ether cylinders in direct sunlight or in temperatures above 49° C (120.2° F). Keep ether cylinders away from open flames or sparks.

Dispose of used ether cylinders properly. Do not puncture an ether cylinder. Keep ether cylinders away from unauthorized personnel.

Fire Extinguisher

As an additional safety measure, keep a fire extinguisher on the machine.

Be familiar with the operation of the fire extinguisher. Inspect the fire extinguisher and service the fire extinguisher regularly. Follow the recommendations on the instruction plate.

Consider installation of an aftermarket Fire Suppression System, if the application and working conditions warrant the installation.

i07041871

Fire Safety

SMCS Code: 7000

Note: Locate secondary exits and how to use the secondary exits before you operate the machine.

Note: Locate fire extinguishers and how to use a fire extinguisher before you operate the machine.

If you find that you are involved in a machine fire, your safety and that of others on site are the top priority. The following actions should only be performed if the actions do not present a danger or risk to you and any nearby people. Assess the risk of personal injury and move away to a safe distance as soon as you feel unsafe.

Move the machine away from nearby combustible material such as fuel/oil stations, structures, trash, mulch, and timber.

Lower any implements and turn off the engine as soon as possible. If you leave the engine running, the engine will continue to feed a fire. The fire will be fed from any damaged hoses that are attached to the engine or pumps.

If possible, turn the battery disconnect switch to the OFF position. Disconnecting the battery will remove the ignition source in the event of an electrical short. Disconnecting the battery will eliminate a second ignition source if electrical wiring is damaged by the fire, resulting in a short circuit.

Notify emergency personnel of the fire and your location.

If your machine is equipped with a fire suppression system, follow the manufacturers procedure for activating the system.

Note: Fire suppression systems need to be regularly inspected by qualified personnel. You must be trained to operate the fire suppression system.

If you are unable to do anything else, shut off the machine before exiting. By shutting off the machine, fuels will not continue to be pumped into the fire.

If the fire grows out of control, be aware of the following risks:

- Tires on wheeled machines pose a risk of explosion as tires burn. Hot shrapnel and debris can be thrown great distances in an explosion.
- Tanks, accumulators, hoses, and fittings can rupture in a fire, spraying fuels and shrapnel over a large area.

- Remember that nearly all the fluids on the machine are flammable, including coolant and oils. Additionally, plastics, rubbers, fabrics, and resins in fiberglass panels are also flammable.

i06952417

Fire Extinguisher Location

SMCS Code: 7000; 7419



Illustration 57

g06188176

Installation of a fire extinguisher is recommended. Be familiar with the operation of the fire extinguisher. Inspect the fire extinguisher and service the fire extinguisher regularly. Obey the recommendations on the instruction plate.

The recommended location for mounting the fire extinguisher is on the upper handrail on the right side of the machine.

i01329108

Track Information

SMCS Code: 4170; 7000

Track adjusting systems use either grease or oil under high pressure to keep the track under tension.

Grease or oil under high pressure coming out of the relief valve can penetrate the body causing injury or death. Do not watch the relief valve to see if grease or oil is escaping. Watch the track or track adjustment cylinder to see if the track is being loosened.

The pins and bushings in a dry track pin joint can become very hot. It is possible to burn the fingers if there is more than brief contact with these components.

i02546320

High Pressure Fuel Lines

SMCS Code: 1000; 1274; 7000



WARNING

Contact with high pressure fuel may cause fluid penetration and burn hazards. High pressure fuel spray may cause a fire hazard. Failure to follow these inspection, maintenance and service instructions may cause personal injury or death.

The high pressure fuel lines are the fuel lines that are between the high pressure fuel pump and the high pressure fuel manifold and the fuel lines that are between the fuel manifold and cylinder head. These fuel lines are different from fuel lines on other fuel systems.

This is because of the following differences:

- The high pressure fuel lines are constantly charged with high pressure.
- The internal pressures of the high pressure fuel lines are higher than other types of fuel system.
- The high pressure fuel lines are formed to shape and then strengthened by a special process.

Do not step on the high pressure fuel lines. Do not deflect the high pressure fuel lines. Do not bend or strike the high pressure fuel lines. Deformation or damage of the high pressure fuel lines may cause a point of weakness and potential failure.

Do not check the high pressure fuel lines with the engine or the starting motor in operation. After the engine has stopped allow 10 minutes to pass in order to allow the pressure to be purged before any service or repair is performed on the engine fuel lines.

Do not loosen the high pressure fuel lines in order to remove air from the fuel system. This procedure is not required.

Visually inspect the high pressure fuel lines before the engine is started. This inspection should be each day.

If you inspect the engine in operation, always use the proper inspection procedure in order to avoid a fluid penetration hazard. Refer to Operation and Maintenance Manual, "General hazard Information".

- Inspect the high pressure fuel lines for damage, deformation, a nick, a cut, a crease, or a dent.
- Do not operate the engine with a fuel leak. If there is a leak do not tighten the connection in order to stop the leak. The connection must only be tightened to the recommended torque. Refer to Disassembly and Assembly for your engine.

- If the high pressure fuel lines are torqued correctly and the high pressure fuel lines are leaking the high pressure fuel lines must be replaced.
- Ensure that all clips on the high pressure fuel lines are in place. Do not operate the engine with clips that are damaged, missing or loose.
- Do not attach any other item to the high pressure fuel lines.
- Loosened high pressure fuel lines must be replaced. Also removed high pressure fuel lines must be replaced. Refer to Disassembly and Assembly for your engine.

i01122596

Electrical Storm Injury Prevention

SMCS Code: 7000

When lightning is striking in the vicinity of the machine, the operator should never attempt the following procedures:

- Mount the machine.
- Dismount the machine.

If you are in the operator's station during an electrical storm, stay in the operator's station. If you are on the ground during an electrical storm, stay away from the vicinity of the machine.

i00771840

Before Starting Engine

SMCS Code: 1000; 7000

Start the engine only from the operator compartment. Never short across the starter terminals or across the batteries. Shorting could damage the electrical system by bypassing the engine neutral start system.

Inspect the condition of the seat belt and of the mounting hardware. Replace any parts that are worn or damaged. Regardless of appearance, replace the seat belt after three years of use. Do not use a seat belt extension on a retractable seat belt.

Adjust the seat so that full pedal travel can be achieved with the operator's back against the back of the seat.

Make sure that the machine is equipped with a lighting system that is adequate for the job conditions. Make sure that all machine lights are working properly.

Before you start the engine and before you move the machine, make sure that no one is underneath the machine, around the machine, or on the machine. Make sure that the area is free of personnel.

i07746368

Visibility Information

SMCS Code: 7000

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

While the machine is in operation, constantly survey the area around the machine in order to identify potential hazards as hazards become visible around the machine.

Your machine may be equipped with visual aids. Some examples of visual aids are Closed Circuit Television (CCTV) and mirrors. Before operating the machine, ensure that the visual aids are in proper working condition and that the visual aids are clean. Adjust the visual aids using the procedures that are located in this Operation and Maintenance Manual. If equipped, the Work Area Vision System shall be adjusted according to Operation and Maintenance Manual, SEBU8157, "Work Area Vision System". If equipped, the Cat Detect Object Detection shall be adjusted according to the Operation and Maintenance Manual, "Cat Detect Object Detection" for your machine.

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 and vehicle movement
- Workers that direct safe movement of traffic
- 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

Modifications of the machine configuration by the user that result in a restriction of visibility shall be evaluated.

i07575957

Restricted Visibility

SMCS Code: 7000

The size and the configuration of this machine may result in areas that cannot be seen when the operator is seated. For restricted visibility areas, an appropriate job site organization must be utilized to minimize hazards of this restricted visibility. For more information regarding job site organization refer to Operation and Maintenance Manual, "Visibility Information".

Illustrations 58 - 61 provide an approximate visual indication of the areas at ground level inside a radius of 12 m (39 ft) from the operator of significant restricted visibility for various machine configurations. Refer to the correct illustration for your machine configuration. All restricted visibility areas less than 300 mm wide may not be shown. These illustrations do not indicate areas of restricted visibility for distances outside of the shown radius. The areas of restricted visibility shown in the illustrations are with the track and work tool of the machine in the Travel position. Illustration 62 shows the position of the work tool in the travel position. The Caterpillar authorized work tool that resulted in the largest visibility restriction was used.

Illustration 58 indicates restricted visibility areas at ground level inside the shown radius from the operator without the use of visual aids that may be optional for this product in some markets.

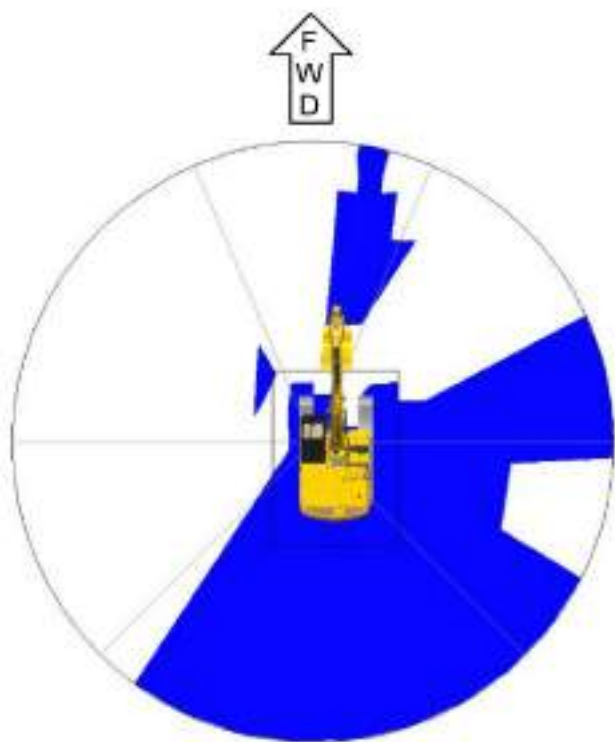


Illustration 58

g06366562

Top view of the machine, ground level visibility without use of optional visual aids

(A) 12 m (39 ft)

Note: The shaded areas indicate the approximate location of areas with significant restricted visibility.

Illustration 59 indicates restricted visibility areas at ground level inside the shown radius from the operator with the use of available rear camera, right side mirror, and left side mirror installed.

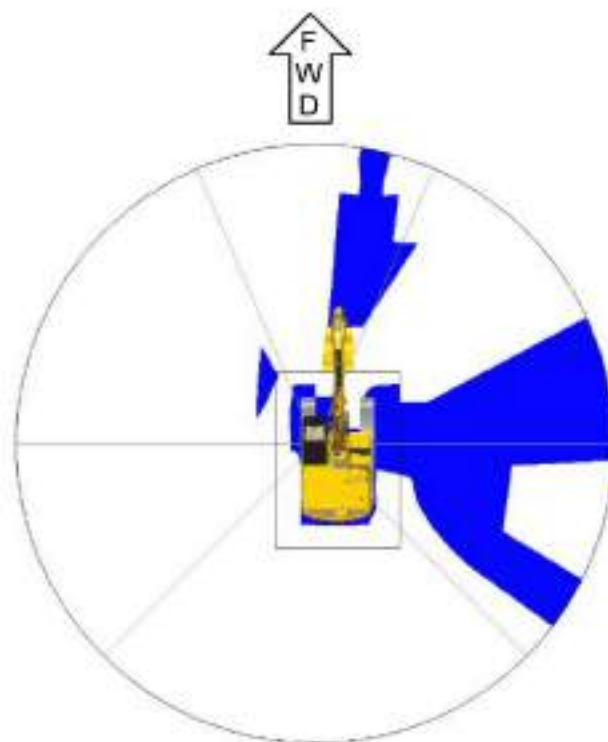


Illustration 59

g06366568

Top view of the machine, ground level visibility with rear camera, left side mirror, and right side mirror

(A) 12 m (39 ft)

Note: The shaded areas indicate the approximate location of areas with significant restricted visibility.

Illustration 60 indicates restricted visibility areas at ground level inside the shown radius from the operator with the use of available rear camera, right side camera, left side mirrors, and left side second mirror.

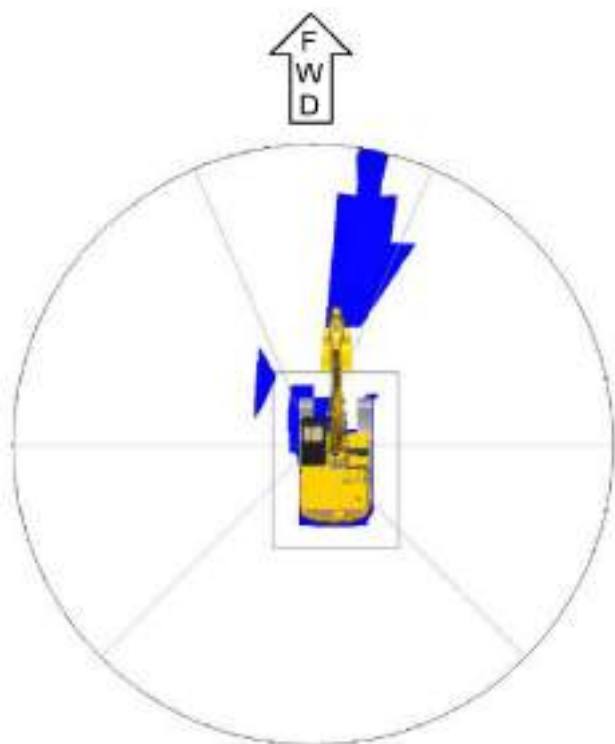


Illustration 60

g06356105

Top view of the machine, ground level visibility with rear camera, right side camera, left side mirror, and left side second mirror.

(A) 12 m (39 ft)

Note: The shaded areas indicate the approximate location of areas with significant restricted visibility.

Illustration 61 indicated restricted visibility areas at ground level inside the shown radius from the operator with the use of front camera, rear camera, right side camera, left side camera installed.

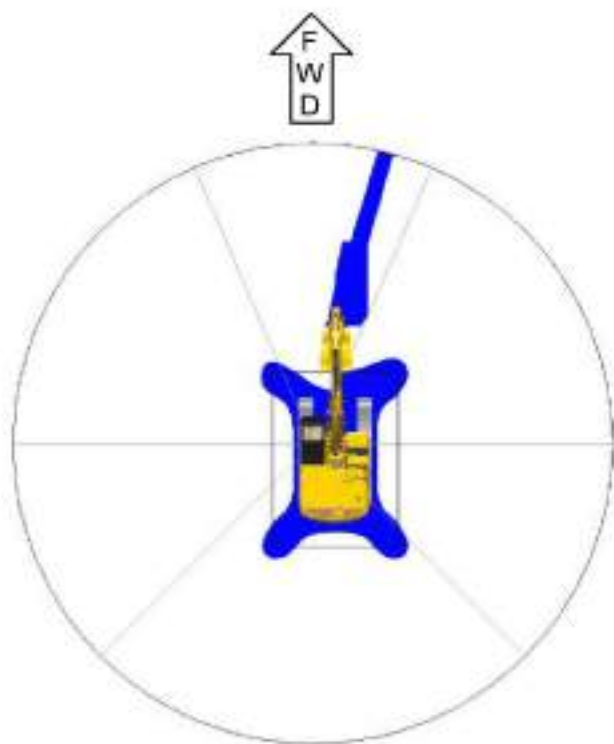


Illustration 61

g06356117

Top view of the machine, 360 visibility with front camera, rear camera, right side camera, and left side camera.

Note: The shaded areas indicate the approximate location of areas with significant restricted visibility.

Restricted visibility is measured when the front linkage of the machine is in the travel position. Illustration 62 shows the machine in the travel position.



Illustration 62

g06181081

(A) 1 m (3.0 ft) from the front of the machine to the bucket
(B) 0.5 m (1.6 ft) from ground level

i03562260

Engine Starting

SMCS Code: 1000; 7000

If a warning tag is attached to the engine start switch or to the controls, do not start the engine. Also, do not move any controls.

Make sure that you are seated before you start the engine.

Move all hydraulic controls to the HOLD position before you start the engine. Move the hydraulic lockout control to the LOCKED position. For further details on this procedure, refer to Operation and Maintenance Manual, "Operator Controls".

Diesel engine exhaust contains products of combustion which can be harmful to your health. Always run the engine in a well ventilated area. If you are in an enclosed area, vent the exhaust to the outside.

Briefly sound the horn before you start the engine.

i01340061

Before Operation

SMCS Code: 7000

Clear all personnel from the machine and from the area.

Clear all obstacles from the machine's path. Beware of hazards (wires, ditches, etc).

Be sure that all windows are clean. Secure the doors and the windows in the open position or in the shut position.

Adjust the rearview mirrors (if equipped) for the best visibility close to the machine. Make sure that the horn, the travel alarm (if equipped), and all other warning devices are working properly.

Fasten the seat belt securely.

Warm up the engine and the hydraulic oil before operating the machine.

Before moving the machine, check the position of the undercarriage. The normal travel position is with the idler wheels to the front under the cab and the drive sprockets to the rear. When the undercarriage is in the reversed position, the directional controls must be operated in opposite directions.

i04159629

Work Tools

SMCS Code: 6700

Only use work tools that are recommended by Caterpillar for use on Cat machines.

Use of work tools, including buckets, which are outside of Caterpillar's recommendations or specifications for weight, dimensions, flows, pressures, and so on, may result in less-than-optimal vehicle performance, including but not limited to reductions in production, stability, reliability, and component durability. Caterpillar recommends appropriate work tools for our machines to maximize the value our customers receive from our products. Caterpillar understands that special circumstances may lead a customer to use tools outside of our specifications. In these cases, customers must be aware that such choices can reduce vehicle performance and will affect their ability to claim warranty in the event of what a customer may perceive as a premature failure.

Work tools and work tool control systems, that are compatible with your Cat machine, are required for safe machine operation and/or reliable machine operation. If you are in doubt about the compatibility of a particular work tool with your machine, consult your Cat dealer.

Make sure that all necessary guarding is in place on the host machine and on the work tool.

Keep all windows and doors closed on the host machine. A polycarbonate shield must be used when the host machine is not equipped with windows and when a work tool could throw debris.

Do not exceed the maximum operating weight that is listed on the ROPS certification.

If your machine is equipped with an extendable stick, install the transport pin when you are using the following work tools: hydraulic hammers, augers and compactors

Always wear protective glasses. Always wear the protective equipment that is recommended in the operation manual for the work tool. Wear any other protective equipment that is required for the operating environment.

To prevent personnel from being struck by flying objects, ensure that all personnel are out of the work area.

While you are performing any maintenance, any testing, or any adjustments to the work tool stay clear of the following areas: cutting edges, pinching surfaces and crushing surfaces.

Never use the work tool for a work platform.

i07199415

Assist and E-Fence

SMCS Code: 5050

WARNING

Personal Responsibility

When the Assist System is engaged, the Assist System will control various machine functions. The Assist System is not a substitute for the personal judgment of an operator for the present work site situation or work site conditions. Failure to pay attention to work site situations or work site conditions with the Assist System engaged could result in personal injury or death. Always be aware of the work site situation and work site conditions when operating the machine with the Assist System engaged.

WARNING

Be Alert

Due to system limitations with the Assist System, warnings from the Assist System may be issued late, improperly, or not at all. Failure to respond to warnings from the Assist System with appropriate action could result in personal injury or death. Always be alert when operating a machine with the Assist System engaged and be ready to intervene to prevent an accident.

Operation Guidance

- Ground personnel should maintain a safe distance from the machine. Remain out of the swing radius/swing zone, and always check for ground personnel in the swing radius/swing zone. Do not operate with ground personnel in the swing radius/swing zone.
- When setting height or load restrictions, make sure that any work tools that are attached are in the least favorable position.
- Check for the correct operation once the restriction has been set.
- Validate proper settings both initially and periodically during machine operation.
- Do not move the (machine) quickly when close to a restriction setting.
- Do not operate the machine in a reckless manner.
- Do not travel with the restriction set.
- Reset the load restriction if the machine is moved to a different location.
- Always check settings or reestablish desired settings after leaving the machine for any period to ensure desired performance.
- If the proper setting procedure has been followed, but the system does not appear to be functioning properly, consult your Cat dealer.

Hazard recommendations:

- Return the joysticks to the neutral position once a limit has been reached
- Operate the machine at a slow speed
- Do not travel

Lifting operations with the machine

- Ensure that Lift Mode is selected during lifting operations
- Operate the machine at a safe speed
- Take special care when traveling with a load attached

- Do not operate the machine in a reckless manner

i07889511

Operation

SMCS Code: 7000

Machine Operating Temperature Range

The machine must function satisfactorily in the anticipated ambient temperature limits that are encountered during operation. The standard machine configuration is intended for use within an ambient temperature range of -18°C (0°F) to 43°C (109°F). Special configurations for different ambient temperatures may be available. Consult your Cat dealer for additional information on special configurations of your machine.

Limiting Conditions and Criteria

Limiting conditions are immediate issues with this machine that must be addressed prior to continuing operation.

The Operation and Maintenance Manual, Safety Section describes limiting condition criteria for replacing items such as safety messages, seat belt and mounting hardware, lines, tubes, hoses, battery cables and related parts, electrical wires, and repairing any fluid leak.

The Operation and Maintenance Manual, Maintenance Interval Schedule describes limiting condition criteria that require repair or replacement for items (if equipped) such as alarms, horns, braking system, steering system, and rollover protective structures.

The Operation and Maintenance Manual, Monitoring System (if equipped) provides information on limiting condition criteria, including a Warning Category 3 that requires immediate shutdown of the engine.

Critical Failures

The following table provides summary information on several limiting conditions found in this Operation and Maintenance Manual. The table provides criteria and required action for the limiting conditions listed. Each System or Component in this table, together with the respective limiting condition, describes a potential critical failure that must be addressed. Not addressing limiting conditions with required actions may, in conjunction with other factors or circumstances, result in a risk of personal injury or death. If an accident occurs, notify emergency personnel and provide location and description of accident.

Safety Section
Operation

Table 1

System or Component Name	Limiting Condition	Criteria for Action	Required Action
Line, tubes, and hoses	End fittings are damaged or leaking. Outer coverings are chafed or cut. Wires are exposed. Outer coverings are swelling or ballooning. Flexible parts of the hoses are kinked. Outer covers have exposed embedded armoring. End fittings are displaced.	Visible corrosion, loose, or damaged lines, tubes, or hoses. Visible fluid leaks.	Immediately repair any lines, tubes, or hoses that are corroded, loose, or damaged. Immediately repair any leaks as these may provide fuel for fires.
Electrical Wiring	Signs of fraying, abrasion, cracking, discoloration, cuts on the insulation	Visible damage to electrical wiring	Immediately replace damaged wiring
Battery cable(s)	Signs of fraying, abrasion, cracking, discoloration, cuts on the insulation of the cable, fouling, corroded terminals, damaged terminals, and loose terminals	Visible damage to battery cable(s)	Immediately replace damaged battery cables
Operator Protective Structure	Structures that are bent, cracked, or loose. Loose, missing, or damaged bolts.	Visible damage to structure. Loose, missing, or damaged bolts.	Do not operate machine with damaged structure or loose, missing, or damaged bolts. Contact your Cat dealer for inspection and repair or replacement options.
Seat Belt	Worn or damaged seat belt or mounting hardware	Visible wear or damage	Immediately replace parts that are worn or damaged.
Seat Belt	Age of seat belt	Three years after date of installation	Replace seat belt three years after date of installation
Safety Messages	Appearance of safety message	Damage to safety messages making them illegible	Replace the illustrations if illegible.
Audible Warning Device(s) (if equipped)	Sound level of audible warning	Reduced or no audible warning present	Immediately repair or replace audible warning devices not working properly.
Camera(s) (if equipped)	Dirt or debris on camera lens	Dirt or debris obstructing camera view	Clean camera before operating machine.
Cab Windows (if equipped)	Dirt, debris, or damaged windows	Dirt or debris obstructing operator visibility. Any damaged windows.	Clean windows before operating machine. Repair or replace damaged windows before operating machine.
Mirrors (if equipped)	Dirt, debris, or damaged mirror	Dirt or debris obstructing operator visibility. Any damaged mirrors.	Clean mirrors before operating machine. Repair or replace damaged mirrors before operating machine.
Braking System	Inadequate braking performance	System does not pass Braking System - Test(s) included in Maintenance Section or in the Testing and Adjusting Manual	Contact your Cat dealer to inspect and, if necessary, repair the brake system.
Cooling System	The coolant temperature is too high.	Monitoring System displays Warning Category 3	Stop the engine immediately. Check the coolant level and check the radiator for debris. Refer to Operation and Maintenance Manual, Cooling System Coolant Level - Check. Check the fan drive belts for the water pump. Refer to Operation and Maintenance Manual, Belts - Inspect/Adjust/ Replace. Make any necessary repairs.
Engine Oil System	A problem has been detected with the engine oil pressure.	Monitoring System displays Warning Category 3	If the warning stays on during low idle, stop the engine and check the engine oil level. Perform any necessary repairs as soon as possible.
Engine system	An engine fault has been detected by the engine ECM.	Monitoring System displays Warning Category 3	Stop the engine immediately. Contact your Cat dealer for service.
Fuel System	A problem has been detected with the fuel system.	Monitoring System displays Warning Category 3	Stop the engine. Determine the cause of the fault and perform any necessary repairs.
Hydraulic Oil System	The hydraulic oil temperature is too high.	Monitoring System displays Warning Category 3	Stop the engine immediately. Check the hydraulic oil level and check the hydraulic oil cooler for debris. Perform any necessary repairs as soon as possible.

(continued)

(Table 1, contd)

System or Component Name	Limiting Condition	Criteria for Action	Required Action
Steering System	A problem has been detected with the steering system. (If equipped with steering system monitoring.)	Monitoring System displays Warning Category 3	Move machine to a safe location and stop the engine immediately. Contact your Cat dealer to inspect and, if necessary, repair the steering system.
Overall Machine	Machine service is required.	Monitoring System displays Warning Category 3	Stop the engine immediately. Contact your Cat dealer for service.

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.

Check for proper operation of all controls and of all protective devices while you operate the machine slowly in an open area.

When the machine is moving watch the clearance of the boom. Uneven ground can cause the boom to move in all directions.

Make sure that no personnel will be endangered before you move the machine. Do not allow riders on the machine unless the machine has an additional seat with a seat belt.

Report any machine damage that was noted during machine operation. Make any necessary repairs.

Never use the work tool for a work platform.

Hold attachments approximately 40 cm (15 inches) above ground level while you drive the machine. Do not drive the machine close to an overhang, to the edge of a cliff, or to the edge of an excavation.

If the machine begins to sideslip on a grade, immediately dump the load and turn the machine downhill.

Be careful to avoid any ground condition which could cause the machine to tip. Tipping can occur when you work on hills, on banks, or on slopes. Tipping can also occur when you cross ditches, ridges, or other unexpected obstructions.

When possible, operate the machine up slopes and down slopes with the final drive sprockets facing down the slope. Avoid operating the machine across the slope. Place the heaviest end of the machine uphill when you are working on an incline.

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

Avoid changing the direction of travel on a slope. Changing the direction of travel on a slope could result in tipping or side slipping of the machine.

Bring the load close to the machine before traveling any distances.

Bring the load close to the machine before swinging the load.

Lifting capacity decreases as the load is moved further from the machine.

Make sure that the towing eyes and the towing devices are adequate for your needs.

Only connect trailing equipment to a drawbar or to a hitch.

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

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

Check the local regulations, state codes, and/or directives of the job site for a specific minimum distance from obstacles.

Before you operate the machine, check with local utilities for the locations of underground pipes and for the locations of buried cables.

Know the maximum dimensions of your machine.

Watch the load at all times.

Do not operate the machine without the counterweight. The machine can tip when the boom is over the side.

The clamshell, the grapple, or the magnet can swing in all directions. Move the joysticks in a continuous motion. Failure to move the joysticks in a continuous motion can cause the clamshell, the grapple, or the magnet to swing into the cab or into a person in the work area. This will result in personal injury.

Certain machine front linkage combinations (boom, stick, quick coupler, work tool) can allow the work tool to contact the machine undercarriage, swing frame, boom, boom hydraulic cylinder and or the cab. Be aware of the position of the work tool while you operate the machine.

Shut down the machine until damaged or non-functioning visibility aid(s) is repaired (if applicable) or until appropriate job site organization is used to minimize hazards that are caused by any resulting restricted visibility.

Machine Operation when the Machine is not Completely Assembled



Illustration 63

g02202544

Attach the tag to the controls of the machine. When the tag is attached to the controls, operate the machine as described below.

If the machine needs to be operated without the boom, stick, and/or counterweight being installed, the machine should be operated slowly on flat, stable ground or pavement by qualified operators. Avoid any machine operations which could affect machine stability, including the swing function. The ROPS structural certification depends on the support of the boom, stick, and counterweight in the event of a machine tip over or a machine rollover incident.

i06299648

Engine Stopping

SMCS Code: 1000; 7000

Do not stop the engine immediately after the machine has been operated under load. Stopping the engine immediately can cause overheating and accelerated wear of engine components.

After the machine is parked and the parking brake is engaged, allow the engine to run at low idle for 5 minutes before shutdown. Running the engine allows hot areas of the engine to cool gradually.

i06304391

Lifting Objects

SMCS Code: 7000

There may be local regulations and/or government regulations that govern the use of machines which lift heavy objects. Obey all local and government regulations.

If this machine is used to lift objects within an area that is controlled by the European Directive "2006/42/EC", the machine must be equipped with a boom lowering control valve, a stick lowering control valve, and an overload warning device.

If this machine is used to lift objects within Japan, Japanese regulations require the machine to be equipped with a shovel crane configuration.

Contact your Cat dealer for additional information

i07749631

Demolition

SMCS Code: 6700

There maybe local regulations and/or government regulations that govern the use of machines which are designed and used as demolition machinery.

Note: Obey all local and government regulations.

Demolition machinery is designed for demolishing by pushing or pulling, or fragmenting. Demolition is done by crushing or shearing, buildings and/or other civil engineering structures and component parts and/or separating the resultant debris.

If this machine is used for demolition within an area that is controlled by the European Directive 2006/42/EC, the machine must be equipped with:

- Rollover Protective Structure (ROPS, not required for demolition excavators)
- Boom Lowering Control Valve (BLCV) / Stick Lowering Control Valve (SLCV)
- Top Guard / Front Guard
- Bottom / Motor / Swivel Guard
- EN 356 class P5A front window glass
- If a roof window is used to provide visibility to the working area, then roof window shall be equipped with motorized windscreen wipers and washers.

Demolition applications may generate flying debris. Ensure that there are no personnel in the area around the machine where flying debris may travel.

Demolition applications may generate airborne dust that can be hazardous to your health. If you operate the machine in a dust generating applications, use appropriate safeguarding or adequate ventilation to minimize risk.

i07946718

Parking

SMCS Code: 7000

The hydraulic system controls remain pressurized if the accumulator is charged. This condition is true even when the engine is not running. The hydraulic control system pressure should decrease in a short time (approximately 1 minute). While the hydraulic controls maintain a charge, the hydraulic work tools and machine controls remain functional.

There can be residual pressure within the hydraulic system even when the accumulator is empty. Refer to this Operation and Maintenance Manual, "System Pressure Release" before any service is performed to the hydraulic system.

Machine movement that is sudden and unexpected will occur if any of the controls are moved. Machine movement that is sudden and unexpected, can cause personal injury or death.

Always move the hydraulic lockout control to the LOCKED position before you shut off the engine or immediately after the engine stops running.

Park the machine on a hard, level surface. If you must park the machine on a grade, chock the tracks of the machine.



Illustration 64

g06181120

Place the machine in the servicing position.

Note: Make sure that all work tools are in the recommended servicing position before servicing the machine.

Stop the engine.

Turn the engine start switch to the OFF position.

Turn the battery disconnect switch to the OFF position, if you do not intend on operating the machine for an extended period. This will prevent drainage of the battery. A battery short circuit, any current draw from certain components, and vandalism can cause drainage of the battery.

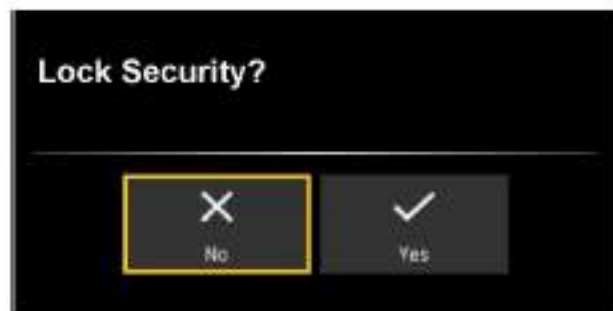


Illustration 65

g06217247

Note: Do not turn off the battery disconnect switch until 5 seconds have elapsed after turning the engine start switch to the OFF position. Do not turn off the battery disconnect switch while the "Lock Security?" screen is displayed on the monitor. Both conditions would prevent the Diesel Exhaust Fluid (DEF) system from being purged and could cause the fluid to freeze in the lines.

Install barriers or lighting as required to prevent interference in road traffic.

Select places free of danger by flooding and other water damage.

i07746366

Slope Operation

SMCS Code: 7000

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, and tire inflation pressures. 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 or tires – Narrower tracks or narrower tires 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. This may also decrease the weight on the uphill tires. 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.

Note: Operators with lots of experience and proper equipment for specific applications are also required. Safe operation on steep slopes may also require special machine maintenance. Refer to Lubricant Viscosities and Refill Capacities in this manual for the proper fluid level requirements and intended machine use. Fluids must be at the correct levels to ensure that systems will operate properly on a slope.

i08229294

Equipment Lowering with Engine Stopped

SMCS Code: 7000-II

Before lowering any equipment with the engine stopped, clear the area around the equipment of all personnel. The procedure to use will vary with the type of equipment to be lowered. Keep in mind most systems use a high pressure fluid or air to raise or lower equipment. The procedure will cause high pressure air, hydraulic, or some other media to be released in order to lower the equipment. 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.

i07452241

Sound Information and Vibration Information

SMCS Code: 7000

Sound Level Information

The declared dynamic operator sound pressure level is 71 dB(A) when "ISO 6396: 2008" is used to measure the value for an enclosed cab. The measurement was conducted at 70% of the maximum engine cooling fan speed. The sound level may vary at different engine cooling fan speeds. The measurement was conducted with the cab doors and the cab windows closed. The cab was properly installed and maintained.

The declared sound levels listed above include both measurement uncertainty and uncertainty due to production variation.

Hearing protection may be needed when the machine is operated with an open operator station 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.

Sound Level Information for Machines in European Union Countries and in Countries that Adopt the “EU Directives”

The declared exterior sound power level (L_{WA}) is 103 dB(A) when the value is measured according to the dynamic test procedures and conditions that are specified in “ISO 6395:2008”. The measurement was conducted at 70% of the maximum engine cooling fan speed. The sound level may vary at different engine cooling fan speeds.

The declared dynamic operator sound pressure level is 71 dB(A) when “ISO 6396: 2008” is used to measure the value for an enclosed cab. The measurement was conducted at 70% of the maximum engine cooling fan speed. The sound level may vary at different engine cooling fan speeds. The measurement was conducted with the cab doors and the cab windows closed. The cab was properly installed and maintained.

The declared sound levels listed above include both measurement uncertainty and uncertainty due to production variation.

Sound Level Information for Machines in Eurasian Economic Union Countries

The declared dynamic operator sound pressure level is 71 dB(A) when “ISO 6396: 2008” is used to measure the value for an enclosed cab. The measurement was conducted at 70% of the maximum engine cooling fan speed. The sound level may vary at different engine cooling fan speeds. The measurement was conducted with the cab doors and the cab windows closed. The cab was properly installed and maintained.

The declared exterior sound power level (L_{WA}) is 103 dB(A) when the value is measured according to the dynamic test procedures and conditions that are specified in “ISO 6395:2008”. The measurement was conducted at 70% of the maximum engine cooling fan speed. The sound level may vary at different engine cooling fan speeds.

The declared sound levels listed above include both measurement uncertainty and uncertainty due to production variation.

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

Vibration Data for Track Type Excavator

Information Concerning Hand/Arm Vibration Level

When the machine is operated according to the intended use, the hand/arm vibration of this machine is below 2.5 meter per second squared.

Information Concerning Whole Body Vibration Level

This section provides vibration data and a method for estimating the vibration level for track type excavators.

Note: Vibration levels are influenced by many different parameters. Many items are listed below.

- Operator training, behavior, mode, and stress
- Job site organization, preparation, environment, weather, and material
- Machine type, quality of the seat, quality of the suspension system, attachments, and condition of the equipment

It is not possible to get precise vibration levels for this machine. The expected vibration levels can be estimated with the information in Table 2 to calculate the daily vibration exposure. A simple evaluation of the machine application can be used.

Estimate the vibration levels for the three vibration directions. For typical operating conditions, use the average vibration levels as the estimated level. With an experienced operator and smooth terrain, subtract the Scenario Factors from the average vibration level to obtain the estimated vibration level. For aggressive operations and severe terrain, add the Scenario Factors to the average vibration level to obtain the estimated vibration level.

Note: All vibration levels are in meter per second squared.

Table 2

"ISO Reference Table A - Equivalent vibration levels of whole body vibration emission for earthmoving equipment."							
Machine Type	Typical Operating Activity	Vibration Levels			Scenario Factors		
		X axis	Y axis	Z axis	X axis	Y axis	Z axis
Track Type Excavators	excavating	0,44	0,27	0,30	0,24	0,16	0,17
	hydraulic breaker application	0,53	0,31	0,55	0,30	0,18	0,28
	mining application	0,65	0,42	0,61	0,21	0,15	0,32
	transfer	0,48	0,32	0,79	0,19	0,20	0,23

Note: Refer to "ISO/TR 25398 Mechanical Vibration - Guideline for the assessment of exposure to whole body vibration of ride on operated earthmoving machines" for more information about vibration. This publication uses data that is measured by international institutes, organizations, and manufacturers. This document provides information about the whole body exposure of operators of earthmoving equipment. Refer to Operation and Maintenance Manual, SEBU8257, "The European Union Physical Agents (Vibration) Directive 2002/44/EC" for more information about machine vibration levels.

The Caterpillar suspension seat meets the criteria of "ISO 7096". This represents vertical vibration level under severe operating conditions.

Guidelines for Reducing Vibration Levels on Earthmoving Equipment

Properly adjust machines. Properly maintain machines. Operate machines smoothly. Maintain the conditions of the terrain. The following guidelines can help reduce the whole body vibration level:

1. Use the right type and size of machine, equipment, and attachments.
2. Maintain machines according to the manufacturer recommendations.
 - a. Tire pressures
 - b. Brake and steering systems
 - c. Controls, hydraulic system, and linkages
3. Keep the terrain in good condition.
 - a. Remove any large rocks or obstacles.
 - b. Fill any ditches and holes.
 - c. Provide machines and schedule time to maintain the conditions of the terrain.
4. Use a seat that meets "ISO 7096". Keep the seat maintained and adjusted.
 - a. Adjust the seat and suspension for the weight and the size of the operator.

- b. Inspect and maintain the seat suspension and adjustment mechanisms.

5. Perform the following operations smoothly.

- a. Steer
- b. Brake
- c. Accelerate.
- d. Shift the gears.

6. Move the attachments smoothly.

7. Adjust the machine speed and the route to minimize the vibration level.

- a. Drive around obstacles and rough terrain.
- b. Slow down when it is necessary to go over rough terrain.

8. Minimize vibrations for a long work cycle or a long travel distance.

- a. Use machines that are equipped with suspension systems.
- b. Use the ride control system on track type excavators.
- c. If no ride control system is available, reduce speed to prevent bounce.
- d. Haul the machines between workplaces.

9. Less operator comfort may be caused by other risk factors. The following guidelines can be effective to provide better operator comfort:

- a. Adjust the seat and adjust the controls to achieve good posture.
- b. Adjust the mirrors to minimize twisted posture.
- c. Provide breaks to reduce long periods of sitting.
- d. Avoid jumping from the cab.
- e. Minimize repeated handling of loads and lifting of loads.

- f. Minimize any shocks and impacts during sports and leisure activities.

i07746359

Sources

The vibration information and the calculation procedure is based on "ISO/TR 25398 Mechanical Vibration - Guideline for the assessment of exposure to whole body vibration of ride on operated earthmoving machines". Harmonized data is measured by international institutes, organizations, and manufacturers.

This literature provides information about assessing the whole body vibration exposure of operators of earthmoving equipment. The method is based on measured vibration emission under real working conditions for all machines.

You should check the original directive. This document summarizes part of the content of the applicable law. This document is not meant to substitute the original sources. Other parts of these documents are based on information from the United Kingdom Health and Safety Executive.

Refer to Operation and Maintenance Manual, SEBU8257, "The European Union Physical Agents (Vibration) Directive 2002/44/EC" for more information about vibration.

Consult your local Caterpillar dealer for more information about machine features that minimize vibration levels. Consult your local Caterpillar dealer about safe machine operation.

Use the following web site to find your local dealer:

Caterpillar, Inc.
www.cat.com

i07746362

Operator Station

SMCS Code: 7300; 7301; 7325

Any modifications to the inside of the operator station should not project into the operator space or into the space for the companion seat (if equipped). The addition of a radio, fire extinguisher, and other equipment must be installed so that the defined operator space and the space for the companion seat (if equipped) is maintained. Any item that is brought into the cab should not project into the defined operator space or the space for the companion seat (if equipped). A lunch box or other loose items must be secured. Objects must not pose an impact hazard in rough terrain or in the event of a rollover.

Guards (Operator Protection)

SMCS Code: 7000; 7150

There are different types of guards that are used to protect the operator. The machine and the machine application determine the type of guard that should be used.

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 an appropriate protective guard. Follow the established operating procedures that are recommended for your machine.

Rollover Protective Structure (ROPS), Falling Object Protective Structure (FOPS) or Tip Over Protection Structure (TOPS)

The ROPS/FOPS Structure (if equipped) on your machine is specifically designed, tested and certified for that machine. Any alteration or any modification to the ROPS/FOPS Structure could weaken the structure. This places the operator into an unprotected environment. Modifications or attachments that cause the machine to exceed the weight that is stamped on the certification plate also place the operator into an unprotected environment. Excessive weight may inhibit the brake performance, the steering performance and the ROPS. The protection that is offered by the ROPS/FOPS Structure will be impaired if the ROPS/FOPS Structure has structural damage. Damage to the structure can be caused by an overturn, a falling object, a collision, etc.

Do not mount items (fire extinguishers, first aid kits, work lights, etc) by welding brackets to the ROPS/FOPS Structure or by drilling holes in the ROPS/FOPS Structure. Welding brackets or drilling holes in the ROPS/FOPS Structures can weaken the structures. Consult your Cat dealer for mounting guidelines.

The Tip Over Protection Structure (TOPS) is another type of guard that is used on mini hydraulic excavators. This structure protects the operator in the event of a tipover. The same guidelines for the inspection, the maintenance and the modification of the ROPS/FOPS Structure are required for the Tip Over Protection Structure.

Other Guards (If Equipped)

Protection from flying objects and/or falling objects is required for special applications. Logging applications and demolition applications are two examples that require special protection.

A front guard needs to be installed when a work tool that creates flying objects is used. Mesh front guards that are approved by Caterpillar or polycarbonate front guards that are approved by Caterpillar are available for machines with a cab or an open canopy. On machines that are equipped with cabs, the windows should also be closed. Safety glasses are recommended when flying hazards exist for machines with cabs and machines with open canopies.

If the work material extends above the cab, top guards and front guards should be used. Typical examples of this type of application are listed below:

- Demolition applications
- Rock quarries
- Forestry products

Additional guards may be required for specific applications or work tools. The Operation and Maintenance Manual for your machine or your work tool will provide specific requirements for the guards. Refer to Operation Maintenance manual, "Demolition" for additional information. Consult your Cat dealer for additional information.

Product Information Section

General Information

i07105852

Regulatory Information (Japan)

SMCS Code: 7000

Qualifications for Machine Operation

The following qualifications are required for the operation of this machine:

Excavation and Loading

Completion of the construction machines (for land leveling, hauling, loading, and excavation) operation skill training course. (Qualification by the Industrial Safety and Health Act)

Demolition

Completion of the construction machines (for demolition) operation skill training course. (Qualification by the Industrial Safety and Health Act)

Mining Jobs

Certification by the Director General or Deputy Director General of Bureau of Mine Safety after completion of the safety training course. (Qualification by the Mine Safety Act)

Crane Slings for the Bucket with a Hook

Completion of the special slinging training for the crane for loads weighing less than 1 ton. (Qualification by the Industrial Safety and Health Act)

Trailer Transportation

In principle, this machine should be transported by a trailer. Select the appropriate trailer regarding the machine weight and measurements shown in the major specifications in the specification part of this manual. Be aware machine weight and transportation measurements differ depending on the various types of attachments.

- In the event heavy items are to be transported, observe the related laws. These laws include Road Traffic Law, Road Laws, Road Transportation Vehicle Laws, and Vehicle Restriction Laws.

- Conduct prior investigation of the road width, ground clearance of road/railway bridges, weight restrictions etc. of the planned transportation route, to confirm the viability of the transportation execution.

Load

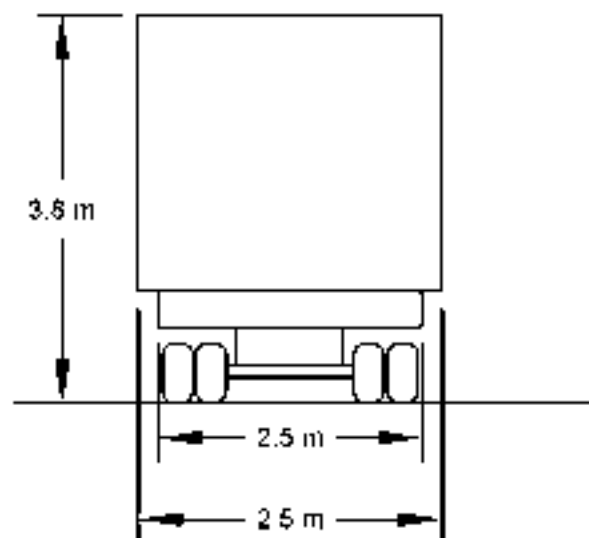


Illustration 66

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- Not more than 3.8 m (12 ft 6 inch)
- Not more than 2.5 m (8 ft 2 inch)(Safety Standard)
- Not more than 2.5 m (8 ft 2 inch) (Vehicle Restriction Laws)
- Items that protrude out are not allowed. (Government ordinance for Road Traffic Laws)

Transportation weight and measurements are restricted by the Vehicle Restriction Laws. If the actual weight/measurements exceed the limitation figures, you must submit the restriction relaxation request to the pertinent governmental agencies. For details, consult your Cat dealer.

Table 3

Total Length	Not more than 12 m (39 ft 4 inch)
Total Width (A)	Not more than 2.5 m (8 ft 2 inch)

(continued)

(Table 3, contd)

Total Height (B)	Not more than 3.8 m (12 ft 6 inch) when loaded on the trailer.
Total Weight	20 to 25 ton (depending on road, axle, and vehicle length)

Operation of Construction Equipment and the Governing Laws and Regulations

NOTICE

Various laws and regulations, including Industrial Safety and Health Act, are enforced to ensure prevention of injuries on and around construction equipment and safe and comfortable operation of equipment. Be sure to obey them.

NOTICE

The notices regarding machine operation, inspection, maintenance, and safety contained in this manual are applicable only to cases in which the machine is used for the specified jobs. It is impossible for this kind of manual to cover every kind of operation. Therefore, the content of this manual does not necessarily explain all possible cases. Be sure to pay careful attention also to the items not covered by this manual and confirm the safety before starting jobs to prevent human injury and machine damage accidents.

Qualification of Operators

Operation of construction equipment is limited to persons who have any of the following licenses by law.

Note: Employers will face imprisonment up to a maximum of 6 months or a fine of up to a maximum of five hundred thousand yen if they let unqualified personnel operate equipment. Unqualified operators will also be fined up to a maximum of five hundred thousand yen.

- One who completed an operating skill course for vehicle-type construction equipment at a registered training institution.
- One who passed the construction equipment and technologies license examination (Type 1-3) defined by the Construction Industry Law.
- One who completed an operating training course for construction equipment defined by the Vocational Training Law.

- One who took a special training (rules and skills) at a registered training institution to operate equipment weighing less than 3 tons.
- With an auto-drivers license, an operator does not need to complete an operating skill course for construction equipment to operate equipment on the roads that apply to the rules of the Road Traffic Act. However, the operator needs to complete the course to engage in snow clearing or excavating on the roads.
- The operator must be qualified under the Mine Safety Act to operate construction equipment in a mine.

Acquisition of the Qualifications

The company offers training courses for construction machine operation, in addition to other skills. For details, contact the company's dealer in your area.

Regarding machine operation qualifications, also refer to the laws related to the construction machines shown at the end of this manual.

Subsidy System

Small-to-medium-sized construction business companies are eligible to receive a subsidy for a part of training fees and wages when they have their employees attend a training course to improve skills.

Operation of Construction Equipment and the Governing Laws and Regulations

NOTICE

Information about operating skill course for vehicle-type construction equipment (for ground leveling, transporting, loading, excavating).

Industrial Safety and Health Act requires operators of construction equipment weight 3 tons and over to acquire a certificate of completion of an operating skill course. Registered with and authorized by the respective directors general of the regional labor bureaus, we offer operating skill courses for vehicle-type construction equipment and special trainings.

Request for Periodical Self-Inspection

Rules of Periodical Self-Inspection

The employer shall, as provided for by the Ordinance of the Ministry of Health, Labor and Welfare, conduct self-inspection periodically. The employer shall keep the records of the results in respect to construction equipment such as tractor shovels and power shovels, etc., specified by Cabinet Order. (from Article 45, Industrial Safe and Health Act)

Ordinance on Industrial Safety and Hygiene

Periodical self-inspections Article 167

(1) The employer shall, as regards a vehicle type construction machine, carry out self-inspections for the following matters periodically once every period within a year. However, this shall not apply to the non-use period of a vehicle type construction machine, which is not used for a period exceeding 1 year.

(2) The employer shall, as regards a vehicle type construction machine set forth in the proviso of the proceeding paragraph, carry out self-inspection for abnormalities in each part of a construction machine before resuming the operation.

Periodical self-inspections Article 168

(1) The employer shall, as regards a vehicle type construction machine, carry out self-inspections for the following matters periodically once every period within a month. However, this shall not apply to the non-use period of a vehicle type construction machine, which is not used for a period exceeding one month:

- (i) Abnormalities in a brake, a clutch, a controlling device, and working devices.
- (ii) Damage in a wire, rope, and a chain
- (iii) Damage in a bucket, a dipper, etc.

(2) The employer shall, as regards to the vehicle type construction machine set forth in the proviso of the preceding paragraph, carry out self-inspection for the matters listed in each item of the same paragraph before resuming the operation.

Record of Periodical Self-Inspections Article 169

The employer shall, when having carried out the self-inspections set forth in the preceding two Articles, record the results and retain the records for 3 years.

Specified Self-Inspection Article 169-2

The specified self-inspection pertaining to the vehicle type construction machine shall be the self-inspection (prescribed by Article 167) and carried out by qualified personnel. The employer shall, when having carried out the specified self-inspection pertaining to a vehicle type construction machine, affix an inspection sticker stating the month and year when the said specified self-inspection was carried out at a readily visible location of the said machine.

- Caterpillar Japan has a supporting program for self-inspection as a registered inspection agency. Qualified personnel and inspection equipment are available to help customers who do not conduct internal inspections or do not have time to conduct the specified self-inspections. Contact a Cat dealer near you for details.
- Maintenance and inspection record book for a record-saving purpose can be purchased at Caterpillar Japan.
- Penalty: Employer who fails to carry out self-inspections and to record the results will face a fine of up to five hundred thousand yen.

Checkup before Commencing the Work Article 170

The employer shall, when carrying out the work using a vehicle type construction machine, check functions of a brake and a clutch before commencing the work for the day.

Other Rules

Besides qualification for operating equipment and self inspections, the following obligations are set forth in the Industrial Safety and Health Act:

- To conduct health and safety training for new recruits and shop foremen.
- To appoint the operation leader or supervisor, and establish health and safety management system.
- To inform employees of a chain of command at the worksite, communication and signal rules, traveling route of equipment, speed limits, signs of restricted areas, etc. for securing safety in the workplace.

The Industrial Safety and Health Act further also set obligations related to mechanical structures and rental activities of equipment.

Safety comes before anything else. Establish a workplace where no injuries occur by observing the governing laws and by referring to this manual, specifically the descriptions on safety.

Construction Equipment and Environmental Laws

Prohibition of Emissions and Obligations to Recover Fluorocarbons

Law Concerning the Recovery and Destruction of Fluorocarbons (Enforcement date: April 1, 2015)

Being emitted into the atmosphere, Fluorocarbons, used as refrigerants of air conditioning, destroy the ozone layer and accelerate the global warming as a cause of environmental destruction. Follow the instructions below required by law when handling air conditioners to protect the global environment.

1. 1. Do not arbitrarily emit the encapsulated refrigerant installed on the product into the atmosphere.
2. 2. Recover the encapsulated refrigerant when disposing of the product.

Note: Violators of the law will face a maximum one-year imprisonment or a fine up to a maximum of five hundred thousand yen.

When you need to fill, recover a refrigerant or dispose of a product with an encapsulated refrigerant installed, please ask a filling-recovery operator registered with the government of the local prefecture as "class-1 filling-recovery operator." And carry out the simple inspection of air conditioner and keep the record.

Class-1 Specified products sold after October 1, 2015 shall have the label inside of the cab showing the type and quantity of refrigerant, GWP (Global Warming Potential), and precautions for use. (Refer to the fluorocarbon label in the OMM safety section)

Standard Certificate of Transfer

Dear Customers

Japan Construction Equipment Manufacturers Association

Standard Certificate of Transfer

Issued by the Japan Construction Equipment Manufacturers Association

Standard Certificate of Transfer issued by the Japan Construction Equipment Manufacturers Association proves the ownership of your equipment. Request us to issue the certificate as a proof of transfer of ownership.

Commercial transactions of construction equipment are generally made on a long-term installment plan basis with a special provision of reservation of ownership that the seller retains the ownership of the sold equipment until the buyer completely pays off the installments.

Ownership of some construction equipment can be proved with a vehicle inspection certificate, but the certificate is not issued for most of the equipment. Therefore, the buyer will need to present a third party with a proof of ownership of the sold equipment.

Japan Construction Equipment Manufacturers Association launched a system of standard certificate of transfer in 1971 to normalize trading in construction equipment and establishes a business practice relating to transfer of ownership. Customers are kindly requested to understand the intent of the system and request your seller to issue a certificate of transfer.

1. About the standard certificate of transfer

- a. Japan Construction Equipment Manufacturers Association (hereinafter referred to as CEMA) sets the rules and form of standard certificate of transfer (hereinafter referred to as certificate of transfer), and members of the CEMA issue the certificate of transfer. A certificate of transfer proves the ownership of equipment.

2. Purpose of issuance

- a. A certificate of transfer will be issued for the purpose of clarifying the ownership of equipment and preventing misconduct such as trades of stolen equipment or fraud.

3. Issuer

- a. A certificate of transfer will be issued by a distributor (Primary transferer) who sells new construction equipment and is authorized by the CEMA.

4. Eligibility

- a. A certificate of transfer will be issued for the equipment, which is sold by CEMA-member distributors and defined as construction equipment by the CEMA

5. Issuance

- a. A certificate of transfer will be issued and directly given to a buyer upon the buyer's request when he/she buys eligible equipment from an issuer.
- b. A certificate of transfer may not be issued for the equipment, which was sold as new merchandise more than 10 years ago.
- c. A certificate of transfer is not permitted to substitute a vehicle inspection certificate.

6. Prohibition of reissuance

- a. Certificate of transfer should be safely stored as it will not be reissued under any circumstances.

7. In case a certificate description runs out of space
- Discretionary page/s to the certificate will be valid with a tally seal of the issuer at the joint of two pages.

Contact CEMA-member companies or distributors for more details of the system.

Industrial Safety and Health Act

Article 164 (Extracted) of Industrial Safety and Health Act (Restriction on use Other Than Main Application)

Article 164

Business Operator must not use construction machineries of vehicle type for applications other than main application of the applicable construction machineries of vehicle type such as: lifting cargos by hydraulic excavator or lifting/lowering workers using the clamshell.

[2] The previous clause will not be applied for any of the following cases:

- In performing cargo lifting, any one of the following may be applicable.
 - Cannot be avoided due to the nature of the work or necessary in view of performing work in safe.
 - When working with attachments installed for metals of hook or shackle etc or other devices for lifting application applicable to any one of the following as implements for boom or bucket etc
 - Enough strength is retained bearable for loads to be applied.
 - Load lifted up is not feared to be dropped from the applicable instrument used, due to provided locking device is in use or etc.
 - Load not feared of disengaging from the implement.

- In performing work other than cargo lifting, nothing is feared to do harm to the workers.

[3] The business operator must take the following measures, in performing cargo lifting work applicable to Items 1a and 1b of Step 1 above. To prevent any danger of workers from contact with lifted cargo, drop of lifted cargo or turnover or falling down of construction machineries of vehicle type.

- Designate one person who issues a sign as well as setting up fixed signs related to cargo lifting work, and follow his signs.
- Perform work on a flat ground.
- Keep any worker away from any place where is feared to cause any danger to worker due to contact with a cargo or drop of lifted cargo.

[4] Do not perform any work applying load exceeding the allowed rated max load specified according to structure or materials of the applicable construction machineries of the vehicle type.

[5] In using wire rope in slinging device, use wire rope applicable to every item of the followings.

- Safety coefficient is 6 or more. (The safety coefficient here must be the same as specified in Article 213 item 2 in Safety Rules on Crane Works (Article 34 in Ordinance of Ministry of Labor, 1972) etc. Hereinafter called as "Crane Rules")
- Among wire rope 1 strands, numbers of cut strands (other than filler) are less than 10%.
- Reduction of diameter is 7% or less than nominal diameter.
- Free from kinking.
- Free from badly collapse and corrosion.

[6] In using lifting chain as slinging device, the chain is applicable to every item of the followings.

- Safety coefficient is 5 or more.
- Elongation is 5% or less than the length when the applicable lifting chain was fabricated.
- Reduction of diameter of the cross section of link is 10% or less than diameter of cross section of the applicable link when the applicable lifting chain was manufactured.
- Free from cracks.

[7] In using those other than wire rope and lifting chain as slinging device, they must be free from bad damage and corrosion.

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Specifications

SMCS Code: 7000

Intended Use

The intended use of this machine is for excavating with a bucket or working with approved work tools. The machine should be operated with the undercarriage in a stationary position since the upper structure is normally capable of 360 degree swing with mounted equipment. This machine can be used in object handling applications that are within the lift capacity of the machine. When this machine is used in object handling applications, ensure that the machine is properly configured and operated properly. Obey any local governmental regulations and regional governmental regulations. Only lift objects from approved lifting points and with approved lifting devices.

Expected Life

The expected life, defined as total machine hours, of this machine is dependent upon many factors including the machine owner's desire to rebuild the machine back to factory specifications. The expected life interval of this machine is 8,000 service hours. The expected life interval corresponds to the service hours to engine overhaul. Service hours to engine overhaul may vary based on overall machine duty cycle. At the expected life interval, remove the machine from operation and consult your Cat dealer for inspect, repair, rebuild, install remanufactured, install new components, or disposal options and to establish a new expected life interval. If a decision is made to remove this machine from service, refer to Operation and Maintenance Manual, "Decommissioning and Disposal".

The following items are required to obtain an economical expected life of this machine:

- Perform regular preventive maintenance procedures as described in the Operation and Maintenance Manual.
- Perform machine inspections as described in the Operation and Maintenance Manual and correct any problems discovered.
- Perform system testing as described in the Operation and Maintenance Manual and correct any problems discovered.
- Ensure that machine application conditions comply with Caterpillar's recommendations.

- Ensure that the operating weight does not exceed limits set by manufacturer.
- Ensure that all frame cracks are identified, inspected, and repaired to prevent further development.

Application/Configuration Restrictions

The maximum travel operating slope for machine lubrication is 35 degrees

The operator station is ROPS certified up to a mass of 36100 kg (79587 lb) per ISO 12117-2:2008.

Specification Data

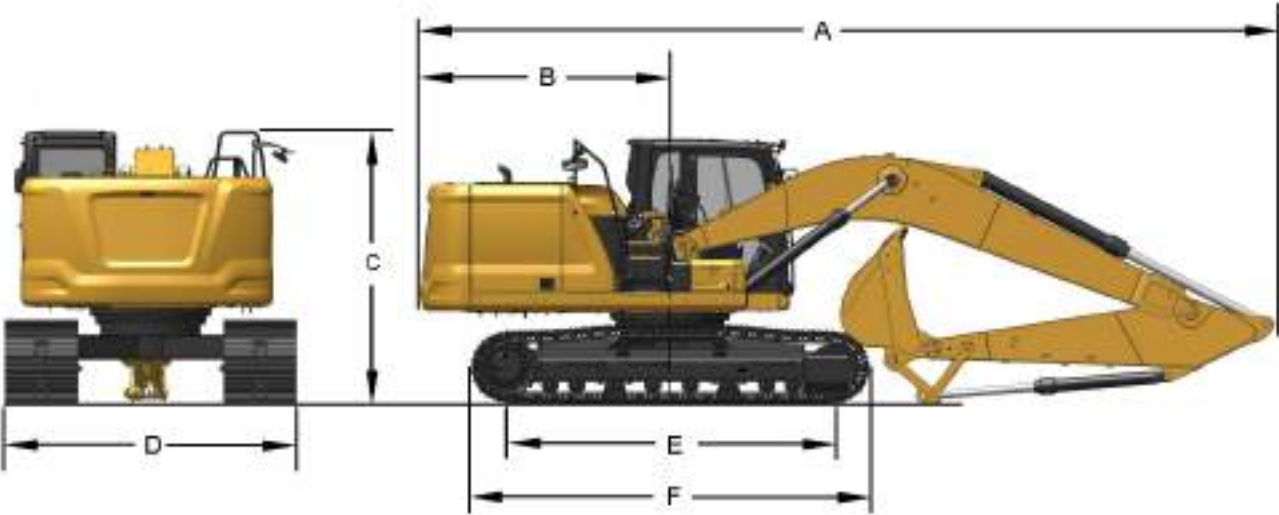


Illustration 67

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Table 4

330 Specifications							
Boom			Reach Boom			Mass Boom	SLR Boom
Stick			3.2 m (10 ft 6 inch)	2.65 m (8 ft 8 inch)	3.75 m (12 ft 4 inch)	2.5 m (8 ft 2 inch)	7.85 m (25 ft 9 inch)
Bucket			1.54 m³ (2.01 yd³)	1.54 m³ (2.01 yd³)	1.3 m³ (1.70 yd³)	2.12 m³ (2.80 yd³)	0.45 m³ (0.59 yd³)
Weight	330 ⁽¹⁾		28664 kg (63193 lb) (2)	28564 kg (62973 lb) (2)	28938 kg (63797 lb) (2)	29433 kg (64889 lb) (2)	30219 kg (66621 lb) ⁽³⁾
	330 ⁽⁴⁾		28652 kg (63167 lb) (2)	28552 kg (62946 lb) (2)	28926 kg (63771 lb) (2)	29421 kg (64862 lb) (2)	30207 kg (66595 lb) (3)
Overall Length (A)	All Models		10390 mm (34 ft 1 inch)	10400 mm (34 ft 1 inch)	10380 mm (34 ft 1 inch)	9830 mm (32 ft 3 inch)	1440 mm (47 ft 5 inch)
Swing Radius (B)	All Models		3090 mm (10 ft 2 inch)				
Overall Height (C) ⁽⁵⁾	All Models		3370 mm (11 ft 1 inch)	3450 mm (11 ft 4 inch)	3680 mm (12 ft 1 inch)	3520 mm (11 ft 7 inch)	3230 mm (10 ft 7 inch)
Overall Width (D)	330 ⁽¹⁾	600 mm (24 inch)	3190 mm (10 ft 6 inch)				
		700 mm (30 inch)	3290 mm (10 ft 10 inch)				

(continued)

Product Information Section
Specifications

(Table 4, contd)

330 Specifications					
Boom			Reach Boom		
Stick			3.2 m (10 ft 6 inch)	2.65 m (8 ft 8 inch)	3.75 m (12 ft 4 inch)
Bucket			1.54 m ³ (2.01 yd ³)	1.54 m ³ (2.01 yd ³)	1.3 m ³ (1.70 yd ³)
		800 mm (32 inch)	3390 mm (11 ft 1 inch)		
		900 mm (35 inch)	3490 mm (11 ft 5 inch)		
	330 ⁽⁴⁾	600 mm (24 inch)	2990 mm (9 ft 10 inch)		
		700 mm (30 inch)	3090 mm (10 ft 2 inch)		
		800 mm (32 inch)	3190 mm (10 ft 6 inch)		
		900 mm (35 inch)	3290 mm (10 ft 10 inch)		
Length to Centers of Rollers (E)	330 ⁽¹⁾ 330 ⁽⁴⁾		3990 mm (13 ft 1 inch)		
Length of Track (F)	330 ⁽¹⁾ 330 ⁽⁴⁾		4860 mm (15 ft 11 inch)		

⁽¹⁾ Equipped with long undercarriage

⁽²⁾ Approximate weight for machines equipped with 700 mm (30 inch) triple grouser track shoes, a 5800 kg (12787 lb) counterweight, and without a quick coupler.

⁽³⁾ Approximate weight for machines equipped with 700 mm (30 inch) triple grouser track shoes, a 6750 kg (14881 lb) counterweight, and without a quick coupler.

⁽⁴⁾ Equipped with long and narrow undercarriage

⁽⁵⁾ Including track shoe lug height

Working Ranges

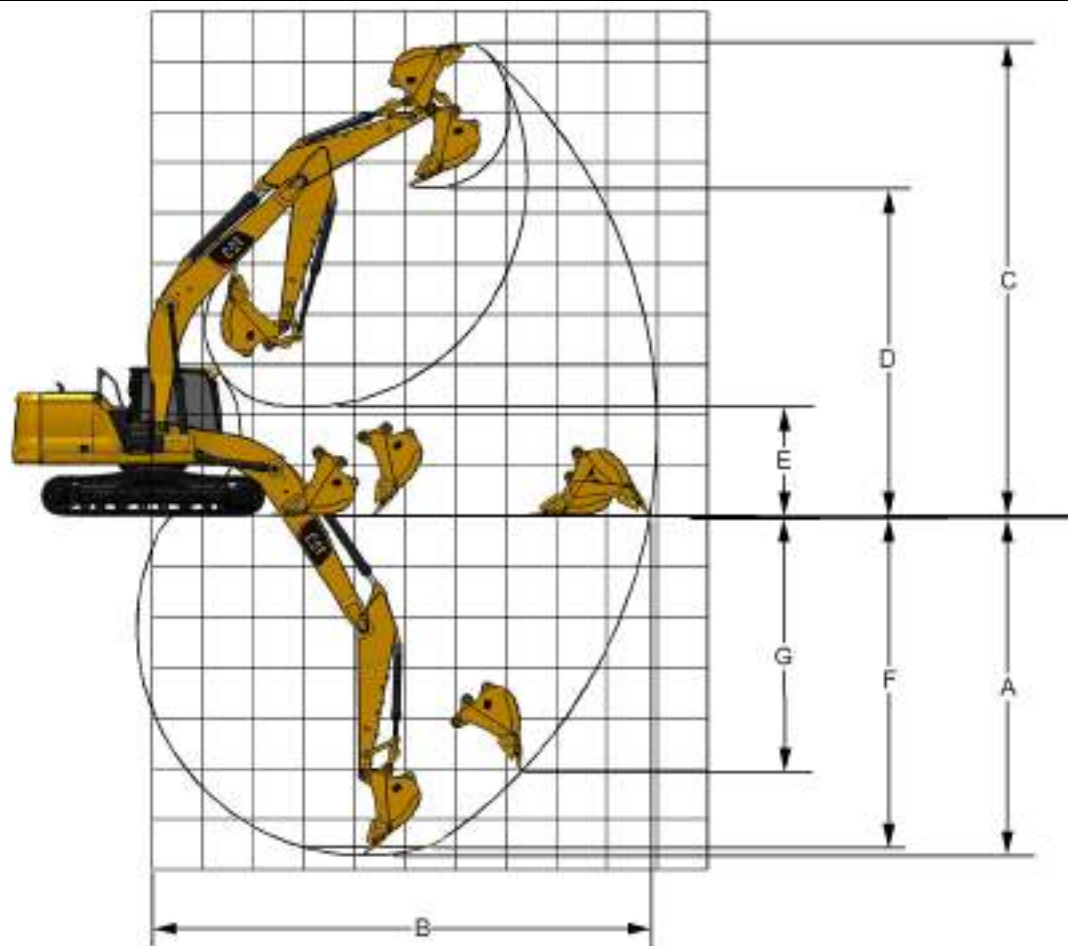


Illustration 68

Reach Boom, Mass Boom

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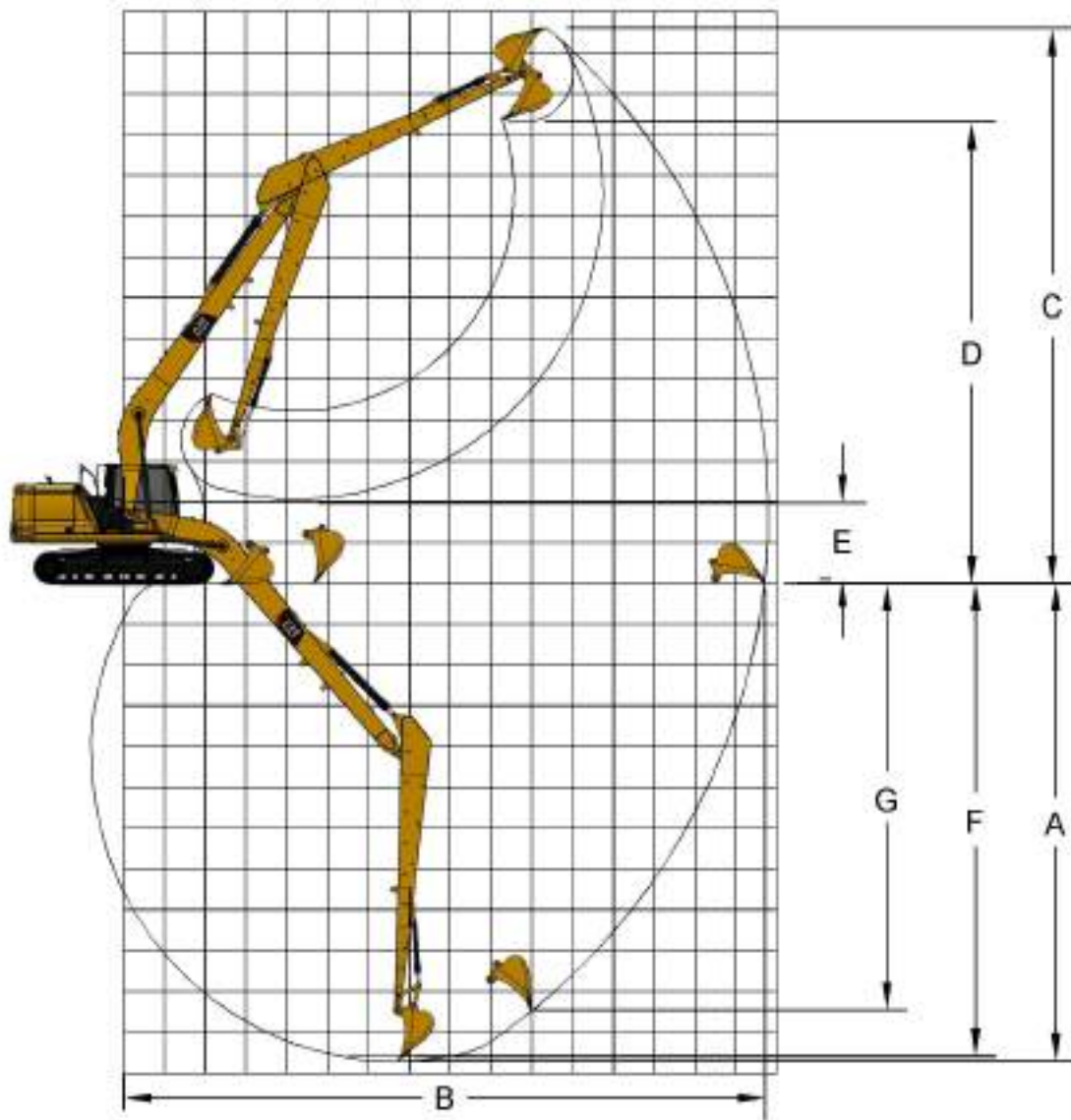


Illustration 69

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Super Long Reach (SLR)

Table 5

330					
Boom	Reach Boom			Mass Boom	SLR Boom
Stick	3.2 m (10 ft 6 inch)	2.65 m (8 ft 8 inch)	3.75 m (12 ft 4 inch)	2.5 m (8 ft 2 inch)	7.85 m (25 ft 9 inch)
Bucket	1.54 m ³ (2.01 yd ³)	1.54 m ³ (2.01 yd ³)	1.3 m ³ (1.70 yd ³)	2.12 m ³ (2.80 yd ³)	0.60 m ³ (0.78 yd ³)
Maximum Digging Depth (A)	7250 mm (23 ft 9 inch)	6700 mm (22 ft 0 inch)	7800 mm (25 ft 7 inch)	6100 mm (20 ft 0 inch)	14750 mm (48 ft 5 inch)
Maximum Reach at Ground Level (B)	10680 mm (35 ft 0 inch)	10200 mm (33 ft 6 inch)	11180 mm (36 ft 8 inch)	9430 mm (30 ft 11 inch)	18420 mm (60 ft 5 inch)
Maximum Cutting Height (C)	10010 mm (32 ft 10 inch)	9900 mm (32 ft 6 inch)	10190 mm (33 ft 5 inch)	9130 mm (29 ft 11 inch)	13620 mm (44 ft 8 inch)
Maximum Loading Height (D)	6950 mm (22 ft 10 inch)	6800 mm (22 ft 4 inch)	7140 mm (23 ft 5 inch)	6000 mm (19 ft 8 inch)	11420 mm (37 ft 6 inch)
Minimum Loading Height (E)	2290 mm (7 ft 6 inch)	2840 mm (9 ft 4 inch)	1740 mm (5 ft 9 inch)	2470 mm (8 ft 1 inch)	1170 mm (3 ft 10 inch)
Maximum Cut Depth (F) ⁽¹⁾	7090 mm (23 ft 3 inch)	6520 mm (21 ft 5 inch)	7660 mm (25 ft 2 inch)	5910 mm (19 ft 5 inch)	14650 mm (48 ft 1 inch)
Maximum Digging Depth (Vertical Wall) (G)	5980 mm (19 ft 7 inch)	5680 mm (18 ft 8 inch)	6420 mm (21 ft 1 inch)	4250 mm (13 ft 11 inch)	12690 mm (41 ft 8 inch)

⁽¹⁾ 2440 mm (8 ft) level bottom

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Boom/Stick/Bucket Combinations

SMCS Code: 6000; 6700

This machine can be equipped with a large variety of boom-stick-bucket combinations in order to meet the needs of various applications.

Buckets are grouped into families according to the capacity of the bucket. Generally, use a bucket with a smaller capacity when you are using a longer stick and/or a longer boom. Conversely, use a bucket with a larger capacity when you are using a shorter stick and/or a shorter boom. This rule ensures better machine stability and protection against structural machine damage.

A stick is designed to match only one specific family of buckets.

Note: The selection of a compatible boom-stick-bucket combination is a guide. Work tools, uneven ground conditions, soft ground conditions, or poor ground conditions have effects on machine performance. The operator is responsible for being aware of these effects.

Contact your Cat dealer for information on selecting the correct boom-stick-bucket combination.

The following tables show various compatible boom-stick-bucket combinations. Select an optimum combination according to the working conditions and according to the type of work that is being done.

330

Table 6

330 Excavator without a quick coupler												
Bucket Type	Linkage	Width of Bucket	SAE Capacity of Bucket	Weight of Bucket	Fill (%)	Long Undercarriage					Long Narrow Undercarriage	
						Reach Boom			Heavy Duty Reach Boom		Reach Boom	
						6700 kg (14770 lb) Counterweight						
						2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick	3.75 m (12 ft 4 inch) Stick	2.65 m (8 ft 10 inch) HD Stick	3.2 m (10 ft 6 inch) HD Stick	2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick
General Duty (GD)	CB	600 mm (24 inch)	0.52 m³ (0.68 yd³)	659 kg (1454 lb)	100	(1)	(1)	(1)	(1)	(1)	(1)	(1)
		750 mm (30 inch)	0.71 m³ (0.93 yd³)	731 kg (1611 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1000 mm (40 inch)	1.03 m³ (1.35 yd³)	835 kg (1841 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1050 mm (42 inch)	1.12 m³ (1.46 yd³)	865 kg (1906 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1200 mm (48 inch)	1.33 m³ (1.74 yd³)	928 kg (2047 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1350 mm (54 inch)	1.54 m³ (2.02 yd³)	1011 kg (2228 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1400 mm (55 inch)	1.54 m³ (2.02 yd³)	1125 kg (2480 lb)		(1)	(1)	(2)	(1)	(1)	(1)	(2)
		1500 mm (60 inch)	1.76 m³ (2.30 yd³)	1075 kg (2370 lb)		(1)	(1)	(2)	(1)	(2)	(1)	(2)
		1600 mm (63 inch)	1.86 m³ (2.43 yd³)	1099 kg (2423 lb)		(1)	(2)	(3)	(1)	(2)	(2)	(3)
General Duty Capacity (GDC)	CB	600 mm (24 inch)	0.63 m³ (0.83 yd³)	724 kg (1597 lb)	100	(1)	(1)	(1)	(1)	(1)	(1)	(1)
		750 mm (30 inch)	0.86 m³ (1.13 yd³)	811 kg (1788 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		900 mm (36 inch)	1.09 m³ (1.43 yd³)	908 kg (2002 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1050 mm (42 inch)	1.34 m³ (1.75 yd³)	980 kg (2161 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1200 mm (48 inch)	1.58 m³ (2.07 yd³)	1072 kg (2363 lb)		(1)	(1)	(2)	(1)	(1)	(1)	(2)
		1350 mm (54 inch)	1.83 m³ (2.40 yd³)	1166 kg (2570 lb)		(1)	(2)	(3)	(1)	(2)	(2)	(3)
Heavy Duty (HD)	CB	600 mm (24 inch)	0.52 m³ (0.68 yd³)	733 kg (1616 lb)	100	(1)	(1)	(1)	(1)	(1)	(1)	(1)

(continued)

(Table 6, contd)

330 Excavator without a quick coupler												
Bucket Type	Linkage	Width of Bucket	SAE Capacity of Bucket	Weight of Bucket	Fill (%)	Long Undercarriage					Long Narrow Undercarriage	
						Reach Boom			Heavy Duty Reach Boom		Reach Boom	
						6700 kg (14770 lb) Counterweight						
						2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick	3.75 m (12 ft 4 inch) Stick	2.65 m (8 ft 10 inch) HD Stick	3.2 m (10 ft 6 inch) HD Stick	2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick
		750 mm (30 inch)	0.71 m ³ (0.93 yd ³)	851 kg (1876 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		900 mm (36 inch)	0.91 m ³ (1.19 yd ³)	945 kg (2084 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1050 mm (42 inch)	1.12 m ³ (1.46 yd ³)	1041 kg (2295 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1200 mm (48 inch)	1.33 m ³ (1.74 yd ³)	1159 kg (2556 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1250 mm (49 inch)	1.33 m ³ (1.74 yd ³)	1158 kg (2554 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1300 mm (51 inch)	1.36 m ³ (1.78 yd ³)	1173 kg (2587 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1350 mm (53 inch)	1.45 m ³ (1.90 yd ³)	1194 kg (2633 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1350 mm (54 inch)	1.54 m ³ (2.02 yd ³)	1212 kg (2672 lb)		(1)	(1)	(2)	(1)	(1)	(1)	(2)
		1400 mm (55 inch)	1.54 m ³ (2.02 yd ³)	1263 kg (2784 lb)		(1)	(1)	(2)	(1)	(1)	(1)	(2)
		1450 mm (57 inch)	1.57 m ³ (2.05 yd ³)	1280 kg (2882 lb)		(1)	(1)	(2)	(1)	(1)	(1)	(2)
		1500 mm (60 inch)	1.65 m ³ (2.16 yd ³)	1308 kg (2884 lb)		(1)	(1)	(2)	(1)	(2)	(1)	(2)
		1500 mm (60 inch)	1.76 m ³ (2.30 yd ³)	1391 kg (3067 lb)		(1)	(2)	(3)	(1)	(2)	(2)	(3)
		1650 mm (66 inch)	1.97 m ³ (2.58 yd ³)	1383 kg (3048 lb)		(2)	(3)	(4)	(2)	(3)	(3)	(3)
Heavy Duty Power (HDP)	CB	1050 mm (42 inch)	1.12 m ³ (1.47 yd ³)	1070 kg (2360 lb)	100	(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1200 mm (48 inch)	1.33 m ³ (1.73 yd ³)	1148 kg (2532 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1350 mm (54 inch)	1.53 m ³ (2.01 yd ³)	1253 kg (2762 lb)		(1)	(1)	(2)	(1)	(1)	(1)	(2)

(continued)

Product Information Section
Boom/Stick/Bucket Combinations

(Table 6, contd)

330 Excavator without a quick coupler												
Bucket Type	Linkage	Width of Bucket	SAE Capacity of Bucket	Weight of Bucket	Fill (%)	Long Undercarriage					Long Narrow Undercarriage	
						Reach Boom			Heavy Duty Reach Boom		Reach Boom	
						6700 kg (14770 lb) Counterweight						
						2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick	3.75 m (12 ft 4 inch) Stick	2.65 m (8 ft 10 inch) HD Stick	3.2 m (10 ft 6 inch) HD Stick	2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick
Heavy Duty Excavation (HDX)	CB	1300 mm (51 inch)	1.10 m ³ (1.44 yd ³)	1110 kg (2447 lb)	100	(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1450 mm (57 inch)	1.30 m ³ (1.70 yd ³)	1213 kg (2674 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
Severe Duty (SD)	CB	600 mm (24 inch)	0.52 m ³ (0.68 yd ³)	755 kg (1665 lb)	90	(1)	(1)	(1)	(1)	(1)	(1)	(1)
		600 mm (24 inch)	0.51 m ³ (0.66 yd ³)	832 kg (1835 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		750 mm (30 inch)	0.71 m ³ (0.93 yd ³)	915 kg (2017 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		900 mm (36 inch)	0.91 m ³ (1.19 yd ³)	1000 kg (2204 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		900 mm (36 inch)	0.88 m ³ (1.16 yd ³)	1062 kg (2341 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1050 mm (42 inch)	1.12 m ³ (1.46 yd ³)	1099 kg (2424 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1050 mm (42 inch)	1.08 m ³ (1.42 yd ³)	1170 kg (2580 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1200 mm (48 inch)	1.33 m ³ (1.74 yd ³)	1177 kg (2596 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1200 mm (48 inch)	1.28 m ³ (1.68 yd ³)	1257 kg (2772 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1300 mm (51 inch)	1.36 m ³ (1.78 yd ³)	1321 kg (2911 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1350 mm (54 inch)	1.56 m ³ (2.04 yd ³)	1239 kg (2731 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1350 mm (54 inch)	1.45 m ³ (1.90 yd ³)	1346 kg (2967 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1400 mm (56 inch)	1.54 m ³ (2.02 yd ³)	1421 kg (3133 lb)		(1)	(1)	(2)	(1)	(1)	(1)	(1)
Maximum load pin-on (payload + bucket)						5045 kg (11122 lb)	4605 kg (10152 lb)	4140 kg (9127 lb)	4965 kg (10946 lb)	4450 kg (9811 lb)	4610 kg (10163 lb)	4200 kg (9259 lb)

(1) 2100 kg/m³ (3500 lb/yd³) is the maximum density of material.(2) 1800 kg/m³ (3000 lb/yd³) is the maximum density of material.(3) 1500 kg/m³ (2500 lb/yd³) is the maximum density of material.(4) 1200 kg/m³ (2000 lb/yd³) is the maximum density of material.

Table 7

330 Excavator with Pin Grabber Coupler												
Bucket Type	Linkage	Width of Bucket	SAE Capacity of Bucket	Weight of Bucket	Fill (%)	Long Undercarriage					Long Narrow Undercarriage	
						Reach Boom			Heavy Duty Reach Boom		Reach Boom	
						6700 kg (14770 lb) Counterweight						
						2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick	3.75 m (12 ft 4 inch) Stick	2.65 m (8 ft 10 inch) HD Stick	3.2 m (10 ft 6 inch) HD Stick	2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick
General Duty (GD)	CB	600 mm (24 inch)	0.52 m³ (0.68 yd³)	659 kg (1454 lb)	100	(1)	(1)	(1)	(1)	(1)	(1)	(1)
		750 mm (30 inch)	0.71 m³ (0.93 yd³)	731 kg (1611 lb)		(1)	(1)	(1)	(1)	(1)	(1)	
		1000 mm (40 inch)	1.03 m³ (1.35 yd³)	835 kg (1841 lb)		(1)	(1)	(1)	(1)	(1)	(1)	
		1050 mm (42 inch)	1.12 m³ (1.46 yd³)	865 kg (1906 lb)		(1)	(1)	(1)	(1)	(1)	(1)	
		1200 mm (48 inch)	1.33 m³ (1.74 yd³)	928 kg (2047 lb)		(1)	(1)	(1)	(1)	(1)	(1)	
		1350 mm (54 inch)	1.54 m³ (2.02 yd³)	1011 kg (2228 lb)		(1)	(2)	(3)	(1)	(2)	(2)	
		1400 mm (55 inch)	1.54 m³ (2.02 yd³)	1125 kg (2480 lb)		(1)	(2)	(3)	(1)	(2)	(2)	(3)
		1500 mm (60 inch)	1.76 m³ (2.30 yd³)	1075 kg (2370 lb)		(2)	(3)	(3)	(2)	(3)	(3)	(3)
		1600 mm (63 inch)	1.86 m³ (2.43 yd³)	1099 kg (2423 lb)		(2)	(3)	(4)	(2)	(3)	(3)	(4)
General Duty Capacity (GDC)	CB	600 mm (24 inch)	0.63 m³ (0.83 yd³)	724 kg (1597 lb)	100	(1)	(1)	(1)	(1)	(1)	(1)	(1)
		750 mm (30 inch)	0.86 m³ (1.13 yd³)	811 kg (1788 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		900 mm (36 inch)	1.09 m³ (1.43 yd³)	908 kg (2002 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1050 mm (42 inch)	1.34 m³ (1.75 yd³)	980 kg (2161 lb)		(1)	(1)	(2)	(1)	(1)	(1)	(1)
		1200 mm (48 inch)	1.58 m³ (2.07 yd³)	1072 kg (2363 lb)		(1)	(2)	(3)	(1)	(2)	(2)	(3)
		1350 mm (54 inch)	1.83 m³ (2.40 yd³)	1166 kg (2570 lb)		(2)	(3)	(4)	(2)	(3)	(3)	(4)
Heavy Duty (HD)	CB	600 mm (24 inch)	0.52 m³ (0.68 yd³)	733 kg (1616 lb)	100	(1)	(1)	(1)	(1)	(1)	(1)	(1)
		750 mm (30 inch)	0.71 m³ (0.93 yd³)	851 kg (1876 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)

(continued)

Product Information Section
Boom/Stick/Bucket Combinations

(Table 7, contd)

330 Excavator with Pin Grabber Coupler												
Bucket Type	Linkage	Width of Bucket	SAE Capacity of Bucket	Weight of Bucket	Fill (%)	Long Undercarriage					Long Narrow Undercarriage	
						Reach Boom			Heavy Duty Reach Boom		Reach Boom	
						6700 kg (14770 lb) Counterweight						
						2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick	3.75 m (12 ft 4 inch) Stick	2.65 m (8 ft 10 inch) HD Stick	3.2 m (10 ft 6 inch) HD Stick	2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick
		900 mm (36 inch)	0.91 m ³ (1.19 yd ³)	945 kg (2084 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1050 mm (42 inch)	1.12 m ³ (1.46 yd ³)	1041 kg (2295 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1200 mm (48 inch)	1.33 m ³ (1.74 yd ³)	1159 kg (2556 lb)		(1)	(1)	(2)	(1)	(1)	(1)	(2)
		1250 mm (49 inch)	1.33 m ³ (1.74 yd ³)	1158 kg (2554 lb)		(1)	(1)	(2)	(1)	(1)	(1)	(2)
		1300 mm (51 inch)	1.36 m ³ (1.78 yd ³)	1173 kg (2587 lb)		(1)	(1)	(2)	(1)	(1)	(1)	(2)
		1350 mm (53 inch)	1.45 m ³ (1.90 yd ³)	1194 kg (2633 lb)		(1)	(2)	(3)	(1)	(2)	(2)	(3)
		1350 mm (54 inch)	1.54 m ³ (2.02 yd ³)	1212 kg (2672 lb)		(1)	(2)	(3)	(1)	(2)	(2)	(3)
		1400 mm (55 inch)	1.54 m ³ (2.02 yd ³)	1263 kg (2784 lb)		(1)	(2)	(3)	(1)	(2)	(2)	(3)
		1450 mm (57 inch)	1.57 m ³ (2.05 yd ³)	1280 kg (2882 lb)		(1)	(2)	(3)	(1)	(3)	(2)	(3)
		1500 mm (60 inch)	1.65 m ³ (2.16 yd ³)	1308 kg (2884 lb)		(2)	(3)	(4)	(2)	(3)	(3)	(3)
		1500 mm (60 inch)	1.76 m ³ (2.30 yd ³)	1391 kg (3067 lb)		(2)	(3)	(4)	(2)	(3)	(3)	(4)
		1650 mm (66 inch)	1.97 m ³ (2.58 yd ³)	1383 kg (3048 lb)		(3)	(4)	(5)	(3)	(4)	(4)	(4)
Heavy Duty Power (HDP)	CB	1050 mm (42 inch)	1.12 m ³ (1.47 yd ³)	1070 kg (2360 lb)	100	(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1200 mm (48 inch)	1.33 m ³ (1.73 yd ³)	1148 kg (2532 lb)		(1)	(1)	(2)	(1)	(1)	(1)	(2)
		1350 mm (54 inch)	1.53 m ³ (2.01 yd ³)	1253 kg (2762 lb)		(1)	(2)	(3)	(1)	(2)	(2)	(3)
Heavy Duty Excavation (HDX)	CB	1300 mm (51 inch)	1.10 m ³ (1.44 yd ³)	1110 kg (2447 lb)	100	(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1450 mm (57 inch)	1.30 m ³ (1.70 yd ³)	1213 kg (2674 lb)		(1)	(1)	(2)	(1)	(1)	(1)	(2)

(continued)

(Table 7, contd)

330 Excavator with Pin Grabber Coupler												
Bucket Type	Linkage	Width of Bucket	SAE Capacity of Bucket	Weight of Bucket	Fill (%)	Long Undercarriage					Long Narrow Undercarriage	
						Reach Boom			Heavy Duty Reach Boom		Reach Boom	
						6700 kg (14770 lb) Counterweight						
						2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick	3.75 m (12 ft 4 inch) Stick	2.65 m (8 ft 10 inch) HD Stick	3.2 m (10 ft 6 inch) HD Stick	2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick
Severe Duty (SD)	CB	600 mm (24 inch)	0.52 m³ (0.68 yd³)	755 kg (1665 lb)	90	(1)	(1)	(1)	(1)	(1)	(1)	(1)
		600 mm (24 inch)	0.51 m³ (0.66 yd³)	832 kg (1835 lb)		(1)	(1)	(1)	(1)	(1)	(1)	
		750 mm (30 inch)	0.71 m³ (0.93 yd³)	915 kg (2017 lb)		(1)	(1)	(1)	(1)	(1)	(1)	
		900 mm (36 inch)	0.91 m³ (1.19 yd³)	1000 kg (2204 lb)		(1)	(1)	(1)	(1)	(1)	(1)	
		900 mm (36 inch)	0.88 m³ (1.16 yd³)	1062 kg (2341 lb)		(1)	(1)	(1)	(1)	(1)	(1)	
		1050 mm (42 inch)	1.12 m³ (1.46 yd³)	1099 kg (2424 lb)		(1)	(1)	(1)	(1)	(1)	(1)	
		1050 mm (42 inch)	1.08 m³ (1.42 yd³)	1170 kg (2580 lb)		(1)	(1)	(1)	(1)	(1)	(1)	
		1200 mm (48 inch)	1.33 m³ (1.74 yd³)	1177 kg (2596 lb)		(1)	(1)	(1)	(1)	(1)	(1)	
		1200 mm (48 inch)	1.28 m³ (1.68 yd³)	1257 kg (2772 lb)		(1)	(1)	(1)	(1)	(1)	(1)	
		1300 mm (51 inch)	1.36 m³ (1.78 yd³)	1321 kg (2911 lb)		(1)	(1)	(2)	(1)	(1)	(1)	(2)
		1350 mm (54 inch)	1.56 m³ (2.04 yd³)	1239 kg (2731 lb)		(1)	(1)	(3)	(1)	(2)	(1)	(2)
		1350 mm (54 inch)	1.45 m³ (1.90 yd³)	1346 kg (2967 lb)		(1)	(1)	(2)	(1)	(2)	(1)	(2)
		1400 mm (56 inch)	1.54 m³ (2.02 yd³)	1421 kg (3133 lb)		(1)	(2)	(3)	(1)	(2)	(2)	(3)
		Maximum load pin-on (payload + bucket)					4519 kg (9962 lb)	4079 kg (8992 lb)	3614 kg (7967 lb)	4439 kg (9786 lb)	3924 kg (8650 lb)	4084 kg (9003 lb)

(1) 2100 kg/m³ (3500 lb/yd³) is the maximum density of material.(2) 1800 kg/m³ (3000 lb/yd³) is the maximum density of material.(3) 1500 kg/m³ (2500 lb/yd³) is the maximum density of material.(4) 1200 kg/m³ (2000 lb/yd³) is the maximum density of material.(5) 900 kg/m³ (1500 lb/yd³) is the maximum density of material.

Product Information Section
Boom/Stick/Bucket Combinations

Table 8

330 Excavator with CW-40 Coupler												
Bucket Type	Linkage	Width of Bucket	SAE Capacity of Bucket	Weight of Bucket	Fill (%)	Long Undercarriage					Long Narrow Undercarriage	
						Reach Boom			Heavy Duty Reach Boom		Reach Boom	
						6700 kg (14770 lb) Counterweight						
						2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick	3.75 m (12 ft 4 inch) Stick	2.65 m (8 ft 10 inch) HD Stick	3.2 m (10 ft 6 inch) HD Stick	2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick
General Duty (GD)	CB	750 mm (30 inch)	0.71 m³ (0.93 yd³)	634 kg (1399 lb)	100	(1)	(1)	(1)	(1)	(1)	(1)	(1)
		900 mm (36 inch)	0.91 m³ (1.19 yd³)	730 kg (1610 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1050 mm (42 inch)	1.12 m³ (1.46 yd³)	806 kg (1777 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1200 mm (48 inch)	1.33 m³ (1.74 yd³)	870 kg (1918 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1200 mm (48 inch)	1.29 m³ (1.69 yd³)	894 kg (1971 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1300 mm (54 inch)	1.44 m³ (1.88 yd³)	960 kg (2117 lb)		(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1350 mm (54 inch)	1.54 m³ (2.02 yd³)	951 kg (2097 lb)		(1)	(1)	(2)	(1)	(1)	(1)	(2)
		1400 mm (55 inch)	1.57 m³ (2.05 yd³)	1003 kg (2211 lb)		(1)	(1)	(2)	(1)	(1)	(1)	(2)
		1500 mm (60 inch)	1.76 m³ (2.30 yd³)	1017 kg (2242 lb)		(1)	(2)	(3)	(1)	(2)	(2)	(3)
		1500 mm (60 inch)	1.71 m³ (2.24 yd³)	1047 kg (2308 lb)		(1)	(2)	(3)	(1)	(2)	(2)	(3)
		1600 mm (63 inch)	1.86 m³ (2.43 yd³)	1113 kg (2453 lb)		(2)	(2)	(3)	(2)	(3)	(2)	(3)
		1650 mm (66 inch)	1.97 m³ (2.58 yd³)	1099 kg (2422 lb)		(2)	(3)	(4)	(2)	(3)	(3)	(3)
Heavy Duty (HD)	CB	1050 mm (42 inch)	1.12 m³ (1.46 yd³)	945 kg (2083 lb)	100	(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1350 mm (54 inch)	1.54 m³ (1.97 yd³)	1088 kg (2398 lb)		(1)	(1)	(2)	(1)	(2)	(1)	(2)
		1650 mm (66 inch)	1.97 m³ (2.58 yd³)	1258 kg (2774 lb)		(2)	(3)	(4)	(2)	(3)	(3)	(4)

(continued)

(Table 8, contd)

330 Excavator with CW-40 Coupler												
Bucket Type	Linkage	Width of Bucket	SAE Capacity of Bucket	Weight of Bucket	Fill (%)	Long Undercarriage					Long Narrow Undercarriage	
						Reach Boom			Heavy Duty Reach Boom		Reach Boom	
						6700 kg (14770 lb) Counterweight						
						2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick	3.75 m (12 ft 4 inch) Stick	2.65 m (8 ft 10 inch) HD Stick	3.2 m (10 ft 6 inch) HD Stick	2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick
Severe Duty (SD)	CB	1050 mm (42 inch)	1.13 m³ (1.48 yd³)	1013 kg (2233 lb)	100	(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1350 mm (54 inch)	1.56 m³ (2.04 yd³)	1201 kg (2647 lb)		(1)	(2)	(3)	(1)	(2)	(1)	(2)
Maximum load pin-on (payload + bucket)						4752 kg (10476 lb)	4312 kg (9506 lb)	3847 kg (8481 lb)	4672 kg (10300 lb)	4157 kg (9165 lb)	4317 kg (9517 lb)	3907 kg (8613 lb)

(1) 2100 kg/m³ (3500 lb/yd³) is the maximum density of material.(2) 1800 kg/m³ (3000 lb/yd³) is the maximum density of material.(3) 1500 kg/m³ (2500 lb/yd³) is the maximum density of material.(4) 1200 kg/m³ (2000 lb/yd³) is the maximum density of material.

Table 9

330 Excavator with CW-45 Coupler												
Bucket Type	Linkage	Width of Bucket	SAE Capacity of Bucket	Weight of Bucket	Fill (%)	Long Undercarriage					Long Narrow Undercarriage	
						Reach Boom			Heavy Duty Reach Boom		Reach Boom	
						6700 kg (14770 lb) Counterweight						
						2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick	3.75 m (12 ft 4 inch) Stick	2.65 m (8 ft 10 inch) HD Stick	3.2 m (10 ft 6 inch) HD Stick	2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick
General Duty (GD)	CB	1500 mm (60 inch)	1.76 m³ (2.30 yd³)	1075 kg (2370 lb)	100	(1)	(2)	(3)	(2)	(3)	(2)	(3)
		1650 mm (66 inch)	1.97 m³ (2.58 yd³)	1159 kg (2555 lb)		(2)	(3)	(4)	(2)	(3)	(3)	(4)
Heavy Duty (HD)	CB	1350 mm (54 inch)	1.54 m³ (2.02 yd³)	1148 kg (2530 lb)	100	(1)	(2)	(3)	(1)	(2)	(2)	(3)
		1500 mm (60 inch)	1.76 m³ (2.30 yd³)	1245 kg (2746 lb)		(2)	(3)	(4)	(2)	(3)	(3)	(3)
		1650 mm (66 inch)	1.97 m³ (2.58 yd³)	1318 kg (2906 lb)		(3)	(3)	(4)	(3)	(4)	(3)	(4)
Maximum load pin-on (payload + bucket)						4610 kg (10163 lb)	4170 kg (9193 lb)	3705 kg (8168 lb)	4530 kg (9987 lb)	4015 kg (8852 lb)	4175 kg (9204 lb)	3765 kg (8300 lb)

(continued)

Product Information Section
Boom/Stick/Bucket Combinations

(Table 9, contd)

- (1) 2100 kg/m³ (3500 lb/yd³) is the maximum density of material.
 (2) 1800 kg/m³ (3000 lb/yd³) is the maximum density of material.
 (3) 1500 kg/m³ (2500 lb/yd³) is the maximum density of material.
 (4) 1200 kg/m³ (2000 lb/yd³) is the maximum density of material.

Table 10

330 Excavator with CW-45S Coupler												
Bucket Type	Linkage	Width of Bucket	SAE Capacity of Bucket	Weight of Bucket	Fill (%)	Long Undercarriage					Long Narrow Undercarriage	
						Reach Boom			Heavy Duty Reach Boom		Reach Boom	
						6700 kg (14770 lb) Counterweight						
						2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick	3.75 m (12 ft 4 inch) Stick	2.65 m (8 ft 10 inch) HD Stick	3.2 m (10 ft 6 inch) HD Stick	2.65 m (8 ft 10 inch) Stick	3.2 m (10 ft 6 inch) Stick
General Duty (GD)	CB	750 mm (30 inch)	0.71 m³ (0.93 yd³)	693 kg (1529 lb)	100	(1)	(1)	(1)	(1)	(1)	(1)	(1)
		1050 mm (42 inch)	1.12 m³ (1.46 yd³)	948 kg (2090 lb)		(1)	(1)	(1)	(1)	(1)	(1)	
		1350 mm (54 inch)	1.54 m³ (2.02 yd³)	1144 kg (2521 lb)		(1)	(2)	(3)	(1)	(2)	(2)	(2)
		1500 mm (60 inch)	1.76 m³ (2.30 yd³)	1243 kg (2741 lb)		(2)	(3)	(4)	(2)	(3)	(3)	(3)
		1650 mm (66 inch)	1.97 m³ (2.58 yd³)	1316 kg (2902 lb)		(3)	(3)	(4)	(3)	(4)	(3)	(4)
Maximum load pin-on (payload + bucket)					4640 kg (10229 lb)	4200 kg (9529 lb)	3735 kg (8234 lb)	4560 kg (10053 lb)	4045 kg (8918 lb)	4205 kg (9270 lb)	3795 kg (8367 lb)	

- (1) 2100 kg/m³ (3500 lb/yd³) is the maximum density of material.
 (2) 1800 kg/m³ (3000 lb/yd³) is the maximum density of material.
 (3) 1500 kg/m³ (2500 lb/yd³) is the maximum density of material.
 (4) 1200 kg/m³ (2000 lb/yd³) is the maximum density of material.

Table 11

330 Excavator without quick coupler						
Bucket Type	Linkage	Width of Bucket	SAE Capacity of Bucket	Weight of Bucket	Fill (%)	Long Undercarriage
						Super Long Reach Boom
						6700 kg (14770 lb) Counterweight
						Super Long Reach Stick
Ditch Cleaning (DC)	A	1150 mm (45 inch)	0.60 m ³ (0.78 yd ³)	292 kg (644 lb)	100	(1)

(continued)

(Table 11, contd)

330 Excavator without quick coupler						
Bucket Type	Linkage	Width of Bucket	SAE Capacity of Bucket	Weight of Bucket	Fill (%)	Long Undercarriage
						Super Long Reach Boom
						6700 kg (14770 lb) Counterweight
						Super Long Reach Stick
		1200 mm (48 inch)	0.57 m ³ (0.74 yd ³)	388 kg (855 lb)		(1)
General Duty (GD)		900 mm (36 inch)	0.53 m ³ (0.69 yd ³)	394 kg (869 lb)		(1)
Maximum load pin-on (payload + bucket)						1135 kg (2502 lb)

(1) 1200 kg/m³ (2000 lb/yd³) is the maximum density of material.

i07879333

Lifting Capacities (330)

SMCS Code: 7000

WARNING

Failure to comply to the rated load can cause possible personal injury or property damage. This includes the risk of unintended boom lowering. Review the rated load of a particular work tool before performing any operation. Make adjustments to the rated load as necessary for non-standard configurations.

There may be local regulations and/or government regulations that govern the use of excavators which lift heavy objects. Obey all local and government regulations.

Lifting capacities should be used as a guide. Work tools, uneven ground conditions, soft ground conditions, or poor ground conditions have effects on lifting capacities. The operator is responsible for being aware of these effects.

The lifting capacities are defined by "ISO 10567 2007". The lifting capacities are defined as the lower value of 75% of the static tipping capacity or 87% of the hydraulic lift capacity. Lifting capacities should be within 5% of the below values for machines with different shoes.

Note: Lifting capacities are based on a standard machine with the following conditions:

- Lift point: Stick nose without bucket

- Lubricants full
- Fuel tank full
- Steel track
- Complete cab with a 75 kg (165 lb) operator

Lifting capacities will vary with different work tools and attachments. The weight of a work tool attachment must be subtracted from the lift capacity. Consult your Cat dealer regarding the lifting capacities for specific work tools and attachments.

This machine may be equipped with various sticks. Lifting capacities may vary between the different sticks. Measure the distance on the stick between the boom hinge pin and the work tool hinge pin. This distance will inform you of the size of the stick that is equipped on the machine.

Use the lifting eye that is provided on the stick nose to lift objects. When the lifting eye is used, the connection must be made with a sling or shackle.

Note: Japan regulations require a shovel crane configuration to lift certain objects. A shovel crane has a rated load capacity, therefore, the lift capacities discussed below do not apply to a shovel crane configuration. Contact your Cat dealer for additional information.

Note: In European countries, regulations require a load sensing indicator and a boom and stick lowering control device if more than 1000 kg (2200 lb) is lifted during object handling applications. Regulations also require a load sensing indicator and a boom lowering control device if a force that is greater than 40000 N·m (29500 lb ft) is created during object handling applications. Even if the hydraulic lift capacity is capable, do not exceed a load of 1000 kg (2200 lb). Do not exceed a force of 40000 N·m (29500 lb ft) in European object handling applications.

Configuration Identification

Note: Each component has a stamp to identify the configuration affecting lifting capacity.

The owner will need to check the machine configuration to identify the correct lifting capacity.

The configuration identifier will be located with the part number stamped on the component. Refer to the following table for the abbreviation of the configuration.

Table 12

Configuration Identification		
Component	Configuration	Abbreviation
Front	Reach Boom	R
	Mass Boom	M
	Variable Angle Boom	VA
	Super Long Reach Boom	SLR
	Standard	STD
	Heavy Duty	HD
	Extreme Special	ES
	Thumb Ready Stick	TR
Undercarriage	Short Undercarriage (Crawler)	STD
	Long Undercarriage (Crawler)	LC
	Long Narrow Undercarriage (Crawler)	LN
Cylinder	Standard	-
	Heavy Lift	HL
Counterweight	Metric Ton (tonne)	t ⁽¹⁾

(Table 12, contd)

(1) Counterweight stamp indicates metric ton. (example 1.0t = 1000 kg)

Symbols Found in the Lifting Capacity Charts

Below are symbols that are commonly found on lifting capacity charts for track excavators.

Note: Depending on the machine configuration, some symbols may not be used.

(mm)
(inch) **Measurements are provided in millimeters and inches**



Lift Capacities are provided in kilograms and pounds



Load is limited by hydraulic lifting capacity rather than by a tipping load



Lift point radius



Lift point height

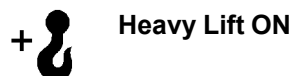


Lifting capacity over the front of the machine



Lifting capacity over the side of the machine

(continued)



Heavy Lift ON

Heavy-Duty Reach Boom with a 3.2 m (10 ft 6 inch) Heavy-Duty Reach Stick

(mm) (inch)	1900 66	3800 125	4500 150	6500 210	7500 240	9000 280		
								(mm) (inch)
7500 300								5050 200
6000 240					7050 280	4300 170		4850 195
4500 180				8100 320	8300 330	1400 55		4850 195
3000 120			12750 506	12400 491	2050 81	1700 67	1300 51	4950 199
1500 60			16000 630	11800 465	18900 748	9000 354	6700 264	4200 165
0 0			16000 630	11200 441	18900 748	9000 354	6700 264	4200 165
-1500 -60	4300 169	9300 366	13000 512	10900 428	18900 748	9000 354	6700 264	4200 165
-3000 -120	11400 449	11400 449	18200 718	10300 405	11200 441	15000 591	11700 461	4200 165
-4500 -180	25400 1000	25400 1000	36100 1421	30700 1209	38300 1508	18900 748	11800 465	4200 165
-6000 -240								

Illustration 70

g06474532

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) heavy-duty reach boom, 3.2 m (10 ft 6 inch) heavy-duty reach stick, 600 mm (24 inch) triple grouser track shoes, and heavy lift OFF

(mm) (inch)	1900 66	3800 125	4500 150	6500 210	7500 240	9000 280		
								(mm) (inch)
7500 300								5050 200
6000 240					7050 280	4300 170		4850 195
4500 180				8100 320	8300 330	1400 55		4850 195
3000 120			14050 556	13050 518	2050 81	1700 67	1300 51	4950 199
1500 60			16000 630	11800 465	18900 748	9000 354	6700 264	4200 165
0 0			16000 630	11200 441	18900 748	9000 354	6700 264	4200 165
-1500 -60	4300 169	9300 366	13000 512	10900 428	18900 748	9000 354	6700 264	4200 165
-3000 -120	11400 449	11400 449	18200 718	10300 405	11200 441	15000 591	11700 461	4200 165
-4500 -180	25400 1000	25400 1000	36100 1421	30700 1209	38300 1508	18900 748	11800 465	4200 165
-6000 -240								

Illustration 71

g06474533

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) heavy-duty reach boom, 3.2 m (10 ft 6 inch) heavy-duty reach stick, 600 mm (24 inch) triple grouser track shoes, and heavy lift ON

(mm) (inch)	1900 66	3800 129	4100 160	4900 240	7300 300	9000 360		(mm) (inch)
7500 306								
6800 268					7000 276	6300 248		5000 197
4500 177				8100 319	8300 326	8100 319		4800 189
3800 150			12700 500	3050 120	6200 244	5150 203	5900 232	4900 193
1600 63			16300 642	11800 465	13900 547	9700 382	8700 343	10500 413
0 0			16300 642	11800 465	13900 547	9700 382	8700 343	10500 413
-1500 -59	6300 248	9300 366	13000 512	10900 429	10500 413	11300 445	5700 224	4700 185
-800 -31	11400 450	11400 450	18200 716	10300 405	11400 450	11400 450	5700 224	3400 134
-120 -4.7	25800 1014	25800 1014	36100 1417	36100 1417	36100 1417	36100 1417	10300 405	11800 465
-350 -13.8		36000 1417	36000 1417	27000 1063	25100 986	18000 709		10400 410

Illustration 72

g06474536

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) heavy-duty reach boom, 3.2 m (10 ft 6 inch) heavy-duty reach stick, 700 mm (28 inch) heavy-duty triple grouser track shoes, and heavy lift OFF

(mm) (inch)	1900 66	3800 129	4100 160	4900 240	7300 300	9000 360		(mm) (inch)
7500 306								
6800 268					7000 276	6300 248		5000 197
4500 177				8100 319	8300 326	8100 319		4800 189
3800 150			14050 554	3050 120	6200 244	5000 197	5450 215	4900 193
1600 63			16050 632	11800 465	13100 516	9800 386	8800 346	10500 413
0 0			16050 632	11800 465	13100 516	9800 386	8800 346	10500 413
-1500 -59	6300 248	9300 366	13000 512	12000 472	10500 413	11300 445	5700 224	4700 185
-800 -31	12450 490	12450 490	17600 693	10300 405	11400 450	11400 450	5700 224	3400 134
-120 -4.7	27900 1094	27900 1094	43000 1693	36000 1417	36000 1417	36000 1417	10300 405	11800 465
-350 -13.8		42100 1655	42100 1655	30900 1213	22400 883	18000 709		20000 787

Illustration 73

g06474539

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) heavy-duty reach boom, 3.2 m (10 ft 6 inch) heavy-duty reach stick, 700 mm (28 inch) heavy-duty triple grouser track shoes, and heavy lift ON

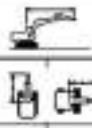
(mm) (inch)	1900 66	3800 129	4300 160	4900 240	7300 300	9000 360		(mm) (inch)
								
7500 306								5050 * 5850 7200
6000 240					7050 6350			4850 * 4650 6240
4500 160				8100 8300 7400 6200	13200 13800			10600 * 10600 13000
3000 120			12700 12700 3050 8300 5150 6600	5900 4550				4950 4450 9140
1500 60			27450 27350 20000 17900 17700 12900					10800 9800 3600
0 0			16300 11800 18600 7900 5800 5800	6700 4300				5200 4300 9100
-1500 -60			32800 35700 22700 17100 16000 12600	13400 8600				11600 9600 3700
-3000 -120			16300 11800 18600 7900 5800 5800					5700 4400 9800
-4500 -180			30500 24800 25000 18000 19100 12200					12700 8750 3600
-6000 -240	6300 9300 13000 19000 16500 11500 12050 7000 6850 5800	14100 22000 30300 24700 26100 16200 10600 12950						6700 4750 9520
-7500 -306	11400 11400 18200 18300 10300 11800 11000 7000 5700 5850	25600 25600 36100 36700 31000 24800 24800 18400 16700 12200						10300 12800 3100
-9000 -360	17100 17700 12900 11800 9900 7500							8400 7900 9970
-10500 -418		38900 38000 27800 20400 22400 18000						10400 16700 2900

Illustration 74

g06474541

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) heavy-duty reach boom, 3.2 m (10 ft 6 inch) heavy-duty reach stick, 800 mm (32 inch) triple grouser track shoes, and heavy lift OFF

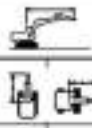
(mm) (inch)	1900 66	3800 129	4300 160	4900 240	7300 300	9000 360		(mm) (inch)
								
7500 306								5050 * 5850 7200
6000 240					7050 6350			5300 * 5300 6240
4500 160				8100 8300 7400 6200	13200 13800			11600 * 11600 13000
3000 120			14050 12700 18050 8300 5900 6600	6450 4550				5400 4450 9140
1500 60			30250 27350 22050 17900 16600 12900					11800 9800 3600
0 0			16800 11800 12100 7900 5700 5800	6900 4300				5700 4300 9100
-1500 -60			36000 35700 28000 17100 19000 12600	13800 8600				12800 9600 3700
-3000 -120			16300 11800 12400 7700 5800 5800					6700 4400 9800
-4500 -180			30900 24800 28000 18000 19100 12200					13000 8750 3600
-6000 -240	6500 9900 13900 19000 16500 11500 12350 7000 6800 5850	15400 24700 30900 24700 26000 16200 10600 12950						7300 4750 9520
-7500 -306	12450 12450 17600 17600 10600 11800 12350 7000 5800 5850	27900 27900 48000 48000 38500 24800 24800 18400 16700 12200						10500 12800 3100
-9000 -360		18800 18800 14300 11800 10600 7500						9100 7900 9970
-10500 -418		42100 42100 30900 20400 22400 18000						20800 16700 2900

Illustration 75

g06474542

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) heavy-duty reach boom, 3.2 m (10 ft 6 inch) heavy-duty reach stick, 800 mm (32 inch) triple grouser track shoes, and heavy lift ON

(mm) (inch)	1900 66	3800 129	4300 160	4900 240	7300 300	9000 360		
								(mm) (inch)
7500 306								* 9000 * 5000 1200 * 9200 * 5200 290
6800 268					* 7000 6400			* 4800 * 4600 6300 * 10000 * 10000 310
4500 160				* 8100 8300 * 1400 6300				* 4800 * 4800 5800 * 10000 * 10000 350
3800 120			* 12700 * 12700 3600 8400 * 5100 6100 * 5900 4000					* 4900 4500 9100 * 10000 9000 360
1600 63			* 16000 12100 * 18000 8000 * 5800 5800 * 6700 4800					* 5200 4400 9100 * 11000 8700 370
0 0			* 16000 11700 * 18000 7000 8000 5700					* 5700 4500 8800 * 12700 8800 360
-1500 -60	* 6300 * 9300 * 13000 * 19000	* 16000 * 20000	* 30300 25800	* 12000 7700 5800 5800				* 6700 4800 9500 * 14700 10000 340
-800 -31	* 11400 * 11400 * 18200 * 18200	* 10000 11700 * 11000 7700 * 5700 5700						* 6000 3500 7700 * 16000 12000 310
-400 -16	* 17700 * 17700 * 12000 11800 * 9800 7000							* 8400 7300 8800 * 10400 9800 290

Illustration 76

g06474544

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) heavy-duty reach boom, 3.2 m (10 ft 6 inch) heavy-duty reach stick, 900 mm (35 inch) triple grouser track shoes, and heavy lift OFF

(mm) (inch)	1900 66	3800 129	4300 160	4900 240	7300 300	9000 360		
								(mm) (inch)
7500 306								* 9000 * 5000 1200 * 9200 * 5200 290
6800 268					* 7000 6400			* 4800 * 4600 6300 * 11000 * 11000 310
4500 160				* 8100 8300 * 1400 6300				* 4800 4800 5800 * 11000 10700 350
3800 120			* 14000 12000 * 18000 8400 * 5900 6100 * 6400 4000					* 5400 4500 9100 * 11000 9000 360
1600 63			* 16000 12100 * 12100 8000 9200 5800 7000 4800					* 5700 4400 9100 * 12000 8700 370
0 0			* 16000 11700 12000 7000 8000 5700					* 6000 4500 8800 * 13000 8800 360
-1500 -60	* 6300 * 9300 * 13000 * 19000	* 16000 * 20000	* 30300 25800	* 12000 7700 5800 5800				* 6700 4800 9500 * 16000 10000 340
-800 -31	* 11400 * 11400 * 17600 * 17600	* 10000 11700 * 10000 7700 * 5700 5700						* 6000 3500 7700 * 16000 12000 310
-400 -16	* 17700 * 17700 * 12000 11800 * 9800 7000							* 8400 7300 8800 * 10400 9800 290

Illustration 77

g06474545

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) heavy-duty reach boom, 3.2 m (10 ft 6 inch) heavy-duty reach stick, 900 mm (35 inch) triple grouser track shoes, and heavy lift ON

Reach Boom with a 2.65 m (8 ft 8 inch) Reach Stick

3300 (10427)	1900 60	3300 128	4800 180	6000 248	7900 309		3300 (10427)
							
7500							
500							
4000							
300							
4500							
100							
3000							
125							
1000							
60							
0							
0							
-1000							
-60							
-3000							
-125							
-4000							
-100							

Illustration 78

g06474547

Lift Chart Above : 330 Long Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 2.65 m (8 ft 8 inch) reach stick, 600 mm (24 inch) triple grouser track shoes, and heavy lift OFF

3300 (10427)	1900 60	3300 128	4800 180	6000 248	7900 309		3300 (10427)
							
7500							
500							
4000							
300							
4500							
100							
3000							
125							
1000							
60							
0							
0							
-1000							
-60							
-3000							
-125							
-4000							
-100							

Illustration 79

g06474549

Lift Chart Above : 330 Long Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 2.65 m (8 ft 8 inch) reach stick, 600 mm (24 inch) triple grouser track shoes, and heavy lift ON

3000 (9m4ft)	1900 60	3000 128	4000 180	6000 248	7900 309		3000 (9m4ft)
							
7000 306				17400 17400		8700 14050	8800 268
6000 306				8100 17700	7700 19000	6300 12200	7710 318
4900 186			11200 24800	9100 18700	8700 17700	6200 13700	8340 338
3900 126			14100 30200	18400 24200	8700 19000	6200 14050	8870 348
1000 46			11800 22900	18600 26100	8000 19000	6300 14050	8720 362
8 8			18800 30400	18400 22000	8700 19000	6300 14050	8810 348
-1000 -46		9800 22200	9030 23400	18400 26100	8700 19000	6300 14050	8810 322
-3000 -126		18300 41800	18600 32300	11200 22700	8700 24300	6300 18800	8710 288
-4000 -186			11800 25200	18600 23300		6300 18800	8820 258

Illustration 80

g06474552

Lift Chart Above : 330 Long and Narrow Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 2.65 m (8 ft 8 inch) reach stick, 600 mm (24 inch) triple grouser track shoes, and heavy lift OFF

3000 (9m4ft)	1900 60	3000 128	4000 180	6000 248	7900 309		3000 (9m4ft)
							
7000 306				18100 17600		7300 16200	8800 268
6000 306				8900 19400	8100 19000	6300 12200	7710 318
4900 186			11200 25400	18000 21700	8700 19000	6300 14050	8340 338
3900 126			15500 33300	14500 24800	8700 19000	6300 14050	8870 348
1000 46			18800 30800	18600 26700	8000 19000	6300 14050	8720 362
8 8			18800 40100	18400 22000	8700 19000	6300 14050	8810 348
-1000 -46		10000 24200	9030 26800	18400 26100	8700 19000	6300 14050	8810 322
-3000 -126		18900 46800	18600 32300	11200 22700	8700 24300	6300 18800	8710 288
-4000 -186			11800 27900	18600 23300		6300 18800	8820 258

Illustration 81

g06474553

Lift Chart Above : 330 Long and Narrow Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 2.65 m (8 ft 8 inch) reach stick, 600 mm (24 inch) triple grouser track shoes, and heavy lift ON

Boom (mm) (inch)	1900 80	3000 120	4000 160	6000 240	7900 300			Boom (mm) (inch)
7000 300				17400 685	17400 685			8080 320
6000 240				8100 319	8100 319	8300 328	8300 328	7710 304
4900 190			11200 441	11200 441	8100 319	8200 322	8200 322	8340 328
3900 150			14100 555	14100 555	8700 343	8700 343	8700 343	8870 349
3000 120			16000 630	16000 630	9200 362	9200 362	9200 362	9340 368
1900 80			18000 709	18000 709	9700 382	9700 382	9700 382	9720 383
800 31			20000 787	20000 787	10200 401	10200 401	10200 401	10200 401
0 0			22000 866	22000 866	10700 420	10700 420	10700 420	10700 420
-1000 -40		9000 354	9000 354	10300 405	10300 405	10300 405	10300 405	10300 405
-2000 -80		18000 709	18000 709	11200 441	11200 441	11200 441	11200 441	11200 441
-3000 -120		27000 1063	27000 1063	12100 478	12100 478	12100 478	12100 478	12100 478
-4000 -160		36000 1417	36000 1417	13000 511	13000 511	13000 511	13000 511	13000 511
-5000 -200		45000 1771	45000 1771	13900 547	13900 547	13900 547	13900 547	13900 547

Illustration 82

g06474554

Lift Chart Above : 330 Long Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 2.65 m (8 ft 8 inch) reach stick, 700 mm (28 inch) heavy-duty triple grouser track shoes, and heavy lift OFF

Boom (mm) (inch)	1900 80	3000 120	4000 160	6000 240	7900 300			Boom (mm) (inch)
7000 300				18100 713	18100 713			8080 320
6000 240				8900 349	8900 349	9100 358	9100 358	7710 304
4900 190			11300 445	11300 445	8900 349	9000 353	9000 353	8340 328
3900 150			14500 569	14500 569	9400 370	9400 370	9400 370	8870 349
3000 120			16500 646	16500 646	9900 390	9900 390	9900 390	9340 368
1900 80			18500 728	18500 728	10400 410	10400 410	10400 410	9720 383
800 31			20500 805	20500 805	10900 428	10900 428	10900 428	10200 401
0 0			22500 886	22500 886	11400 447	11400 447	11400 447	10700 420
-1000 -40		9500 371	9500 371	10400 410	10400 410	10400 410	10400 410	10300 405
-2000 -80		19000 746	19000 746	11300 445	11300 445	11300 445	11300 445	11200 441
-3000 -120		28000 1100	28000 1100	12200 479	12200 479	12200 479	12200 479	12100 478
-4000 -160		37000 1454	37000 1454	13100 513	13100 513	13100 513	13100 513	13000 511
-5000 -200		46000 1808	46000 1808	14000 549	14000 549	14000 549	14000 549	13900 547

Illustration 83

g06474558

Lift Chart Above : 330 Long Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 2.65 m (8 ft 8 inch) reach stick, 700 mm (28 inch) heavy-duty triple grouser track shoes, and heavy lift ON

Reach (m/ft)	1900 80	3000 120	4000 180	6000 240	7900 300		Reach (m/ft)
							
7000 300				17400 17400		8700 8700	8800
6000 240				8100 8100 7700 1800		4300 5500	7710
4900 190				17700 17700 16600 12400		12800 12200	210
3900 150			11200 11200	8100 7900	5700 5700	6200 4900	8340
3000 120			24800 24000	18700 17100	17700 12300	13700 10700	330
1900 80			14100 11400	18400 7900	5700 5500	6400 4500	8870
900 36			30200 24000	22000 16400	10800 12000	14000 9900	340
800 32			11800 18800	17000 7200	9800 9400	8700 4400	8720
700 28			30800 23100	25100 15800	19400 11800	18800 9800	360
600 24			18800 18600	12300 7100	5800 5300	7400 4300	8810
500 20			30400 22000	28000 15400	19200 11400	18400 9900	340
400 16		9800 9800	90300 18000	12200 7100	5800 5300	8100 4300	8810
300 12		22000 22000	25400 22000	28500 15200	19200 11400	17900 10700	320
200 8		18000 18000	18000 18000	11200 7100		8800 5700	7170
100 4		81000 81000	32000 23000	24300 18400		18800 12400	280
0 0			11800 13000			8800 7700	8800
-100 -4			25200 23700			18800 17300	250

Illustration 84

g06474559

Lift Chart Above : 330 Long and Narrow Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 2.65 m (8 ft 8 inch) reach stick, 700 mm (28 inch) heavy-duty triple grouser track shoes, and heavy lift OFF

Reach (m/ft)	1900 80	3000 120	4000 180	6000 240	7900 300		Reach (m/ft)
							
7000 300				18100 17300		8700 7900	8800
6000 240				8900 8200	8300 1800	4900 5500	7710
4900 190				19400 17700	15800 12400	15200 12200	210
3900 150			12300 12300	18000 7900	5800 5700	6500 4900	8340
3000 120			26400 26200	21700 17100	19600 12300	14000 10700	330
1900 80			15500 11400	11200 7900	9200 10500	6900 4500	8870
900 36			32300 24000	24800 16400	15800 12000	12300 9900	340
800 32			18800 18800	12600 7200	9800 9400	7200 4400	8720
700 28			30800 23100	27200 15800	19400 11800	18800 9800	360
600 24			18800 18600	12400 7100	5800 5300	7400 4300	8810
500 20			30400 22000	28700 15400	19200 11400	18400 9900	340
400 16		10000 10000	90800 18000	12300 7100	5800 5300	8100 4300	8810
300 12		24300 24300	25400 22000	28000 15200	19200 11400	17900 10700	320
200 8		18000 18000	18000 18000	11200 7100		8800 5700	7170
100 4		81000 81000	32000 23000	24300 18400		18800 12400	280
0 0			11800 13000			8800 7700	8800
-100 -4			27900 23700			18800 17300	250

Illustration 85

g06474560

Lift Chart Above : 330 Long and Narrow Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 2.65 m (8 ft 8 inch) reach stick, 700 mm (28 inch) heavy-duty triple grouser track shoes, and heavy lift ON

3000 (9m42)	1900 60	3000 128	4000 180	5000 248	7000 308	7000 308		3000 (9m42)
								
7000 308								
6000 308								
4900 180								
3900 128								
2900 80								
1900 60								
-1000 -30								
-2000 -128								
-3000 -180								
-4000 -248								
-5000 -308								

Illustration 86

g06474561

Lift Chart Above : 330 Long Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 2.65 m (8 ft 8 inch) reach stick, 800 mm (32 inch) triple grouser track shoes, and heavy lift OFF

3000 (9m42)	1900 60	3000 128	4000 180	5000 248	7000 308	7000 308		3000 (9m42)
								
7000 308								
6000 308								
4900 180								
3900 128								
2900 80								
1900 60								
-1000 -30								
-2000 -128								
-3000 -180								
-4000 -248								
-5000 -308								

Illustration 87

g06474562

Lift Chart Above : 330 Long Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 2.65 m (8 ft 8 inch) reach stick, 800 mm (32 inch) triple grouser track shoes, and heavy lift ON

3000 (9m4ft)	1900 60	3000 128	4000 180	6000 248	7900 309		3000 (9m4ft)
							
7000 306				17400 17400		6700 14250	6600 268
6000 306				8100 17700	7700 16600	6300 13800	7710 318
4900 186			11200 24800	8100 18700	8000 17300	6200 13400	4900 10000
3900 126			14100 30200	10500 24850	9700 22050	8000 16600	3900 10000
1000 46			11800 25800	18800 26100	1400 19000	9100 18000	1000 362
8 8			18800 30400	12700 20100	12000 28000	8600 18400	8100 10000
-1000 -46		9800 22300	9800 22300	90300 20400	12700 28000	8600 18400	8100 10000
-3000 -126		18300 41800	18300 41800	18300 23300	11200 24300	8200 18100	4900 10000
-4000 -186			11800 25200	11100 23900		8800 18900	8800 258

Illustration 88

g06474563

Lift Chart Above : 330 Long and Narrow Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 2.65 m (8 ft 8 inch) reach stick, 800 mm (32 inch) triple grouser track shoes, and heavy lift OFF

3000 (9m4ft)	1900 60	3000 128	4000 180	6000 248	7900 309		3000 (9m4ft)
							
7000 306				18100 18100		7500 16200	6600 268
6000 306				8900 19400	8200 17900	6300 13800	7710 318
4900 186			12300 26400	18000 21700	8000 17300	6200 13400	4900 10000
3900 126			15500 33300	10500 24850	9700 22050	8000 16600	3900 10000
1000 46			11800 25800	18800 26100	1400 19000	9100 18000	1000 362
8 8			18800 30400	12700 20100	12000 28000	8600 18400	8100 10000
-1000 -46		10000 24300	10000 24300	10000 20400	12700 28000	8600 18400	8100 10000
-3000 -126		18900 46800	18900 46800	18900 23300	12400 24300	8200 18100	4900 10000
-4000 -186			11100 27900	11100 23900		8800 28900	8800 258

Illustration 89

g06474564

Lift Chart Above : 330 Long and Narrow Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 2.65 m (8 ft 8 inch) reach stick, 800 mm (32 inch) triple grouser track shoes, and heavy lift ON

3000 (9m4ft)	1900 60	3000 128	4000 180	5000 248	7000 359	9000 480	11000 620	13000 787	15000 984	17000 1200	19000 1437	21000 1684	23000 1941	25000 2208	27000 2485	29000 2772	31000 3069	33000 3366	35000 3663	37000 3960	39000 4257	41000 4554	43000 4851	45000 5148	47000 5445	49000 5742	51000 6039	53000 6336	55000 6633	57000 6930	59000 7227	61000 7524	63000 7821	65000 8118	67000 8415	69000 8712	71000 9009	73000 9306	75000 9603	77000 9900	79000 10197	81000 10494	83000 10791	85000 11088	87000 11385	89000 11682	91000 11979	93000 12276	95000 12573	97000 12870	99000 13167	101000 13464	103000 13761	105000 14058	107000 14355	109000 14652	111000 14949	113000 15246	115000 15543	117000 15840	119000 16137	121000 16434	123000 16731	125000 17028	127000 17325	129000 17622	131000 17919	133000 18216	135000 18513	137000 18810	139000 19107	141000 19404	143000 19701	145000 20000	147000 20297	149000 20594	151000 20891	153000 21188	155000 21485	157000 21782	159000 22079	161000 22376	163000 22673	165000 22970	167000 23267	169000 23564	171000 23861	173000 24158	175000 24455	177000 24752	179000 25049	181000 25346	183000 25643	185000 25940	187000 26237	189000 26534	191000 26831	193000 27128	195000 27425	197000 27722	199000 28019	201000 28316	203000 28613	205000 28910	207000 29207	209000 29504	211000 29801	213000 30098	215000 30395	217000 30692	219000 30989	221000 31286	223000 31583	225000 31880	227000 32177	229000 32474	231000 32771	233000 33068	235000 33365	237000 33662	239000 33959	241000 34256	243000 34553	245000 34850	247000 35147	249000 35444	251000 35741	253000 36038	255000 36335	257000 36632	259000 36929	261000 37226	263000 37523	265000 37820	267000 38117	269000 38414	271000 38711	273000 39008	275000 39305	277000 39602	279000 39899	281000 40196	283000 40493	285000 40790	287000 41087	289000 41384	291000 41681	293000 41978	295000 42275	297000 42572	299000 42869	301000 43166	303000 43463	305000 43760	307000 44057	309000 44354	311000 44651	313000 44948	315000 45245	317000 45542	319000 45839	321000 46136	323000 46433	325000 46730	327000 47027	329000 47324	331000 47621	333000 47918	335000 48215	337000 48512	339000 48809	341000 49106	343000 49403	345000 49700	347000 50000	349000 50297	351000 50594	353000 50891	355000 51188	357000 51485	359000 51782	361000 52079	363000 52376	365000 52673	367000 52970	369000 53267	371000 53564	373000 53861	375000 54158	377000 54455	379000 54752	381000 55049	383000 55346	385000 55643	387000 55940	389000 56237	391000 56534	393000 56831	395000 57128	397000 57425	399000 57722	401000 58019	403000 58316	405000 58613	407000 58910	409000 59207	411000 59504	413000 59801	415000 60098	417000 60395	419000 60692	421000 60989	423000 61286	425000 61583	427000 61880	429000 62177	431000 62474	433000 62771	435000 63068	437000 63365	439000 63662	441000 63959	443000 64256	445000 64553	447000 64850	449000 65147	451000 65444	453000 65741	455000 66038	457000 66335	459000 66632	461000 66929	463000 67226	465000 67523	467000 67820	469000 68117	471000 68414	473000 68711	475000 69008	477000 69305	479000 69602	481000 69899	483000 70196	485000 70493	487000 70790	489000 71087	491000 71384	493000 71681	495000 71978	497000 72275	499000 72572	501000 72869	503000 73166	505000 73463	507000 73760	509000 74057	511000 74354	513000 74651	515000 74948	517000 75245	519000 75542	521000 75839	523000 76136	525000 76433	527000 76730	529000 77027	531000 77324	533000 77621	535000 77918	537000 78215	539000 78512	541000 78809	543000 79106	545000 79403	547000 79700	549000 80000	551000 80297	553000 80594	555000 80891	557000 81188	559000 81485	561000 81782	563000 82079	565000 82376	567000 82673	569000 82970	571000 83267	573000 83564	575000 83861	577000 84158	579000 84455	581000 84752	583000 85049	585000 85346	587000 85643	589000 85940	591000 86237	593000 86534	595000 86831	597000 87128	599000 87425	601000 87722	603000 88019	605000 88316	607000 88613	609000 88910	611000 89207	613000 89504	615000 89801	617000 90098	619000 90395	621000 90692	623000 90989	625000 91286	627000 91583	629000 91880	631000 92177	633000 92474	635000 92771	637000 93068	639000 93365	641000 93662	643000 93959	645000 94256	647000 94553	649000 94850	651000 95147	653000 95444	655000 95741	657000 96038	659000 96335	661000 96632	663000 96929	665000 97226	667000 97523	669000 97820	671000 98117	673000 98414	675000 98711	677000 99008	679000 99305	681000 99602	683000 99899	685000 100196	687000 100493	689000 100790	691000 101087	693000 101384	695000 101681	697000 101978	699000 102275	701000 102572	703000 102869	705000 103166	707000 103463	709000 103760	711000 104057	713000 104354	715000 104651	717000 104948	719000 105245	721000 105542	723000 105839	725000 106136	727000 106433	729000 106730	731000 107027	733000 107324	735000 107621	737000 107918	739000 108215	741000 108512	743000 108809	745000 109106	747000 109403	749000 109700	751000 110000	753000 110297	755000 110594	757000 110891	759000 111188	761000 111485	763000 111782	765000 112079	767000 112376	769000 112673	771000 112970	773000 113267	775000 113564	777000 113861	779000 114158	781000 114455	783000 114752	785000 115049	787000 115346	789000 115643	791000 115940	793000 116237	795000 116534	797000 116831	799000 117128	801000 117425	803000 117722	805000 118019	807000 118316	809000 118613	811000 118910	813000 119207	815000 119504	817000 119801	819000 120098	821000 120395	823000 120692	825000 120989	827000 121286	829000 121583	831000 121880	833000 122177	835000 122474	837000 122771	839000 123068	841000 123365	843000 123662	845000 123959	847000 124256	849000 124553	851000 124850	853000 125147	855000 125444	857000 125741	859000 126038	861000 126335	863000 126632	865000 126929	867000 127226	869000 127523	871000 127820	873000 128117	875000 128414	877000 128711	879000 129008	881000 129305	883000 129602	885000 129899	887000 130196	889000 130493	891000 130790	893000 131087	895000 131384	897000 131681	899000 131978	901000 132275	903000 132572	905000 132869	907000 133166	909000 133463	911000 133760	913000 134057	915000 134354	917000 134651	919000 134948	921000 135245	923000 135542	925000 135839	927000 136136	929000 136433	931000 136730	933000 137027	935000 137324	937000 137621	939000 137918	941000 138215	943000 138512	945000 138809	947000 139106	949000 139403	951000 139700	953000 140000	955000 140297	957000 140594	959000 140891	961000 141188	963000 141485	965000 141782	967000 142079	969000 142376	971000 142673	973000 142970	975000 143267	977000 143564	979000 143861	981000 144158	983000 144455	985000 144752	987000 145049	989000 145346	991000 145643	993000 145940	995000 146237	997000 146534	999000 146831	1001000 147128	1003000 147425	1005000 147722	1007000 148019	1009000 148316	1011000 148613	1013000 148910	1015000 149207	1017000 149504	1019000 149801	1021000 150098	1023000 150395	1025000 150692	1027000 150989	1029000 151286	1031000 151583	1033000 151880	1035000 152177	1037000 152474	1039000 152771	1041000 153068	1043000 153365	1045000 153662	1047000 153959	1049000 154256	1051000 154553	1053000 154850	1055000 155147	1057000 155444	1059000 155741	1061000 156038	1063000 156335	1065000 156632	1067000 156929	1069000 157226	1071000 157523	1073000 157820	1075000 158117	1077000 158414	1079000 158711	1081000 159008	1083000 159305	1085000 159602	1087000 159899	1089000 160196	1091000 160493	1093000 160790	1095000 161087	1097000 161384	1099000 161681	1101000 161978	1103000 162275	1105000 162572	1107000 162869	1109000 163166	1111000 163463	1113000 163760	1115000 164057	1117000 164354	1119000 164651	1121000 164948	1123000 165245	1125000 165542	1127000 165839	1129000 166136	1131000 166433	1133000 166730	1135000 167027	1137000 167324	1139000 167621	1141000 167918	1143000 168215	1145000 168512	1147000 168809	1149000 169106	1151000 169403	1153000 169700	1155000 170000	1157000 170297	1159000 170594	1161000 170891	1163000 171188	1165000 171485	1167000 171782	1169000 172079	1171000 172376	1173000 172673	1175000 172970	1177000 173267	1179000 173564	1181000 173861	1183000 174158	1185000 174455	1187000 174752	1189000 175049	1191000 175346	1193000 175643	1195000 175940	1197000 176237	1199000 176534	1201000 176831	1203000 177128	1205000 177425	1207000 177722	1209000 178019	1211000 178316	1213000 178613	1215000 178910	1217000 179207	1219000 179504	1221000 179801	1223000 180098	1225000 180395	1227000 180692	1229000 180989	1231000 181286	1233000 181583	1235000 181880	1237000 182177	1239000 182474	1241000 182771	1243000 183068	1245000 183365	1247000 183662	1249000 183959	1251000 184256	1253000 184553	1255000 184850	1257000 185147	1259000 185444	1261000 185741	1263000 186038	1265000 186335	1267000 186632	1269000 186929	1271000 187226	1273000 187523	1275000 187820	1277000 188117	1279000 188414	1281000 188711	1283000 189008	1285000 189305	1287000 189602	1289000 189899	1291000 190196	1293000 190493	1295000 190790	1297000 191087	1299000 191384	1301000 191681	1303000 191978	1305000 192275	1307000 192572	1309000 192869	1311000 193166	1313000 193463	1315000 19376

3000 (9m4)	1900 60	3000 128	4000 180	6000 248	7900 309		
							3000 (9m4)
7000 306				17400 17400		14200 14200	6600 268
6000 306				8100 17700	17000 16600	6300 12700	5700 12800
4900 186			11200 24800	8100 24000	5700 17700	5600 12800	4900 10900
3900 126			14100 25100	18400 22000	5700 16800	5700 12200	4900 10100
1000 66			11800 23800	19000 25100	16000 18000	16000 11800	4900 9900
8 8			18800 23300	12700 28000	7100 15700	6400 11700	4000 10100
-1000 -66		9800 22300	9800 23300	18500 25400	12200 28500	9400 16000	5000 10200
-3000 -126		18300 41800	18300 41800	18400 23300	11200 23300		5000 13900
-4000 -186			11800 25200	12700 24200			5000 17700

Illustration 92

g06474729

Lift Chart Above : 330 Long and Narrow Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 2.65 m (8 ft 8 inch) reach stick, 900 mm (35 inch) triple grouser track shoes, and heavy lift OFF

3000 (9m4)	1900 60	3000 128	4000 180	6000 248	7900 309		
							3000 (9m4)
7000 306				18100 18200		7500 18200	6600 268
6000 306				8900 18400	8400 16600	6300 12700	5700 12800
4900 186			12300 26400	18000 24000	8100 17700	5600 12800	4900 10900
3900 126			15500 25100	14500 24000	5400 16800	5700 12200	4900 10100
1000 66			16800 23800	12900 25100	16000 18000	16000 11800	4900 9900
8 8			18800 23300	12700 27300	7100 15700	6400 11700	4000 10100
-1000 -66		10000 24300	10000 24300	12000 26800	12200 27200	9400 16000	5000 10200
-3000 -126		18900 40800	18900 40800	18400 23300	11200 23300		5000 13900
-4000 -186			11800 27900	12700 24200			5000 17700

Illustration 93

g06474731

Lift Chart Above : 330 Long and Narrow Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 2.65 m (8 ft 8 inch) reach stick, 900 mm (35 inch) triple grouser track shoes, and heavy lift ON

Reach Boom with a 3.2 m (10 ft 6 inch) Reach Stick

(mm) (inch)	1900 66	3810 123	4390 160	4900 240	5500 300	6000 360		(mm) (inch)
								
7500 300								5100 200
6000 240					1150 45	4050 160		4850 190
4500 180				8400 330	8400 330	8100 320		4050 160
3000 120			12300 484	12500 492	8200 323	5000 197	4050 160	5000 197
1500 60			11400 449	11800 464	7000 276	5800 228	4800 189	4300 169
0 0			10000 394	11000 433	12000 472	8800 346	11000 433	8800 346
-1500 -60	8200 323	9300 366	10000 394	10500 413	11400 449	12150 478	6700 264	4750 187
-3000 -120	14200 559	14200 559	13750 541	13600 535	12000 472	10700 421	10000 394	10000 394
-4500 -180	11400 449	11400 449	10200 398	10500 413	11400 449	12150 478	6700 264	4750 187
-6000 -240	8200 323	9300 366	10000 394	10500 413	11400 449	12150 478	6700 264	4750 187
-7500 -300	5100 200	5100 200	4850 190	4850 190	4050 160	4050 160	4050 160	4050 160

Illustration 94

g06474749

Lift Chart Above : 330 Long Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.2 m (10 ft 6 inch) reach stick, 600 mm (24 inch) triple grouser track shoes, and heavy lift OFF

(mm) (inch)	1900 66	3810 123	4390 160	4900 240	5500 300	6000 360		(mm) (inch)
								
7500 300								5000 197
6000 240					1150 45	4050 160		4850 190
4500 180				8400 330	8400 330	8100 320		4050 160
3000 120			14200 559	12500 492	8200 323	5000 197	4050 160	5000 197
1500 60			11700 460	11800 464	7000 276	5800 228	4800 189	4300 169
0 0			10700 421	11000 433	12000 472	8800 346	11000 433	8800 346
-1500 -60	8200 323	9300 366	10000 394	10500 413	11400 449	12150 478	6700 264	4750 187
-3000 -120	14200 559	14200 559	13750 541	13600 535	12000 472	10700 421	10000 394	10000 394
-4500 -180	11400 449	11400 449	10200 398	10500 413	11400 449	12150 478	6700 264	4750 187
-6000 -240	8200 323	9300 366	10000 394	10500 413	11400 449	12150 478	6700 264	4750 187
-7500 -300	5100 200	5100 200	4850 190	4850 190	4050 160	4050 160	4050 160	4050 160

Illustration 95

g06474750

Lift Chart Above : 330 Long Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.2 m (10 ft 6 inch) reach stick, 600 mm (24 inch) triple grouser track shoes, and heavy lift ON

(mm) (inch)	1900 66	3800 125	4500 150	6000 240	7500 300	9000 360		(mm) (inch)
								
7500 306								5100 201
6000 240					7100 279	5800 228		4850 191
4500 180				8400 331	7900 311	5700 224		4600 181
3000 120			12900 508	11400 449	9000 354	5500 217	4200 165	3900 153
1500 60			27000 1063	24000 944	18000 700	16000 625	11000 433	9100 358
0 0			33000 1300	29000 1138	16000 625	11000 433	8800 347	8100 319
-1500 -60	8200 323	9300 366	13000 508	10500 413	8000 315	6500 256		5000 197
-3000 -120	14200 559	14200 559	22700 894	20600 806	14000 551	10500 413		8200 323
-4500 -180	21400 844	21400 844	36200 1418	33000 1298	24000 944	17000 669		12800 504
-6000 -240	26700 1051	26700 1051	46600 1867	42000 1650	30000 1181	21000 827		18000 700
-7500 -300			58000 2286	52000 2048	37000 1455	26000 1024		22000 869
-9000 -360			70000 2756	62000 2449	44000 1724	31000 1219		26000 1024

Illustration 96

g06474752

Lift Chart Above : 330 Long and Narrow Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.2 m (10 ft 6 inch) reach stick, 600 mm (24 inch) triple grouser track shoes, and heavy lift OFF

(mm) (inch)	1900 66	3800 125	4500 150	6000 240	7500 300	9000 360		(mm) (inch)
								
7500 306								5000 197
6000 240					7000 276	5800 228		4750 187
4500 180				8300 327	7800 307	5700 224		4550 179
3000 120			14200 559	12400 488	9000 354	5500 217	4200 165	3900 153
1500 60			30000 1180	26000 1024	18000 700	16000 625	11000 433	9100 358
0 0			36000 1418	32000 1258	18000 700	11000 433	8800 347	8100 319
-1500 -60	9200 362	9800 389	13900 541	10500 413	8000 315	6500 256		5000 197
-3000 -120	15500 612	15500 612	24900 978	22400 881	14000 551	10500 413		8200 323
-4500 -180	22800 898	22800 898	38600 1518	35000 1375	24000 944	17000 669		12800 504
-6000 -240	28100 1106	28100 1106	49000 1875	44000 1708	30000 1181	21000 827		18000 700
-7500 -300			60000 2330	53000 2078	38000 1496	26000 1024		22000 869
-9000 -360			72000 2836	64000 2508	45000 1771	31000 1219		26000 1024

Illustration 97

g06474756

Lift Chart Above : 330 Long and Narrow Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.2 m (10 ft 6 inch) reach stick, 600 mm (24 inch) triple grouser track shoes, and heavy lift ON

(mm) (inch)	1900 66	3800 129	4300 160	4900 240	7300 300	9000 360		(mm) (inch)
								
7500 306								5800 229
6800 268					7100 280	6300 250		4800 190
4500 160				8400 330	8400 330	7800 307		4000 157
3800 129			12900 510	12700 500	8300 327	6500 256	10000 394	5000 197
1600 63			10400 410	12000 472	11100 437	8000 315	6800 268	3000 118
0 0			18000 709	11700 461	12000 472	7100 280	6700 264	0 0
-1500 -60	8200 323	9300 366	13000 510	10000 394	10500 413	7000 276	5800 229	0 0
-400 -157	14200 560	14200 560	12700 500	10400 410	10400 410	10000 394	10000 394	0 0
-800 -315	11400 450	11400 450	10200 401	10000 394	11700 461	7700 303	5700 224	0 0
-1100 -433	10700 421	10700 421	10000 394	10000 394	10000 394	10000 394	10000 394	0 0
-1800 -709	18000 709	18000 709	18000 709	18000 709	18000 709	18000 709	18000 709	0 0
-3400 -1338	30700 1209	30700 1209	30700 1209	30700 1209	30700 1209	30700 1209	30700 1209	0 0

Illustration 98

g06474760

Lift Chart Above : 330 Long Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.2 m (10 ft 6 inch) reach stick, 700 mm (28 inch) heavy-duty triple grouser track shoes, and heavy lift OFF

(mm) (inch)	1900 66	3800 129	4300 160	4900 240	7300 300	9000 360		(mm) (inch)
								
7500 306								5800 229
6800 268					7100 280	6300 250		4800 190
4500 160				8400 330	8400 330	7800 307		4000 157
3800 129			14200 560	12700 500	8300 327	6500 256	10000 394	5000 197
1600 63			10400 410	12000 472	11100 437	8000 315	6800 268	3000 118
0 0			18000 709	11700 461	12000 472	7100 280	6700 264	0 0
-1500 -60	8200 323	9300 366	13000 510	10000 394	10500 413	7000 276	5800 229	0 0
-400 -157	14200 560	14200 560	12700 500	10400 410	10400 410	10000 394	10000 394	0 0
-800 -315	11400 450	11400 450	10200 401	10000 394	11700 461	7700 303	5700 224	0 0
-1100 -433	10700 421	10700 421	10000 394	10000 394	10000 394	10000 394	10000 394	0 0
-1800 -709	18000 709	18000 709	18000 709	18000 709	18000 709	18000 709	18000 709	0 0
-3400 -1338	30700 1209	30700 1209	30700 1209	30700 1209	30700 1209	30700 1209	30700 1209	0 0

Illustration 99

g06474766

Lift Chart Above : 330 Long Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.2 m (10 ft 6 inch) reach stick, 700 mm (28 inch) heavy-duty triple grouser track shoes, and heavy lift ON

(mm) (inch)	1900 66	2818 123	4190 165	4902 240	7390 300	9018 360		(mm) (inch)
								
7500 300								5100 200
6000 240					7100 280	5800 230		4800 190
4500 180				8400 330	8000 310	5750 225		4000 160
3000 120			12900 510	11800 470	9000 350	8500 330	4200 165	3100 125
1500 60			15400 610	10900 430	7300 290	5400 210	4000 160	3100 125
0 0			18000 710	10800 425	7100 280	5200 205	3800 150	2800 110
-1500 -60	8200 325	9300 365	13000 515	10500 415	7000 275	5000 200	3700 145	2500 100
-3000 -120	11400 450	11400 450	16200 640	10500 415	6700 265	4800 190	3500 135	2200 85
-4500 -180	15700 620	15700 620	18600 740	10500 415	6700 265	4800 190	3500 135	2200 85
-6000 -240			18000 710	10800 425	7100 280	5200 205	3800 150	2800 110
-7500 -300			20900 820	10800 425	7100 280	5200 205	3800 150	2800 110

Illustration 100

g06474769

Lift Chart Above : 330 Long and Narrow Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.2 m (10 ft 6 inch) reach stick, 700 mm (28 inch) heavy-duty triple grouser track shoes, and heavy lift OFF

(mm) (inch)	1900 66	2818 123	4190 165	4902 240	7390 300	9018 360		(mm) (inch)
								
7500 300								5000 200
6000 240					7000 280	5800 230		4800 190
4500 180				8000 310	8000 310	5750 225		4000 160
3000 120			14200 560	11800 470	9000 350	8500 330	4200 165	3100 125
1500 60			16000 630	10900 430	7300 290	5400 210	4000 160	3100 125
0 0			18000 710	10800 425	7100 280	5200 205	3800 150	2800 110
-1500 -60	8000 315	9000 355	13000 515	10500 415	7000 275	5000 200	3700 145	2500 100
-3000 -120	11200 440	11200 440	16000 630	10500 415	6700 265	4800 190	3500 135	2200 85
-4500 -180	15500 615	15500 615	18000 710	10800 425	7100 280	5200 205	3800 150	2800 110
-6000 -240			20900 820	10800 425	7100 280	5200 205	3800 150	2800 110

Illustration 101

g06474773

Lift Chart Above : 330 Long and Narrow Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.2 m (10 ft 6 inch) reach stick, 700 mm (28 inch) heavy-duty triple grouser track shoes, and heavy lift ON

(mm) (inch)	1900 66	3800 129	4300 160	4900 240	7300 300	9000 360		
								(mm) (inch)
7500 306								5100 201
6000 240					7100 280	6400 252		4800 190
4500 180				8400 331	8400 331	7800 307		4000 158
3000 120			12900 508	12000 472	9000 354	8100 319	4700 185	5000 197
1500 60			10400 409	12100 476	8100 319	7300 287	4000 158	3000 120
0 0			10000 394	11800 461	7000 276	6000 236	3000 120	0 0
-1500 -60	6200 244	9300 366	13000 512	10000 394	10500 413	8500 335	4700 185	6700 264
-3000 -120	11400 449	11400 449	18200 718	10000 394	10500 413	8500 335	4700 185	10400 409
-4500 -180	16700 657	16700 657	26600 1045	10000 394	10500 413	8500 335	4700 185	15700 618
-6000 -240		18000 709	18000 709	10000 394	10500 413	8500 335	4700 185	20000 787
-7500 -300		18700 738	20000 787	10000 394	10500 413	8500 335	4700 185	20000 787

Illustration 102

g06474775

Lift Chart Above : 330 Long Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.2 m (10 ft 6 inch) reach stick, 800 mm (32 inch) triple grouser track shoes, and heavy lift OFF

(mm) (inch)	1900 66	3800 129	4300 160	4900 240	7300 300	9000 360		
								(mm) (inch)
7500 306								5000 197
6000 240					7000 276	6400 252		5300 209
4500 180				8000 315	8400 331	7800 307		5300 209
3000 120			14200 559	13000 512	9000 354	8100 319	4700 185	5400 213
1500 60			10400 409	12100 476	8100 319	7300 287	4000 158	11200 437
0 0			10000 394	11800 461	7000 276	6000 236	3000 120	0 0
-1500 -60	6000 236	9000 354	13000 512	10000 394	10500 413	8500 335	4700 185	7300 287
-3000 -120	12500 492	12500 492	17600 693	10000 394	10500 413	8500 335	4700 185	16200 638
-4500 -180	18000 709	18000 709	26600 1045	10000 394	10500 413	8500 335	4700 185	21100 833
-6000 -240		18900 748	18900 748	10000 394	10500 413	8500 335	4700 185	20000 787
-7500 -300		19900 787	21100 833	10000 394	10500 413	8500 335	4700 185	20000 787

Illustration 103

g06474779

Lift Chart Above : 330 Long Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.2 m (10 ft 6 inch) reach stick, 800 mm (32 inch) triple grouser track shoes, and heavy lift ON

(mm) (inch)	1900 66	3800 129	4300 160	4900 240	7300 300	9000 360		
								(mm) (inch)
7500 308								5100 201
6000 240					7100 279	5800 228		4800 189
4500 180				8400 331	8100 318	7800 307		4000 157
3000 120			12900 508	11700 461	9000 354	8000 315	4300 169	5000 197
1500 60			10400 409	11800 464	11100 437	7400 291	6000 236	5000 197
0 0			23000 909	24100 948	18000 709	10600 417	12000 472	8100 318
-1500 -60	8200 323	9300 366	13000 512	10000 394	10000 394	10000 394		6700 264
-3000 -120	14200 559	14200 559	22700 896	20800 812	26000 1020	16200 633	11300 443	14200 559
-4500 -180	21400 843	21400 843	38200 1496	30500 1198	30500 1198	20000 787	13000 512	21400 843
-6000 -240	26700 1051	26700 1051	38600 1506	33600 1323	26200 1029	16300 641	11400 449	26700 1051
-7500 -300			18000 709	18000 709	9700 379	7500 295		18000 709
-9000 -360			38700 1516	38700 1516	28000 1093	18700 732		38700 1516

Illustration 104

g06474801

Lift Chart Above : 330 Long and Narrow Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.2 m (10 ft 6 inch) reach stick, 800 mm (32 inch) triple grouser track shoes, and heavy lift OFF

(mm) (inch)	1900 66	3800 129	4300 160	4900 240	7300 300	9000 360		
								(mm) (inch)
7500 308								5000 197
6000 240					7300 287	5800 228		4700 185
4500 180				8000 315	8100 318	7800 307		4000 157
3000 120			14200 559	11700 461	9000 354	8000 315	4300 169	5000 197
1500 60			30000 1180	25200 994	23400 923	16700 653	12100 476	30000 1180
0 0			17000 669	12300 483	7400 291	6000 236	5000 197	17000 669
-1500 -60	9000 354	9800 386	13900 539	10000 394	10000 394	10000 394		7300 287
-3000 -120	15500 612	15500 612	24000 940	20800 812	26000 1020	16200 633	11300 443	15500 612
-4500 -180	22500 886	22500 886	38600 1506	30500 1198	30500 1198	20000 787	13000 512	22500 886
-6000 -240	28000 1102	28000 1102	38600 1506	33600 1323	26200 1029	16300 641	11400 449	28000 1102
-7500 -300			18900 740	18000 709	9700 379	7500 295		18900 740
-9000 -360			42700 1681	42700 1681	31300 1228	18700 732		42700 1681

Illustration 105

g06474804

Lift Chart Above : 330 Long and Narrow Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.2 m (10 ft 6 inch) reach stick, 800 mm (32 inch) triple grouser track shoes, and heavy lift ON

(mm) (inch)	1900 66	3800 129	4300 160	4900 240	7300 300	9000 360		(mm) (inch)
								
7500 306								5800 229
6800 268					7100 280	6800 268		4800 189
4900 193				8400 331	8400 331	7800 307		4800 189
3800 150			12900 508	12900 508	8500 335	6200 244	4750 187	5000 197
1600 63			10400 409	12300 484	11100 437	8000 315	6800 268	5000 197
0 0			23000 906	26400 1036	24100 945	17600 693	12900 508	11800 465
0 0			18000 709	11800 465	12000 472	7900 311	5800 229	5000 197
-1500 -59	8200 323	9300 366	13000 512	10000 394	10500 413	11800 465		6750 265
-400 -157	14200 559	14200 559	22700 894	30800 1210	26000 1024	16000 630		14200 559
-800 -315	11400 449	11400 449	18200 714	10000 394	11700 457	7000 276		9450 372
-1100 -433	26700 1051	26700 1051	38600 1518	33600 1321	26000 1024	16000 630		10700 421
-1800 -709			18000 709	15200 598	9700 381	8000 315		8900 350
-3400 -1338			38700 1520	26000 1024	22800 898	17300 681		16000 630

Illustration 106

g06474805

Lift Chart Above : 330 Long Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.2 m (10 ft 6 inch) reach stick, 900 mm (35 inch) triple grouser track shoes, and heavy lift OFF

(mm) (inch)	1900 66	3800 129	4300 160	4900 240	7300 300	9000 360		(mm) (inch)
								
7500 306								5000 197
6800 268					7300 287	6800 268		5350 211
4900 193				8000 315	8400 331	7800 307		5300 209
3800 150			14200 559	13000 512	8500 335	6200 244	4750 187	5450 214
1600 63			30800 1210	23400 921	18400 728	10900 425	7100 280	5000 197
0 0			36700 1441	26400 1036	20000 787	12900 508	11800 465	12700 500
0 0			18000 709	11800 465	12700 500	7900 311	5800 229	8300 327
-1500 -59	9500 374	9800 389	13900 543	10000 394	10500 413	11800 465		7300 287
-400 -157	15500 610	15500 610	24900 978	30800 1210	27400 1078	16000 630		16200 636
-800 -315	12500 492	12500 492	17600 693	11000 433	11800 465	7000 276		8700 342
-1100 -433	28800 1134	28800 1134	40000 1570	37100 1457	27300 1074	16000 630		10900 425
-1800 -709			18900 740	14800 583	13000 512	8000 315		8900 350
-3400 -1338			42700 1681	31300 1230	22800 898	17300 681		20800 818

Illustration 107

g06474807

Lift Chart Above : 330 Long Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.2 m (10 ft 6 inch) reach stick, 900 mm (35 inch) triple grouser track shoes, and heavy lift ON

(mm) (inch)	1900 66	3800 129	4300 160	4900 240	7300 300	9000 360		(mm) (inch)
								
7500 306								5100 201
6000 240					7100 280	4000 158		4800 190
4500 180				8400 331	8200 323	3800 150		4000 158
3000 120			12900 508	11800 465	9000 354	5700 225	4300 169	5000 197
1500 60			16400 646	11100 433	7100 280	5000 197	4300 169	5000 197
0 0			23000 905	24100 948	16200 638	10600 417	12000 472	11000 433
0 0			18000 705	10800 425	12000 472	7000 276	5400 213	6000 236
-1500 -60	6200 244	9300 366	13000 512	16000 630	10700 421	7100 280	5000 197	6700 264
-3000 -120	14200 559	14200 559	22700 894	30800 1207	26000 1024	16400 646	10400 409	14200 559
-4500 -180	11400 449	11400 449	18200 718	23000 905	19000 746	11700 461	8200 323	11400 449
-6000 -240	26700 1051	26700 1051	38600 1516	50000 1968	42000 1653	26000 1024	16400 646	26700 1051
-7500 -300			18000 705	10800 425	12000 472	7000 276	5400 213	6000 236
-9000 -360			28700 1125	28700 1125	18000 705			28700 1125

Illustration 108

g06474811

Lift Chart Above : 330 Long and Narrow Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.2 m (10 ft 6 inch) reach stick, 900 mm (35 inch) triple grouser track shoes, and heavy lift OFF

(mm) (inch)	1900 66	3800 129	4300 160	4900 240	7300 300	9000 360		(mm) (inch)
								
7500 306								5000 197
6000 240					7000 276	4000 158		5100 201
4500 180				8000 315	8200 323	3800 150		4800 190
3000 120			14200 559	11800 465	9000 354	5700 225	4300 169	5000 197
1500 60			20000 787	23400 925	16000 630	10600 417	12000 472	11000 433
0 0			26700 1051	24100 948	16200 638	10600 417	12000 472	11000 433
0 0			18000 705	10800 425	12000 472	7000 276	5400 213	6000 236
-1500 -60	6200 244	9300 366	13000 512	16000 630	10700 421	7100 280	5000 197	6700 264
-3000 -120	14200 559	14200 559	22700 894	30800 1207	26000 1024	16400 646	10400 409	14200 559
-4500 -180	11400 449	11400 449	18200 718	23000 905	19000 746	11700 461	8200 323	11400 449
-6000 -240	26700 1051	26700 1051	38600 1516	50000 1968	42000 1653	26000 1024	16400 646	26700 1051
-7500 -300			18000 705	10800 425	12000 472	7000 276	5400 213	6000 236
-9000 -360			28700 1125	28700 1125	18000 705			28700 1125

Illustration 109

g06474812

Lift Chart Above : 330 Long and Narrow Undercarriage, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.2 m (10 ft 6 inch) reach stick, 900 mm (35 inch) triple grouser track shoes, and heavy lift ON

Reach Boom with a 3.75 m (12 ft 2 inch) Reach Stick

1000 400	1500 60	2000 120	4000 180	6000 240	7500 180	9000 240	15000 360	20000 480	25000 600	30000 720	35000 840	40000 960	45000 1080	50000 1200	55000 1320	60000 1440	65000 1560	70000 1680	75000 1800	80000 1920	85000 2040	90000 2160	95000 2280	100000 2400	105000 2520	110000 2640	115000 2760	120000 2880	125000 3000	130000 3120	135000 3240	140000 3360	145000 3480	150000 3600	155000 3720	160000 3840	165000 3960	170000 4080	175000 4200	180000 4320	185000 4440	190000 4560	195000 4680	200000 4800	205000 4920	210000 5040	215000 5160	220000 5280	225000 5400	230000 5520	235000 5640	240000 5760	245000 5880	250000 6000	255000 6120	260000 6240	265000 6360	270000 6480	275000 6600	280000 6720	285000 6840	290000 6960	295000 7080	300000 7200	305000 7320	310000 7440	315000 7560	320000 7680	325000 7800	330000 7920	335000 8040	340000 8160	345000 8280	350000 8400	355000 8520	360000 8640	365000 8760	370000 8880	375000 9000	380000 9120	385000 9240	390000 9360	395000 9480	400000 9600	405000 9720	410000 9840	415000 9960	420000 10080	425000 10200	430000 10320	435000 10440	440000 10560	445000 10680	450000 10800	455000 10920	460000 11040	465000 11160	470000 11280	475000 11400	480000 11520	485000 11640	490000 11760	495000 11880	500000 12000	505000 12120	510000 12240	515000 12360	520000 12480	525000 12600	530000 12720	535000 12840	540000 12960	545000 13080	550000 13200	555000 13320	560000 13440	565000 13560	570000 13680	575000 13800	580000 13920	585000 14040	590000 14160	595000 14280	600000 14400	605000 14520	610000 14640	615000 14760	620000 14880	625000 15000	630000 15120	635000 15240	640000 15360	645000 15480	650000 15600	655000 15720	660000 15840	665000 15960	670000 16080	675000 16200	680000 16320	685000 16440	690000 16560	695000 16680	700000 16800	705000 16920	710000 17040	715000 17160	720000 17280	725000 17400	730000 17520	735000 17640	740000 17760	745000 17880	750000 18000	755000 18120	760000 18240	765000 18360	770000 18480	775000 18600	780000 18720	785000 18840	790000 18960	795000 19080	800000 19200	805000 19320	810000 19440	815000 19560	820000 19680	825000 19800	830000 19920	835000 20040	840000 20160	845000 20280	850000 20400	855000 20520	860000 20640	865000 20760	870000 20880	875000 21000	880000 21120	885000 21240	890000 21360	895000 21480	900000 21600	905000 21720	910000 21840	915000 21960	920000 22080	925000 22200	930000 22320	935000 22440	940000 22560	945000 22680	950000 22800	955000 22920	960000 23040	965000 23160	970000 23280	975000 23400	980000 23520	985000 23640	990000 23760	995000 23880	1000000 24000	1005000 24120	1010000 24240	1015000 24360	1020000 24480	1025000 24600	1030000 24720	1035000 24840	1040000 24960	1045000 25080	1050000 25200	1055000 25320	1060000 25440	1065000 25560	1070000 25680	1075000 25800	1080000 25920	1085000 26040	1090000 26160	1095000 26280	1100000 26400	1105000 26520	1110000 26640	1115000 26760	1120000 26880	1125000 27000	1130000 27120	1135000 27240	1140000 27

Illustration 110

g06474813

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.75 m (12 ft 2 inch) reach stick, 600 mm (24 inch) triple grouser track shoes, and heavy lift OFF

1000 (mm)	1500 60	2000 120	2500 180	3000 240	3500 300	4000 360	4500 420	5000 480	5500 540	6000 600	6500 660	7000 720	7500 780	8000 840	8500 900	9000 960	9500 1020	10000 1080	10500 1140	11000 1200	11500 1260	12000 1320	12500 1380	13000 1440	13500 1500	14000 1560	14500 1620	15000 1680	15500 1740	16000 1800	16500 1860	17000 1920	17500 1980	18000 2040	18500 2100	19000 2160	19500 2220	20000 2280	20500 2340	21000 2400	21500 2460	22000 2520	22500 2580	23000 2640	23500 2700	24000 2760	24500 2820	25000 2880	25500 2940	26000 3000	26500 3060	27000 3120	27500 3180	28000 3240	28500 3300	29000 3360	29500 3420	30000 3480	30500 3540	31000 3600	31500 3660	32000 3720	32500 3780	33000 3840	33500 3900	34000 3960	34500 4020	35000 4080	35500 4140	36000 4200	36500 4260	37000 4320	37500 4380	38000 4440	38500 4500	39000 4560	39500 4620	40000 4680	40500 4740	41000 4800	41500 4860	42000 4920	42500 4980	43000 5040	43500 5100	44000 5160	44500 5220	45000 5280	45500 5340	46000 5400	46500 5460	47000 5520	47500 5580	48000 5640	48500 5700	49000 5760	49500 5820	50000 5880	50500 5940	51000 6000	51500 6060	52000 6120	52500 6180	53000 6240	53500 6300	54000 6360	54500 6420	55000 6480	55500 6540	56000 6600	56500 6660	57000 6720	57500 6780	58000 6840	58500 6900	59000 6960	59500 7020	60000 7080	60500 7140	61000 7200	61500 7260	62000 7320	62500 7380	63000 7440	63500 7500	64000 7560	64500 7620	65000 7680	65500 7740	66000 7800	66500 7860	67000 7920	67500 7980	68000 8040	68500 8100	69000 8160	69500 8220	70000 8280	70500 8340	71000 8400	71500 8460	72000 8520	72500 8580	73000 8640	73500 8700	74000 8760	74500 8820	75000 8880	75500 8940	76000 9000	76500 9060	77000 9120	77500 9180	78000 9240	78500 9300	79000 9360	79500 9420	80000 9480	80500 9540	81000 9600	81500 9660	82000 9720	82500 9780	83000 9840	83500 9900	84000 9960	84500 10020	85000 10080	85500 10140	86000 10200	86500 10260	87000 10320	87500 10380	88000 10440	88500 10500	89000 10560	89500 10620	90000 10680	90500 10740	91000 10800	91500 10860	92000 10920	92500 10980	93000 11040	93500 11100	94000 11160	94500 11220	95000 11280	95500 11340	96000 11400	96500 11460	97000 11520	97500 11580	98000 11640	98500 11700	99000 11760	99500 11820	100000 11880	100500 11940	101000 12000	101500 12060	102000 12120	102500 12180	103000 12240	103500 12300	104000 12360	104500 12420	105000 12480	105500 12540	106000 12600	106500 12660	107000 12720	107500 12780	108000 12840	108500 12900	109000 12960	109500 13020	110000 13080	110500 13140	111000 13200	111500 13260	112000 13320	112500 13380	113000 13440	113500 13500	114000 13560	114500 13620	115000 13680	115500 13740	116000 13800	116500 13860	117000 13920	117500 13980	118000 14040	118500 14100	119000 14160	119500 14220	120000 14280	120500 14340	121000 14400	121500 14460	122000 14520	122500 14580	123000 14640	123500 14700	124000 14760	124500 14820	125000 14880	12

Illustration 111

g06474814

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.75 m (12 ft 2 inch) reach stick, 600 mm (24 inch) triple grouser track shoes, and heavy lift ON

Illustration 112

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.75 m (12 ft 2 inch) reach stick, 700 mm (28 inch) heavy-duty triple grouser track shoes, and heavy lift OFF

Illustration 113 g06474820

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.75 m (12 ft 2 inch) reach stick, 700 mm (28 inch) heavy-duty triple grouser track shoes, and heavy lift ON

SWL (ton)	1000 80	3000 120	4000 160	6000 240	7500 300	9000 360		(mm) (ft-in)
								
7500								
300								
6000								
240								
4500								
180								
3000								
120								
1800								
60								
0								
0								
-1050								
-40								
-3000								
-120								
-4500								
-180								
-6000								
-240								

Illustration 114

g06474826

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.75 m (12 ft 2 inch) reach stick, 800 mm (32 inch) triple grouser track shoes, and heavy lift OFF

SWL (ton)	1000 80	3000 120	4000 160	6000 240	7500 300	9000 360		(mm) (ft-in)
								
7500								
300								
6000								
240								
4500								
180								
3000								
120								
1800								
60								
0								
0								
-1050								
-40								
-3000								
-120								
-4500								
-180								
-6000								
-240								

Illustration 115

g06474828

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) reach boom, 3.75 m (12 ft 2 inch) reach stick, 800 mm (32 inch) triple grouser track shoes, and heavy lift ON

SWL (ton)	1000 80	3000 120	4000 160	6000 240	7500 300	9000 360		(mm) (in)
7500 300								
6000 240								
4500 180								
3000 120								
1500 60								
0								
-1500 -60								
-3000 -120								
-4500 -180								
-6000 -240								
-7500 -300								
-9000 -360								
-10500 -420								
-12000 -480								
-13500 -540								
-15000 -600								
-16500 -660								
-18000 -720								
-19500 -780								
-21000 -840								
-22500 -900								
-24000 -960								
-25500 -1020								
-27000 -1080								
-28500 -1140								
-30000 -1200								
-31500 -1260								
-33000 -1320								
-34500 -1380								
-36000 -1440								
-37500 -1500								
-39000 -1560								
-40500 -1620								
-42000 -1680								
-43500 -1740								
-45000 -1800								
-46500 -1860								
-48000 -1920								
-49500 -1980								
-51000 -2040								
-52500 -2100								
-54000 -2160								
-55500 -2220								
-57000 -2280								
-58500 -2340								
-60000 -2400								
-61500 -2460								
-63000 -2520								
-64500 -2580								
-66000 -2640								
-67500 -2700								
-69000 -2760								
-70500 -2820								
-72000 -2880								
-73500 -2940								
-75000 -3000								
-76500 -3060								
-78000 -3120								
-79500 -3180								
-81000 -3240								
-82500 -3300								
-84000 -3360								
-85500 -3420								
-87000 -3480								
-88500 -3540								
-90000 -3600								
-91500 -3660								
-93000 -3720								
-94500 -3780								
-96000 -3840								
-97500 -3900								
-99000 -3960								
-100500 -4020								
-102000 -4080								
-103500 -4140								
-105000 -4200								
-106500 -4260								
-108000 -4320								
-109500 -4380								
-111000 -4440								
-112500 -4500								
-114000 -4560								
-115500 -4620								
-117000 -4680								
-118500 -4740								
-120000 -4800								
-121500 -4860								
-123000 -4920								
-124500 -4980								
-126000 -5040								
-127500 -5100								
-129000 -5160								
-130500 -5220								
-132000 -5280								
-133500 -5340								
-135000 -5400								
-136500 -5460								
-138000 -5520								
-139500 -5580								
-141000 -5640								
-142500 -5700								
-144000 -5760								
-145500 -5820								
-147000 -5880								
-148500 -5940								
-150000 -6000								
-151500 -6060								
-153000 -6120								
-154500 -6180								
-156000 -6240								
-157500 -6300								
-159000 -6360								
-160500 -6420								
-162000 -6480								
-163500 -6540								
-165000 -6600								
-166500 -6660								
-168000 -6720								
-169500 -6780								
-171000 -6840								
-172500 -6900								
-174000 -6960								
-175500 -7020								
-177000 -7080								
-178500 -7140								
-180000 -7200								
-181500 -7260								
-183000 -7320								
-184500 -7380								
-186000 -7440								
-187500 -7500								
-189000 -7560								
-190500 -7620								
-192000 -7680								
-193500 -7740								
-195000 -7800								
-196500 -7860								
-198000 -7920								
-199500 -7980								
-201000 -8040								
-202500 -8100								
-204000 -8160								
-205500 -8220								
-207000 -8280								
-208500 -8340								
-210000 -8400								
-211500 -8460								
-213000 -8520								
-214500 -8580								
-216000 -8640								
-217500 -8700								
-219000 -8760								
-220500 -8820								
-222000 -8880								
-223500 -8940								
-225000 -9000								
-226500 -9060								
-228000 -9120								
-229500 -9180								
-231000 -9240								
-232500 -9300								
-234000 -9360								
-235500 -9420								
-237000 -9480								
-238500 -9540								
-240000 -9600								
-241500 -9660								
-243000 -9720								
-244500 -9780								
-246000 -9840								
-247500 -9900								
-249000 -9960								
-250500 -10020								
-252000 -10080								
-253500 -10140								
-255000 -10200								
-256500 -10260								
-258000 -10320								
-259500 -10380								
-261000 -10440								
-262500 -10500								
-264000 -10560								
-265500 -10620								
-267000 -10680								
-268500 -10740								
-270000 -10800								
-271500 -10860								
-273000 -10920								
-274500 -10980								
-276000 -11040								
-277500 -11100								
-279000 -11160								
-280500 -11220								
-282000 -11280								
-283500 -11340								
-285000 -11400								
-286500 -11460								
-288000 -11520								
-289500 -11580								
-291000 -11640								
-292500 -11700								
-294000 -11760								
-295500 -11820								
-297000 -11880								
-298500 -11940								
-300000 -12000								
-301500 -12060								
-303000 -12120								
-304500 -12180								
-306000 -12240								
-307500 -12300								
-309000 -12360								
-310500 -12420								
-312000 -12480								
-3135								

Mass Boom with a 2.5 m (8 ft 2 inch) Mass Stick

Boom (inch)	1500 60	3000 120	4000 160	6000 240	7500 300		
							(mm) (inch)
7500 300							
6000 240				* 8750 345			
4500 180			* 11150 440	* 11150 440	* 9450 375		
3000 120			* 13080 515	* 13080 515	* 10680 418		
1500 60			* 16860 663	* 16860 663	* 13680 538		
0 0			* 16780 660	* 16780 660	* 13580 534		
-1500 -60			* 15480 613	* 15480 613	* 11950 470		
-3000 -120			* 13150 515	* 13150 515	* 10180 400		

Illustration 118

g06474833

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) mass boom, 2.5 m (8 ft 2 inch) mass stick, 600 mm (24 inch) triple grouser track shoes, and heavy lift OFF

Boom (inch)	1500 60	3000 120	4000 160	6000 240	7500 300		
							(mm) (inch)
7500 300							
6000 240				* 9450 375			
4500 180			* 12250 485	* 12250 485	* 10480 413		
3000 120			* 15280 601	* 15280 601	* 12680 500		
1500 60			* 17980 703	* 17980 703	* 14680 578		
0 0			* 17900 700	* 17900 700	* 14580 574		
-1500 -60			* 17850 700	* 17850 700	* 14530 571		
-3000 -120			* 15150 595	* 15150 595	* 11280 444		

Illustration 119

g06474837

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) mass boom, 2.5 m (8 ft 2 inch) mass stick, 600 mm (24 inch) triple grouser track shoes, and heavy lift ON

Center (inch)	1500 60	3000 120	4500 180	6000 240	7500 300		
							(mm) (inch)
7500 300						* 1900 * 7300	5010 220
6000 240				* 8750 * 8750 * 19200 * 19200		* 7300 * 7300 * 16200 * 16200	6120 270
4500 180			* 11100 * 11100 * 24000 * 24000	* 9400 8600 * 20500 18600		* 7300 6300 * 16200 13700	7440 290
3000 120			* 13000 12700 * 29700 27400	* 10800 8300 * 22900 17900	* 9000 6000 * 19000 12800	* 7800 5800 * 16600 12400	7810 310
1500 60			* 16800 13100 * 34400 28000	* 11800 8000 * 25200 17200	* 8100 4800 * 18600 12600	* 8300 5400 * 16100 12600	7870 310
0 0			* 16700 11000 * 30100 25300	* 12200 7600 * 20500 16000	* 8700 5700 * 17400 13400	* 8800 5800 * 16200 12400	7630 290
-1500 -60		* 15400 * 96400 * 10100 * 37300 * 37300 * 34200	* 11700 11700 * 25800 25800	* 11900 7700 * 25800 16700		* 9700 6200 * 21400 13700	7670 280
-3000 -120		* 19100 * 19100 * 14000 * 41400 * 41400 * 33000	* 11900 11900 * 23600 23600	* 12100 7600		* 9800 7700 * 21700 17200	6100 240

Illustration 120

g06474847

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) mass boom, 2.5 m (8 ft 2 inch) mass stick, 800 mm (32 inch) triple grouser track shoes, and heavy lift OFF

Center (inch)	1500 60	3000 120	4500 180	6000 240	7500 300		
							(mm) (inch)
7500 300						* 0600 * 8000 * 19100 * 19100	5010 220
6000 240				* 9800 8800 * 21100 19000		* 8000 7300 * 17600 16400	6120 270
4500 180			* 12200 * 12200 * 26400 * 26400	* 10400 8600 * 22800 18600		* 7500 6300 * 17500 13700	7440 290
3000 120			* 15200 12700 * 32700 27400	* 11000 8300 * 25200 17900	* 9200 6000 * 19000 12800	* 8300 5800 * 16200 12400	7810 310
1500 60			* 17600 13100 * 37900 28000	* 12800 8000 * 27600 17200	* 8100 4800 * 18600 12600	* 8600 5400 * 16700 12600	7870 310
0 0			* 18400 11000 * 38000 25300	* 12600 7600 * 27000 16000	* 8700 5700 * 17400 13400	* 8800 5800 * 16200 12400	7630 290
-1500 -60		* 17800 * 17800 * 17700 * 40600 * 40600 * 38400	* 11700 11700 * 25200 25200	* 12500 7700 * 26900 16700		* 9800 6200 * 21700 13700	7670 280
-3000 -120		* 21100 * 21100 * 15500 * 46700 * 46700 * 33400	* 11900 11900 * 23600 23600	* 11200 7600		* 10000 7700 * 24000 17200	6100 240

Illustration 121

g06474848

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 6.15 m (20 ft 2 inch) mass boom, 2.5 m (8 ft 2 inch) mass stick, 800 mm (32 inch) triple grouser track shoes, and heavy lift ON

Super Long Reach Boom

Boom Length (ft)	3000 120	3500 130	4000 140	4500 150	5000 160	5500 170	6000 180	6500 190	7000 200	7500 210	8000 220	8500 230	9000 240	9500 250	10000 260	10500 270	11000 280	11500 290	12000 300	12500 310	13000 320	13500 330	14000 340	14500 350	15000 360	15500 370	16000 380	16500 390	17000 400	17500 410	18000 420	18500 430	19000 440	19500 450	20000 460	20500 470	21000 480	21500 490	22000 500	22500 510	23000 520	23500 530	24000 540	24500 550	25000 560	25500 570	26000 580	26500 590	27000 600	27500 610	28000 620	28500 630	29000 640	29500 650	30000 660	30500 670	31000 680	31500 690	32000 700	32500 710	33000 720	33500 730	34000 740	34500 750	35000 760	35500 770	36000 780	36500 790	37000 800	37500 810	38000 820	38500 830	39000 840	39500 850	40000 860	40500 870	41000 880	41500 890	42000 900	42500 910	43000 920	43500 930	44000 940	44500 950	45000 960	45500 970	46000 980	46500 990	47000 1000	47500 1010	48000 1020	48500 1030	49000 1040	49500 1050	50000 1060	50500 1070	51000 1080	51500 1090	52000 1100	52500 1110	53000 1120	53500 1130	54000 1140	54500 1150	55000 1160	55500 1170	56000 1180	56500 1190	57000 1200	57500 1210	58000 1220	58500 1230	59000 1240	59500 1250	60000 1260	60500 1270	61000 1280	61500 1290	62000 1300	62500 1310	63000 1320	63500 1330	64000 1340	64500 1350	65000 1360	65500 1370	66000 1380	66500 1390	67000 1400	67500 1410	68000 1420	68500 1430	69000 1440	69500 1450	70000 1460	70500 1470	71000 1480	71500 1490	72000 1500	72500 1510	73000 1520	73500 1530	74000 1540	74500 1550	75000 1560	75500 1570	76000 1580	76500 1590	77000 1600	77500 1610	78000 1620	78500 1630	79000 1640	79500 1650	80000 1660	80500 1670	81000 1680	81500 1690	82000 1700	82500 1710	83000 1720	83500 1730	84000 1740	84500 1750	85000 1760	85500 1770	86000 1780	86500 1790	87000 1800	87500 1810	88000 1820	88500 1830	89000 1840	89500 1850	90000 1860	90500 1870	91000 1880	91500 1890	92000 1900	92500 1910	93000 1920	93500 1930	94000 1940	94500 1950	95000 1960	95500 1970	96000 1980	96500 1990	97000 2000	97500 2010	98000 2020	98500 2030	99000 2040	99500 2050	100000 2060	100500 2070	101000 2080	101500 2090	102000 2100	102500 2110	103000 2120	103500 2130	104000 2140	104500 2150	105000 2160	105500 2170	106000 2180	106500 2190	107000 2200	107500 2210	108000 2220	108500 2230	109000 2240	109500 2250	110000 2260	110500 2270	111000 2280	111500 2290	112000 2300	112500 2310	113000 2320	113500 2330	114000 2340	114500 2350	115000 2360	115500 2370	116000 2380	116500 2390	117000 2400	117500 2410	118000 2420	118500 2430	119000 2440	119500 2450	120000 2460	120500 2470	121000 2480	121500 2490	122000 2500	122500 2510	123000 2520	123500 2530	124000 2540	124500 2550	125000 2560	125500 2570	126000 2580	126500 2590	127000 2600	127500 2610	128000 2620	128500 2630	129000 2640	129500 2650	130000 2660	130500 2670	131000 2680	131500 2690	132000 2700	132500 2710	133000 2720	133500 2730	134000 2740	134500 2750	135000 2760	135500 2770	136000 2780	136500 2790	137000 2800	137500 2810	138000 2820	138500 2830	139000 2840	139500 2850	140000 2860	140500 2870	141000 2880	141500 2890	142000 2900	142500 2910	143000 2920	143500 2930	144000 2940	144500 2950	145000 2960	145500 2970	146000 2980	146500 2990	147000 3000	147500 3010	148000 3020	148500 3030	149000 3040	149500 3050	150000 3060	150500 3070	151000 3080	151500 3090	152000 3100	152500 3110	153000 3120	153500 3130	154000 3140	154500 3150	155000 3160	155500 3170	156000 3180	156500 3190	157000 3200	157500 3210	158000 3220	158500 3230	159000 3240	159500 3250	160000 3260	160500 3270	161000 3280	161500 3290	162000 3300	162500 3310	163000 3320	163500 3330	164000 3340	164500 3350	165000 3360	165500 3370	166000 3380	166500 3390	167000 3400	167500 3410	168000 3420	168500 3430	169000 3440	169500 3450	170000 3460	170500 3470	171000 3480	171500 3490	172000 3500	172500 3510	173000 3520	173500 3530	174000 3540	174500 3550	175000 3560	175500 3570	176000 3580	176500 3590	177000 3600	177500 3610	178000 3620	178500 3630	179000 3640	179500 3650	180000 3660	180500 3670	181000 3680	181500 3690	182000 3700	182500 3710	183000 3720	183500 3730	184000 3740	184500 3750	185000 3760	185500 3770	186000 3780	186500 3790	187000 3800	187500 3810	188000 3820	188500 3830	189000 3840	189500 3850	190000 3860	190500 3870	191000 3880	191500 3890	192000 3900	192500 3910	193000 3920	193500 3930	194000 3940	194500 3950	195000 3960	195500 3970	196000 3980	196500 3990	197000 4000	197500 4010	198000 4020	198500 4030	199000 4040	199500 4050	200000 4060	200500 4070	201000 4080	201500 4090	202000 4100	202500 4110	203000 4120	203500 4130	204000 4140	204500 4150	205000 4160	205500 4170	206000 4180	206500 4190	207000 4200	207500 4210	208000 4220	208500 4230	209000 4240	209500 4250	210000 4260	210500 4270	211000 4280	211500 4290	212000 4300	212500 4310	213000 4320	213500 4330	214000 4340	214500 4350	215000 4360	215500 4370	216000 4380	216500 4390	217000 4400	217500 4410	218000 4420	218500 4430	219000 4440	219500 4450	220000 4460	220500 4470	221000 4480	221500 4490	222000 4500	222500 4510	223000 4520	223500 4530	224000 4540	224500 4550	225000 4560	225500 4570	226000 4580	226500 4590	227000 4600	227500 4610	228000 4620	228500 4630	229000 4640	229500 4650	230000 4660	230500 4670	231000 4680	231500 4690	232000 4700	232500 4710	233000 4720	233500 4730	234000 4740	234500 4750	235000 4760	235500 4770	236000 4780	236500 4790	237000 4800	237500 4810	238000 4820	238500 4830	239000 4840	239500 4850	240000 4860	240500 4870	241000 4880	241500 4890	242000 4900	242500 4910	243000 4920	243500 4930	244000 4940	244500 4950	245000 4960	245500 4970	246000 4980	246500 4990	247000 5000	247500 5010	248000 5020	248500 5030	249000 5040	249500 5050	250000 5060	250500 5070	251000 5080	251500 5090	252000 5100	252500 5110	253000 5120	253500 5130	254000 5140	254500 5150	255000 5160	255500 5170	256000 5180	256500 5190	257000 5200	257500 5210	258000 5220	258500 5230	259000 5240	259500 5250	260000 5260	260500 5270	261000 5280	261500 5290	262000 5300	262500 5310	263000 5320	263500 5330	264000 5340	264500 5350	265000 5360	265500 5370	266000 5380	266500 5390	267000 5400	267500 5410	268000 5420	268500 5430	269000 5440	269500 5450	270000 5460	270500 5470	271000 5480	271500 5490	272000 5500	272500 5510	273000 5520	273500 5530	274000 5540	274500 5550	275000 5560	275500 5570	276000 5580	276500 5590	277000 5600	277500 5610	278000 5620	278500 5630	279000 5640	279500 5650	280000 5660	280500 5670	281000 5680	281500 5690	282000 5700	282500 5710	283000 5720	283500 5730	284000 5740	284500 5750	285000 5760	285500 5770	286000 5780	286500 5790	287000 5800	287500 5810	288000 5820	288500 5830	289000 5840	289500 5850	290000 5860	290500 5870	291000 5880	291500 5890	292000 5900	292500 5910	293000 5920	293500 5930	294000 5940	294500 5950	295000 5960	295500 5970	296000 5980	296500 5990	297000 6000	297500 6010	298000 6020	298500 6030	299000 6040	299500 6050	300000 6060	300500 6070	301000 6080	301500 6090	302000 6100	302500 6110	303000 6120	303500 6130	304000 6140	304500 6150	305000 6160	305500 6170	306000 6180	306500 6190	307000 6200	307500 6210	308000 6220	308500 6230	309000 6240	309500 6250	310000 6260	310500 6270	311000 6280	311500 6290	312000 6300	312500 6310	313000 6320	313500 6330	314000 6340	314500 6350	315000 6360	315500 6370	316000 6380	316500 6390	317000 6400	317500 6410	318000 6420	318500 6430	319000 6440	319500 6450	320000 6460	320500 6470	321000 6480	321500 6490	322000 6500	322500 6510	323000 6520	323500 6530	324000 6540	324500 6550	325000 6560	325500 6570	326000 6580	326500 6590	327000 6600	327500 6610	328000 6620	328500 6630	329000 6640	329500 6650	330000 6660	330500 6670	331000 6680	331500 6690	332000 6700	332500 6710	333000 6720	333500 6730	334000 6740	334500 6750	335000 6760	335500 6770	336000 6780	336500 6790	337000 6800	337500 6810	338000 6820	338500 6830	339000 6840	339500 6850	340000 6860	340500 6870	341000 6880	341500 6890	342000 6900	342500 6910	343000 6920	343500 6930	344000 6940	344500 6950	345000 6960	345500 6970	346000 6980	346500 6990	347000 7000	347500 7010	348000 7020	348500 7030	349000 7040	349500 7050	350000 7060	350500 7070	351000 7080	351500 7090	352000 7100	352500 7110	353000 7120	353500 7130	354000 7140	354500 7150	355000 7160	355500 7170	356000 7180	356500 7190	357000 7200	357500 7210	358000 7220	358500 7230	359000 7240	359500 7250	360000 7260	360500 7270	361000 7280	361500 7290	362000 7300	362500 7310	363000 7320	363500 7330	364000 7340	364500 7350	365000 7360	365500 7370	366000 7380	366500 7390	367000 7400	367500 7410	368000 7420	368500 7430	369000 7440	369500 7450	370000 7

g06474858

[illegible]

[illegible]

Illustration 124

Lift Chart Above : 330, 6700 kg (14770 lb) counterweight, 10.2 m (33 ft 6 inch) super long reach boom, 7.85 m (25 ft 10 inch) stick, 800 mm (32 inch) triple grouser track shoes, and heavy lift OFF

g06474860

Identification Information

i08291721

Plate Locations and Film Locations

SMCS Code: 1000; 7000

The Product Identification Number (PIN) will be used to identify a powered machine that is designed for an operator to ride.

Caterpillar products such as engines, transmissions, and major attachments that are not designed for an operator to ride are identified by Serial Numbers.

For quick reference, record the identification numbers in the spaces that are provided below the illustration.

Product Identification Number (PIN) Plate



Illustration 125

g06184412

The PIN plate is positioned on the front of the machine, close to the operator compartment.

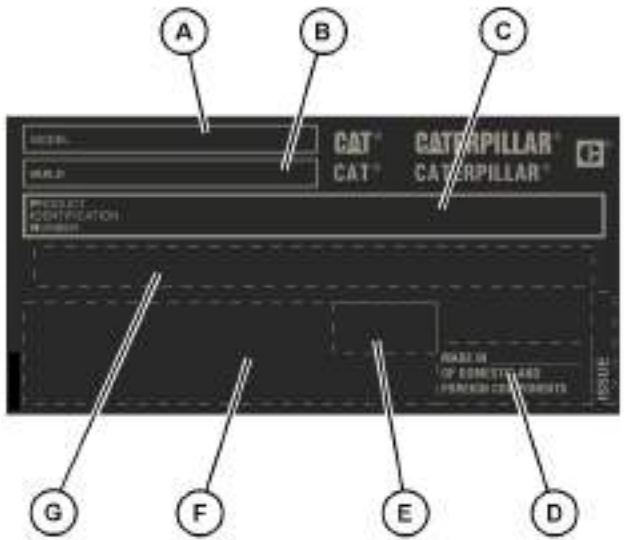


Illustration 126

g06184421

Model number (A)_____

Build (B)_____

Machine PIN (C)_____

Country of Origin Info Plate (If Required) (D)_____

Month and Year of Manufacture (If Required) (E)_____

Regional Certification Plate (If Required) (F)_____

Service Information Plate (G)_____

Local regulation may require documentation of the month and/or year of manufacture in the Operation and Maintenance Manual. Enter on line (E) above if required.

European Union



Illustration 127 g06201193

This plate is positioned on the bottom left side of the plate for the PIN.

Note: The CE plate is on machines that are certified to the European Union requirements that were effective at that time.

For machines compliant to 2006/42/EC, the following information is stamped onto the CE plate. For quick reference, record this information in the spaces that are provided below.

- Engine Power Primary Engine (kW)_____
- Engine Power for Additional Engine (kW) (If Equipped) _____
- Typical Machine Operating Weight for European Market (kg)_____
- Year of Construction_____
- Machine Type _____



Illustration 128 g06201198

This plate is positioned on the bottom left side of the plate for the PIN.

Note: The CE plate is on machines that are certified to the European Union requirements that were effective at that time.

For machines compliant to 98/37/EC and 89/392/EEC, the following information is stamped onto the CE plate. For quick reference, record this information in the spaces that are provided below.

- Engine Power Primary Engine (kW)_____
- Typical Machine Operating Weight for European Market (kg)_____
- Year_____

For manufacturer name and address and the country of origin, see the PIN plate.

Eurasian Economic Union

For machines compliant to the Eurasian Economic Union requirements, the EAC plate is positioned on or near the Product Identification Number (PIN) plate (see Product Information Section of the machine Operation and Maintenance Manual). The EAC plate is placed on machines certified to the Eurasian Economic Union requirements effective at the time of market entry.

Note: One of the below plates may be installed on the machine.



Illustration 129 g06094564

If equipped, the Month and Year of Manufacture are on the PIN plate.



Illustration 130 g06532250

If equipped, the following information is stamped onto the EAC plate. For quick reference, record this information in the spaces provided below.

- Primary Engine Power (kW)_____
- Additional Engine Power (kW) _____
- Typical Machine Operating Weight for Eurasian Economic Union (kg)_____
- Month and Year of Manufacture_____
- Machine Type _____

Manufacturer Information

Manufacturer:

Caterpillar Inc.,
100 N.E. Adams Street
Peoria, Illinois 61629, USA

Entity authorized by the manufacturer at the territory of Eurasian Economic Union:

Caterpillar Eurasia LLC
75, Sadovnicheskaya Emb.
Moscow 115035, Russia

Machine Specification Film

The machine specification film is on machines that are going into Japan.

The Japanese Industrial Safety and Health Act requires machine specifications to be displayed on a film that can easily be seen by the operator.

If equipped, this film will be located on the cab door.

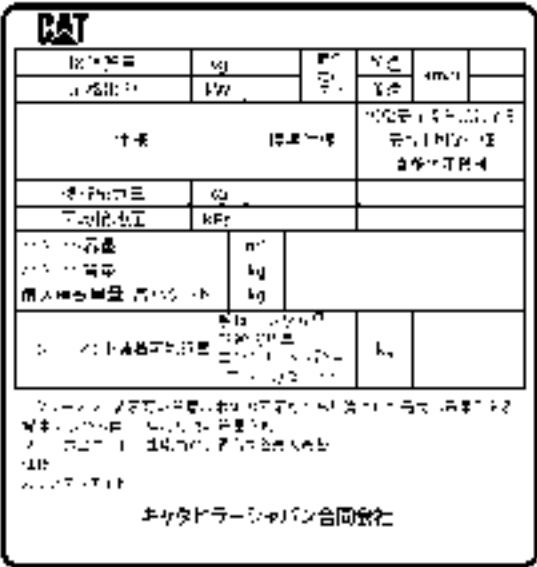


Illustration 131 g06178867

Typical example

Electromagnetic Emissions

Note: This label is on machines that are going into Canada.



Illustration 132

g06063443

If equipped, this label is located next to the PIN plate. This label verifies that the product meets the requirements of ICES-002 Issue 6. Compliance to ICES-002 Issue 6 is accomplished by meeting electromagnetic emissions industry standard CISPR-12.

Engine Serial Number

This label is located on the engine.

Engine Serial Number _____

Sound Certification Film

If equipped, this label is located on the cab door.

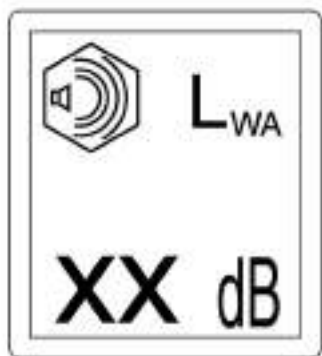


Illustration 133

g06248926

If equipped, this label will be located on the cab door. The certification label is used to verify the environmental sound certification of the machine to the requirements of the European Union. The value that is listed on the label indicates the guaranteed exterior sound power level L_{WA} at the time of manufacture for the conditions that are specified in "2000/14/EC".



Illustration 134

g03105800

(A) Low Noise Film
(B) Super Low Noise Film

If equipped, these certification labels are used to verify the Japan Ministry of Land, Infrastructure, Transportation, and Tourism (MLIT) noise designation according to the Japan "Designation Rule of Low Noise Type Construction Machine".

Low Noise (A) – Verifies that the Japan "MLIT" designates the machine as a "Low Noise" type construction machine.

Super Low Noise (B) – Verifies that the Japan "MLIT" designates the machine as a "Super Low Noise" type construction machine.

i05757951

Emissions Certification Film

SMCS Code: 1000; 7000; 7405

Note: This information is pertinent in Japan.



Illustration 135

g03654940

2014 certification label example

A certification label is located on the cab door.

The certification label verifies that the machine conforms to the 2014 Japan Nonroad Special Motor Vehicle Exhaust Regulation.

i08085827

Emissions Certification Film

SMCS Code: 1000; 7000; 7405

Consult your Cat dealer for an Emission Control Warranty Statement.

The emission certification film is on the engine.

Declaration of Conformity

SMCS Code: 1000; 7000

Table 13

An EC or EU Declaration of Conformity document was provided with the machine if it was manufactured to comply with specific requirements for the European Union. In order to determine the details of the applicable Directives, review the complete EC or EU Declaration of Conformity provided with the machine. The extract shown below from an EC or EU Declaration of Conformity for machines that are declared compliant to "2006/42/EC" applies only to those machines originally "CE" marked by the manufacturer listed and which have not since been modified.

ORIGINAL EC or EU DECLARATION OF CONFORMITY

Manufacturer: Caterpillar Inc., 100 N.E. Adams Street, Peoria, Illinois 61629, USA

Person authorized to compile the Technical File and to communicate relevant part (s) of the Technical File to the Authorities of European Union Member States on request:

Standards & Regulations Manager, Caterpillar France SAS
40 Avenue Leon-Blum 38000 Grenoble, France

I, the undersigned, _____, hereby certify that the construction equipment specified hereunder

Description:	Generic Denomination:	Earth - moving Equipment
	Function:	Hydraulic Excavator
	Model/Type:	330
	Serial Number:	
	Commercial Name:	Caterpillar

Fulfills all the relevant provisions of the following Directives

Directives	Notified Body	Document No.	
2000/14/EC amended by 2005/88/EC, Note (1)			
2006/42/EC	N/A		
2014/30/EU	N/A		

Note (1) Guaranteed Sound Power Level - ____ dB (A) Annex VI
Representative Equipment Type Sound Power Level - ____ dB (A)
[Engine Power per ISO 14396 - ____ kW, Rated engine speed - ____ rpm
Technical Documentation accessible through person listed above authorized to compile the Technical File

Done at:

Signature

Date:

Name/Position

Note: The above information was correct as of August 2017, but may be subject to change, please refer to the individual declaration of conformity issued with the machine for exact details.

Operation Section

Before Operation

i07103304

Mounting and Dismounting

SMCS Code: 6700; 7000



Illustration 136

g06224270

Typical example

Mount the machine and dismount the machine only at locations that have steps and/or handholds. Before you mount the machine, clean the steps and the handholds. Inspect the steps and handholds. Make all necessary repairs.

Face the machine whenever you get on the machine and whenever you get off the machine.

Maintain a three-point contact with the steps and with the 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 carry tools or supplies when you try to mount the machine or when you try to dismount the machine. 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.

Machine Access System Specifications

The machine access system has been designed to meet the intent of the technical requirements in "ISO 2867 Earth-moving Machinery – Access Systems". The access system provides for operator access to the operator station and to conduct the maintenance procedures described in Maintenance section.

Alternate Exit

Machines that are equipped with cabs have alternate exits. For additional information, see Operation and Maintenance Manual, "Alternate Exit".

i08019624

Daily Inspection

SMCS Code: 1000; 6319; 6700; 7000

WARNING

Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact skin.

At operating temperature, the engine coolant is hot and under pressure.

Steam can cause personal injury.

Check the coolant level only after the engine has been stopped and the cooling system pressure cap is cool enough to touch with your bare hand.

Remove the cooling system pressure cap slowly to relieve pressure.

Cooling system conditioner contains alkali. Avoid contact with the skin and eyes to prevent personal injury.

NOTICE

Accumulated grease and oil on a machine is a fire hazard. Remove this debris with steam cleaning or high pressure water, at least every 1000 hours or each time any significant quantity of oil is spilled on a machine.

For maximum service life of the machine, perform a thorough walk-around inspection before you mount the machine and before you start the engine.

First 100 Hours

Daily, perform the procedures that are applicable to your machine:

- Operation and Maintenance Manual, "Boom and Stick Linkage - Lubricate"

- Operation and Maintenance Manual, “Bucket Linkage - Lubricate”

Daily Basis

Daily, perform the procedures that are applicable to your machine:

- Operation and Maintenance Manual, “Cooling System Coolant Level - Check”
- Operation and Maintenance Manual, “Engine Oil Level - Check”
- Operation and Maintenance Manual, “Fuel System Water Separator - Drain”
- Operation and Maintenance Manual, “Fuel Tank Water and Sediment - Drain”
- Operation and Maintenance Manual, “Hydraulic System Oil Level - Check”
- Operation and Maintenance Manual, “Indicators and Gauges - Test”
- Operation and Maintenance Manual, “Seat Belt - Inspect”
- Operation and Maintenance Manual, “Track Adjustment - Inspect”
- Operation and Maintenance Manual, “Travel Alarm - Test”

Refer to Operation and Maintenance Manual, “Maintenance Interval Schedule” for all maintenance recommendations.

Note: Watch closely for leaks. If you observe a leak, find the source of the leak and correct the leak. If you suspect a leak or you observe a leak, check the fluid levels more frequently.



Illustration 137

g06181597

Inspect the attachment control linkage, attachment cylinders, and attachment for damage or excessive wear. Make any necessary repairs.

Inspect the lights for broken bulbs and for broken lenses. Replace any broken bulbs and any broken lenses.

Inspect the engine compartment for any trash buildup. Remove any trash buildup from the engine compartment.

Inspect the cooling system for any leaks, for faulty hoses and for any trash buildup. Correct any leaks. Remove any trash from the radiator.

Inspect all the belts for the engine attachments. Replace any belts that are worn, frayed, or broken.



Illustration 138

g06181620

Inspect the hydraulic system for leaks. Inspect the tank, cylinder rod seals, hoses, tubes, plugs, connections, and fittings. Correct any leaks in the hydraulic system.

Inspect the tubes and hoses along the boom and stick for wear and leaks. Replace any hoses or tubes that are worn or leak.

Inspect the differential and the final drives for leaks. Make any necessary repairs.

Operation Section
Daily Inspection

Inspect the swing drive for leaks.

Make sure that all covers and guards are securely attached. Inspect the covers and the guards for damage.

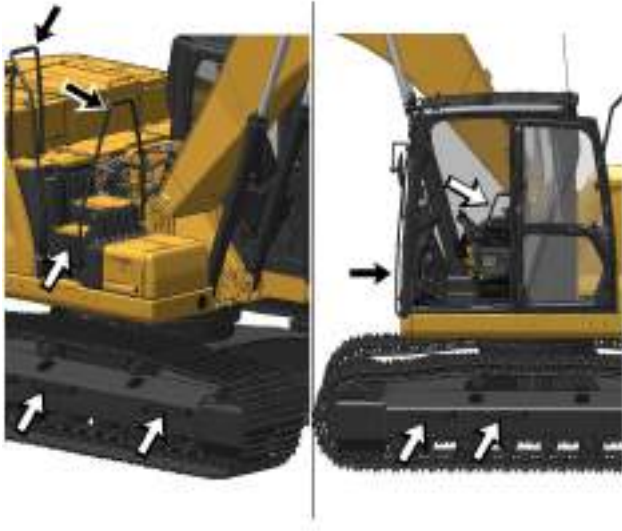


Illustration 139

g06181696

Inspect the steps, the walkways, and the handholds.
Clean the steps, the walkways, and the handholds.
Make any necessary repairs.

Inspect the operator compartment for trash buildup.
Check for trash buildup under the floorplate and on
the crankcase guard. Keep these areas clean.

Adjust the mirrors to achieve the best visibility.

Machine Operation

i06952448

Alternate Exit

SMCS Code: 7310

Rear Window with Ring Seal (If Equipped)

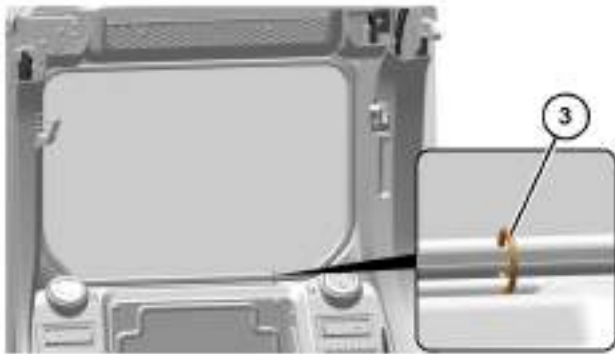


Illustration 140

g06187008



Alternate Exit – The rear window serves as an alternate exit.

To remove the rear window, pull ring (3) and completely remove the window seal, then push out the glass. Climb through the rear window opening to exit the cab.

Rear Window with Lever (If Equipped)



Illustration 141

g06213470

Inside lever in latched position



Alternate Exit – The rear window serves as an alternate exit.

To remove the rear window, rotate handle from its latched position, then push out the glass. Climb through the rear window opening to exit the cab.

i07383859



Illustration 142

g06213471

The window is also equipped with an outside handle. If the operator is unable, outside personnel can rotate the outside handle and pull the window out.

Seat

SMCS Code: 5258-025; 7312-025; 7324; 7327

Comfort Level Seat (If Equipped)



Illustration 143

g06225151

- (1) Headrest
- (2) Backrest adjuster
- (3) Seat and console fore and aft adjuster
- (4) Indicator
- (5) Seat height adjustment lever
- (6) Seat fore and aft lever

The operator can adjust the height of headrest (1). To adjust the headrest, hold the headrest with both hands. Move the headrest up and down. Release the headrest when the desired position is attained. The headrest will remain in the desired position.

Pull up on backrest adjuster (2) to release the lock. Move the backrest to the desired position and then release the adjuster.

Lift up on fore and aft adjuster (3) to release the seat from the locked position. Adjust the seat and console forward or rearward to the desired position and then release the lever to lock the seat.

Use seat height adjustment lever (5) to adjust the seat for the operator's height and weight. Move the adjuster switch to the "+" symbol to raise the height. Ratchet the seat upward without sitting in the seat. Then sit in the seat to check the color of indicator (4). When the indicator is showing green, the seat is in the right range for the operator. Further adjustment can be made as long as the indicator stays green.

To lower the seat, move the adjust switch to the "-" symbol. Ratchet the adjuster downward without sitting in the seat. Then sit in the seat to check the color of indicator (4). When the indicator is showing green, the seat is in the right range for the operator. Further adjustment can be made as long as the indicator stays green.

Pull upward on seat fore and aft lever (6) to release the cushion lock. Adjust the seat cushion forward or backward to the desired position and then release the lock to lock the cushion in place.

Deluxe Level Seat (If Equipped)



Illustration 144

g06303504

- (1) Adjustment lever for the lumbar support
- (2) Seat heater switch
- (3) Adjustment lever for reclining the seat
- (5) Indicator
- (6) Seat and console fore and aft lever
- (7) Seat height adjustment
- (8) Seat cushion angle adjuster
- (9) Console height adjuster
- (10) Seat fore and aft adjuster
- (11) Seat cushion fore and aft adjuster
- (12) Headrest

Operation Section

Seat

The lumbar support is located in the back of the seat. Turn knob (1) (if equipped) counterclockwise to increase the force of the lumbar support. To decrease the lumbar support, continue to turn the knob counterclockwise.

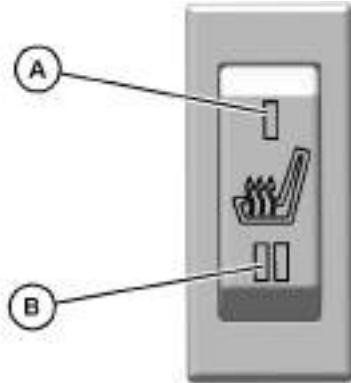


Illustration 145

g06251600

(A) Low heat
(B) High heat

Seat heater switch (2) is a three position switch. The middle position of the switch is off. Press the top position of the switch for low heat. Press the bottom of the switch for high heat.

WARNING

Heat-induced burns can occur when some people use a seat heater. Do not use the seat heater if you have a reduced ability to sense temperature changes, a reduced ability to feel pain, or have sensitive skin.

Pull up lever (3) to change the angle of the backrest. With the backrest in the desired position. Release the lever.

Push in adjuster (11) to adjust the fore/aft position of the seat cushion.

Pull lever (6) to adjust the seat and the console forward and backward.

Operate seat height adjustment (7) to adjust the seat and the console to the desired height. Pull up the lever to raise the height of the seat. Push down on the lever to lower the seat. Indicator (5) will turn green when the seat is at the optimum height for the operator's height and weight. If the indicator is yellow, further adjustment is required.

Note: Do not operate the seat compressor for over a minute or damage can result.

Use handle (9) to adjust the height of the console. When the lever is pulled forward, a gear is released. The operator can rotate the lever freely. Release the lever to return to the original position.

To adjust the seat forward or backward, pull up lever (10) and hold the lever. Move the seat to the desired position. To lock the seat in the selected position, release the lever.

Push the adjuster (8) to adjust the tilt angle of the seat cushion.

The operator can adjust the height of headrest (12). To adjust the headrest, hold the headrest with both hands. Move the headrest up and down. Release the headrest when the desired position is attained. The headrest will remain in the desired position.

Premium Level Seat (If Equipped)



Illustration 146

g06251562

- (1) Seat heater switch
- (2) Cooling switch
- (3) Adjustment lever for reclining the seat
- (4) Fore/Aft isolator activate/deactivate lever
- (5) Seat and console fore and aft lever
- (6) Seat cushion angle adjuster
- (7) Seat height adjustment
- (8) Adjustable damper
- (9) Seat cushion fore and aft adjuster
- (10) Console height adjustment
- (11) Seat fore and aft adjuster
- (12) Headrest

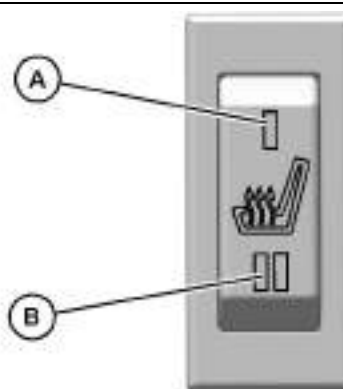


Illustration 147

g06251600

- (A) Low heat
- (B) High heat

Seat heater switch (1) is a three position switch. The middle position of the switch is off. Press the top position of the switch for low heat. Press the bottom of the switch for high heat.

WARNING

Heat-induced burns can occur when some people use a seat heater. Do not use the seat heater if you have a reduced ability to sense temperature changes, a reduced ability to feel pain, or have sensitive skin.

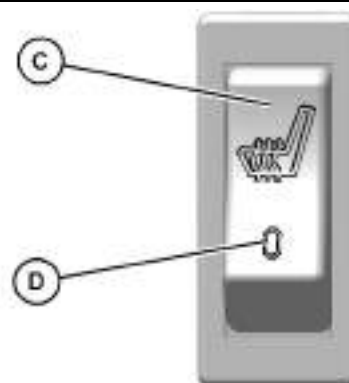


Illustration 148

g06251623

- (C) Cooling on
- (D) Cooling off

To cool the seat, press the top of cooling switch (2). Press the bottom of the switch to turn the cooling off.

Pull up lever (3) to change the angle of the backrest. With the backrest in the desired position. Release the lever.

Push in adjuster (9) to adjust the fore/aft position of the seat cushion.

Pull lever (5) to adjust the seat and the console forward and backward.

Fore/Aft isolator activate/deactivate lever (4) allows the operator to lock the seat and console or allow the seat and console to float with the movement of the machine. With the adjuster pointing to the front of the machine, the console is locked. Rotate the lever to the rear to unlock the console and allow it to float.

Operate seat height adjustment (7) to adjust the seat and the console to the desired height. Pull up the lever to raise the height of the seat. Push down on the lever to lower the seat.

Use adjustable damper (8) to stiffen or loosen the seat suspension.

Note: Do not operate the seat compressor for over a minute or damage can result.

Use handle (10) to adjust the height of the console. When the lever is pulled forward, a gear is released. The operator can rotate the lever freely. Release the lever to return to the original position.

To adjust the seat forward or backward, pull up lever (11) and hold the lever. Move the seat to the desired position. To lock the seat in the selected position, release the lever.

Push adjuster (6) to adjust the tilt angle of the seat cushion.

The operator can adjust the height of headrest (12). To adjust the headrest, hold the headrest with both hands. Move the headrest up and down. Release the headrest when the desired position is attained. The headrest will remain in the desired position.

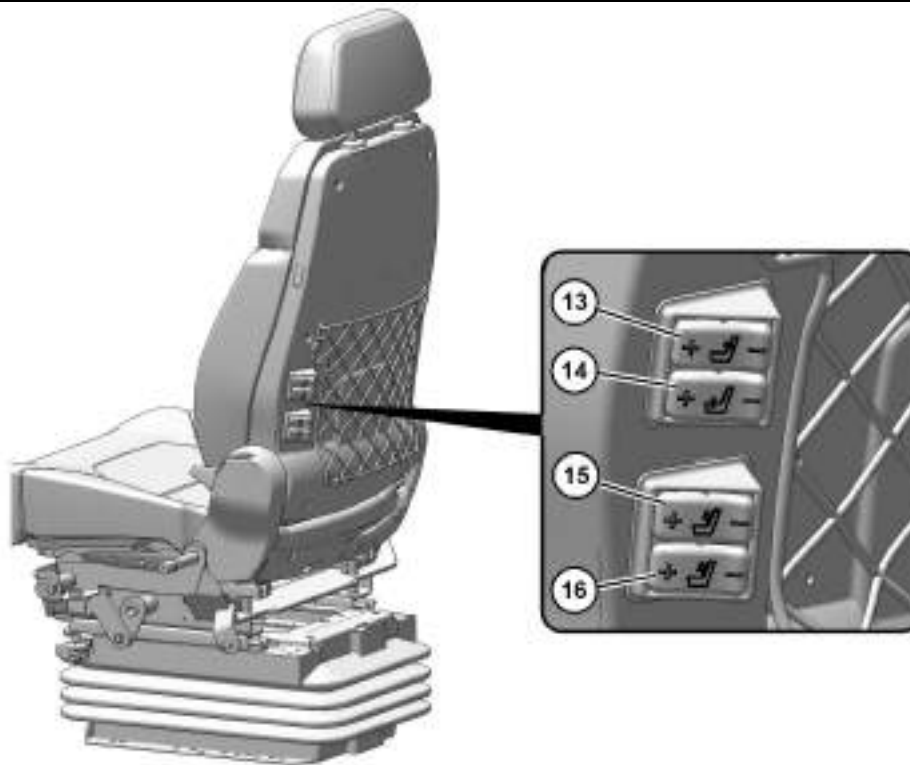


Illustration 149

g06251575

(13) Seat back side bolster control
(14) Seat cushion side bolster control

(15) Upper lumbar control
(16) Lower lumbar control

The lumbar controls on the back of the seat back all use two position switches. Press the + symbol to increase lumbar support. Press the - symbol to decrease lumbar support.

i07092308

Seat Belt

SMCS Code: 7327

Note: This machine was equipped with a seat belt when the machine was shipped from Caterpillar. At the time of installation, the seat belt and the instructions for installation of the seat belt meet the SAE J386 and ISO 6683 standards. Consult your Cat dealer for all replacement parts.

Always check the condition of the seat belt and the condition of the mounting hardware before you operate the machine.

Seat Belt Adjustment for Retractable Seat Belts

Fastening The Seat Belt



Illustration 150

g06223891

Pull seat belt (2) out of retractor (1) in a continuous motion.

Fasten seat belt catch (3) into buckle (4). Make sure that the seat belt is placed low across the lap of the operator.

The retractor will adjust the belt length and the retractor will lock in place. The comfort ride sleeve will allow the operator to have limited movement.

Releasing The Seat Belt



Illustration 151

g06223894

Push the release button on the buckle to release the seat belt. The seat belt will automatically retract into the retractor.

Extension of the Seat Belt

WARNING

When using retractable seat belts, do not use seat belt extensions, or personal injury or death can result.

The retractor system may or may not lock up depending on the length of the extension and the size of the person. If the retractor does not lock up, the seat belt will not retain the person.

Longer, non-retractable seat belts and extensions for the non-retractable seat belts are available.

Caterpillar requires only non-retractable seat belts to be used with a seat belt extension.

Consult your Cat dealer for longer seat belts and for information on extending the seat belts.

i07098988

Selective Catalytic Reduction Warning System

SMCS Code: 1091-WXX; 7400

The selective catalytic reduction (SCR) system is a system used to reduce NOx emissions from the engine. Diesel exhaust fluid (DEF) is pumped from the DEF tank and is sprayed into the exhaust stream. The DEF reacts with the SCR catalyst to reduce NOx and leaves a nitrogen and water vapor. The Exhaust Gas Recirculation (EGR) system cools, measures, and introduces recirculated exhaust gas into the intake manifold to aid in NOx reduction.

NOTICE

Stopping the engine immediately after the engine has been working under load can result in overheating of SCR components.

Refer to the Operation and Maintenance Manual, "Engine Stopping" procedure to allow the engine to cool and to prevent excessive temperatures in the turbocharger housing and the DEF injector.

Note: With the operator key in the OFF position, the purge system will activate.

Definitions

Observe the following definitions.

Self-correct – Fault condition no longer exists. An active fault code will no longer be active.

Notification – Action taken by the system to alert the operator of pending Inducement.

Inducement – Engine derates, vehicle speed limits, or other actions intended to prompt the operator to repair or maintain the emission control system.

Inducement Trigger – Fault conditions that result in activation of the inducement strategy. DEF level inducement faults have a diagnostic fault code. DEF quality fault, SCR tampering fault, SCR system fault, and EGR system faults will all have a related diagnostic fault code along with an inducement diagnostic fault code.

First occurrence – A DEF quality fault, SCR tampering fault, SCR system fault, or an EGR system fault becomes active for the first time.

Repeat occurrence – If any DEF quality fault, SCR tampering fault, SCR system fault, or an EGR system fault becomes active again within 40 hours of the first occurrence.

Safe Harbor Mode – Safe harbor mode is a 20 minute engine run time period. The engine can be operated with full power after reaching a level 3 inducement. Once in level 3 inducement, the operator can perform a key cycle and the engine will enter safe harbor mode. Safe harbor mode can only be implemented once. Safe harbor mode is not allowed for DEF level inducements.



Illustration 152

g06223861

DEF Level Normal

Inducement Strategy for DEF Level

If multiple warnings are present in the system, the most important problem is shown first. Press the right key or press the left key to view all the warnings that are present in the machine. If no keys are pressed within 5 seconds, the display will return to the most important problem.

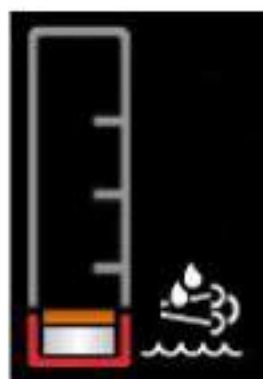


Illustration 153

g06223864

DEF Level Low

If the DEF level falls below 19%, "DEF Level Low" message will be displayed on the monitor. To avoid further inducements, turn the key to the OFF position and add DEF to the DEF tank.

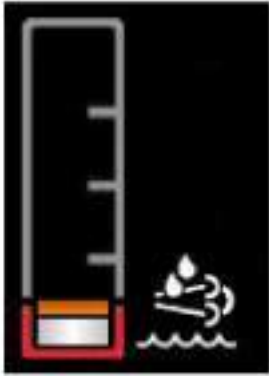


Illustration 154

g06223865

DEF Level Low and Emission Fault

If the DEF level falls below 12.5%, a level 1 inducement event will occur. a “DEF Level Low” message and an “Emission Fault” message will appear on the monitor.



Illustration 156

g06223883

DEF Level Low, Emission Fault, Flashing Action Lamp, and Audible Alarm

If the ECM is configured to “Reduced Performance” and the DEF tank has been emptied of all DEF, the engine will be in a level 3 final inducement. If the ECM is configured to “Reduced Time” and the DEF level is 0%, the engine will be in a level 3 final inducement. Prior to final inducement a “DEF Level Low” message, and an “Emission Fault” message will appear on the monitor. The action lamp on the monitor will flash and an audible alarm will sound 20 seconds prior to the final inducement. The engine will be taken to low idle or will be shut down. Once shut down, the engine can be restarted for 5 minute periods at reduced speed and torque. If set to idle, the engine will idle indefinitely at reduced torque. The amber indicator next to the DEF level gauge on the dash will remain lit.

Note: Turn the key to the OFF position and add DEF to the DEF tank to reset the DEF level inducement.



Illustration 155

g06223866

DEF Level Low, Emission Fault, and Flashing Action Lamp

If the DEF level is below 6%, a level 2 inducement event will occur. a “DEF Level Low” message and an “Emission Fault” message will appear on the monitor. The action lamp on the monitor will flash. If the ECM is configured to “Reduced Performance” and the DEF level has reached 0%, the machine will be limited to 75% torque.

Inducement Strategy for DEF Quality, Tampering, SCR System Fault, and Impeded EGR

If multiple warnings are present in the system, the most important problem is shown first. Press the right key or press the left key to view all the warnings that are present in the machine. If no keys are pressed within 5 seconds, the display will return to the most important problem.



Illustration 157

g03623190

A “Engine Fault Check Engine” message and an “Emission Fault” message will appear on the monitor for a fault resulting from poor DEF quality, SCR system tampering, SCR system fault, or an EGR system fault. If the fault is the result of poor DEF quality, SCR system tampering, or SCR system fault, a first occurrence will result in a level 1 inducement for a duration of 2.5 hours. The level 1 inducement will also illuminate the check engine lamp. Repeat occurrences will result in a level 1 inducement duration of 5 minutes. If the fault is the result of an EGR system fault, a first occurrence will result in a level 1 inducement for a duration of 35 hours. Repeat occurrences will result in a level 1 inducement duration of 48 minutes.

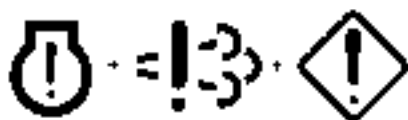


Illustration 158

g03623191

If a fault condition exists for the entire duration of inducement level 1, the strategy advances to inducement level 2. A “Engine Fault Check Engine” message, and an “Emission Fault” message will appear on the monitor and the action lamp on the monitor will flash for a fault resulting from poor DEF quality, SCR system tampering, SCR system fault, or an EGR system fault. For poor DEF quality, SCR system tampering, and SCR system faults, the duration for a level 2 inducement is 70 minutes for the first occurrence. For EGR system faults, the duration for a level 2 inducement is 60 minutes for the first occurrence. Repeat occurrences for poor DEF quality, SCR system tampering, and SCR system faults will result in a level 2 inducement of 5 minutes. Repeat occurrences for EGR system faults will result in a level 2 inducement of 60 minutes.

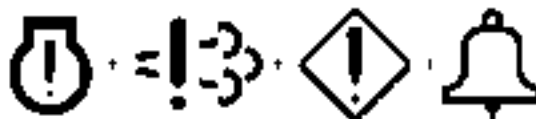


Illustration 159

g03623193

If a fault condition exists for the entire duration of inducement level 2, the strategy advances to inducement level 3. A “Engine Fault Check Engine” message, and an “Emission Fault” message will appear on the monitor, the action lamp will flash, and an audible alarm will sound 20 seconds prior to the level 3 inducement. The engine will be taken to low idle or will be shut down. After the level 3 inducement you may cycle the key, which will allow 20 minutes of engine run time with full torque. After 20 minutes, the engine will be in level 3 final inducement and will allow idle only or be shut down until the issue has been resolved. Once shut down, the engine can be restarted for 5 minute periods at reduced speed and torque. If set to idle, the engine will idle indefinitely at reduced torque.

Note: Contact your Cat dealer for repairs if a fault occurs.

i08036134

Operator Controls

SMCS Code: 7300; 7301; 7451

Note: Your machine may not be equipped with all the controls that are described in this topic.

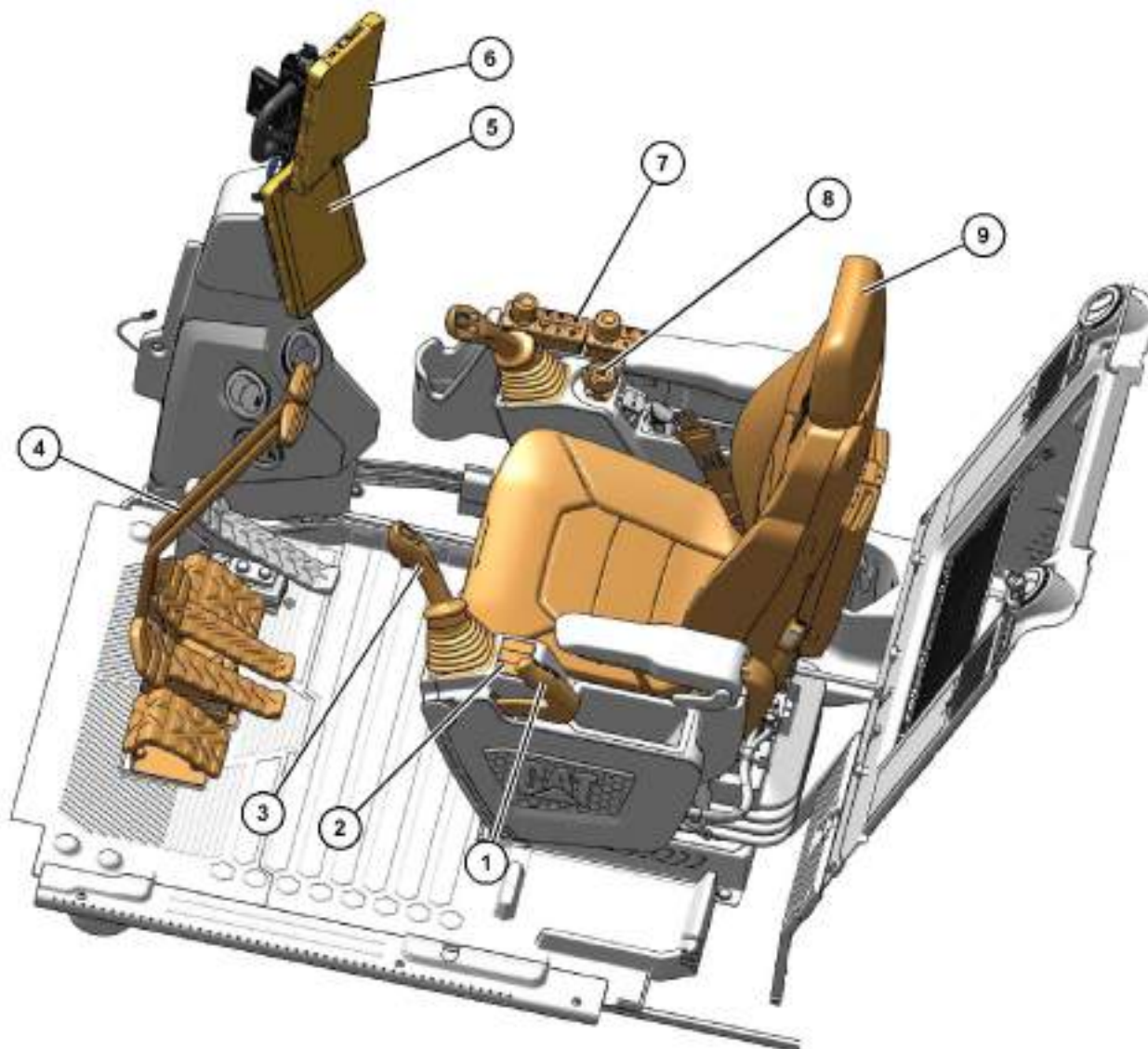


Illustration 160

g06178344

- (1) Hydraulic lockout control
- (2) Left side switch panel
- (3) Joystick controls

- (4) Travel controls
- (5) Monitor
- (6) Cat Grade Control Monitor (If Equipped)

- (7) Right side switch panel
- (8) Engine start switch
- (9) Operator seat

Hydraulic Lockout Control (1)

The lever for the hydraulic lockout control is at the left side of the left console.



Locked – Move the travel levers/pedals and move the joysticks to the **HOLD** (center) position. Move the lever for the hydraulic lockout control backward to the **LOCKED** position. All the factory installed hydraulic controls will become inoperable.



Unlocked – Move the lever for the hydraulic lockout control forward to the **UNLOCKED** position. All the factory installed hydraulic controls will become operable.

Note: Make sure that the lever for the hydraulic lockout control is in the **LOCKED** position before attempting to start the engine. If the lever is in the **UNLOCKED** position, the engine start switch will not function.



Tilt – For machines equipped with the tilt-up console, pull the lever to the rearmost position to release the console lock and tilt the console upward for easier exit and entry.

Left Side Switch Panel (2)



Illustration 161

g06219690

Beacon Light Switch (2A) (If equipped)



Beacon Light Switch – Push the top of the switch to turn on the beacon light. Push the bottom of the switch to turn off the beacon light.

Quick Coupler Control (2B) (If equipped)



If equipped, the switch for the quick coupler control is on the left console. The switch is equipped with a spring loaded lock button. To operate the switch, the lock button must be pushed forward to release the switch. With the lock held forward, press the rear of the switch downward to uncouple the bucket or work tool. Press the button again to attach the bucket or work tool.

Note: An alarm will sound whenever the switch has been activated to lock or unlock a work tool.

For further details, see Operation and Maintenance Manual, “Quick Coupler Operation”.

Joystick Controls (3)

The joystick control is used to control the functions of the machine implements. For more information on the individual functions of the joysticks, refer to Operation and Maintenance Manual, “Joystick Controls”.

Travel Control (4)



Illustration 162

g06178249

Position for normal travel

- (A) Rear of machine
- (B) Final drive
- (C) Idler

When you travel, make sure that final drive sprockets (B) are under the rear of the machine.

Stop – Release the travel levers/pedals to stop the machine. When you release the travel levers/pedals from any position, the travel levers/pedals will return to the CENTER position. The travel brakes will be applied.

Move both of the travel levers or both of the travel pedals equally in the same direction to travel straight.

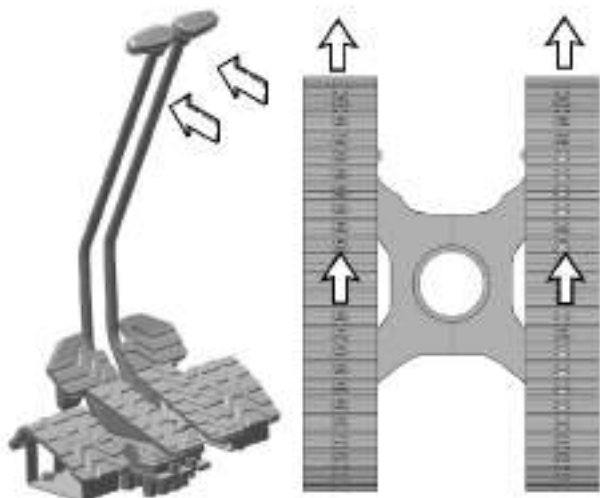


Illustration 163
FORWARD travel

g06178269

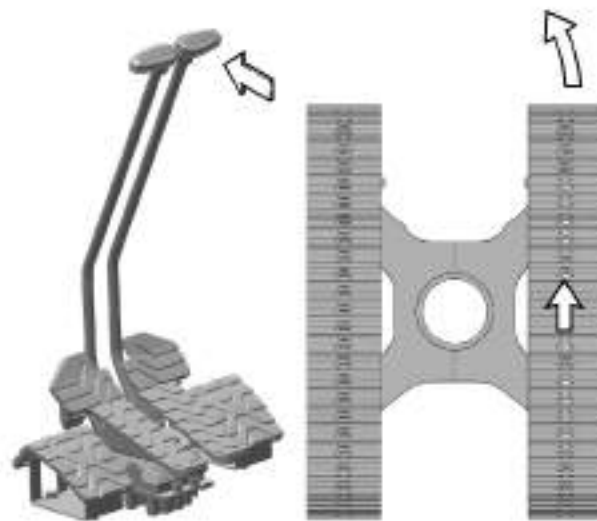


Illustration 165
Pivot left turn (FORWARD)

g06178288

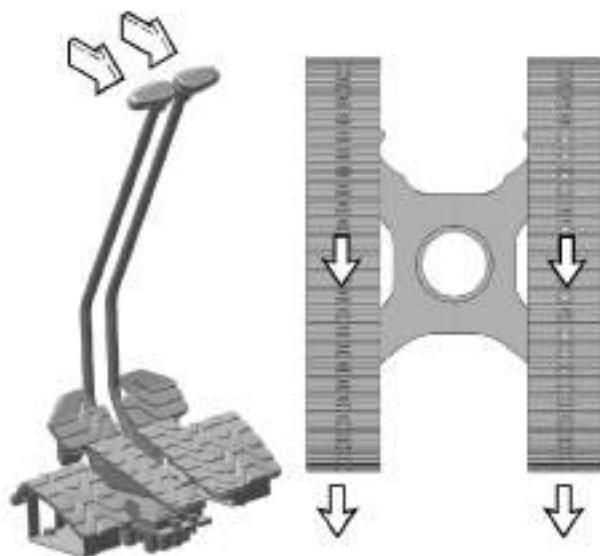


Illustration 164
REVERSE travel

g06178283

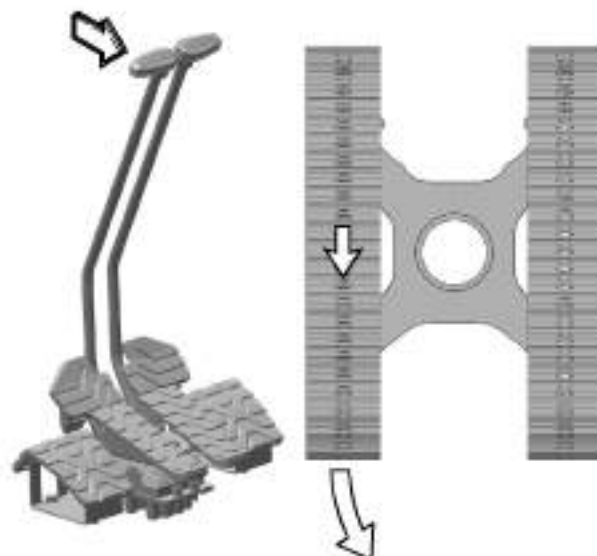


Illustration 166
Pivot Left Turn (REVERSE)

g06178294

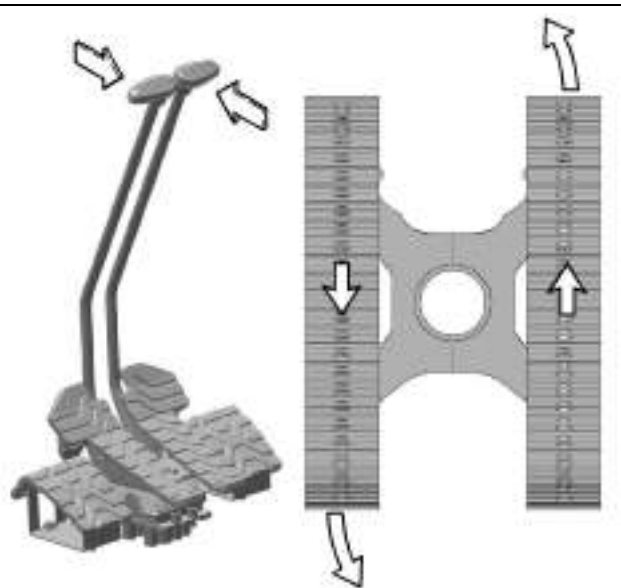


Illustration 167

g06178300

Counterrotate turn (LEFT)

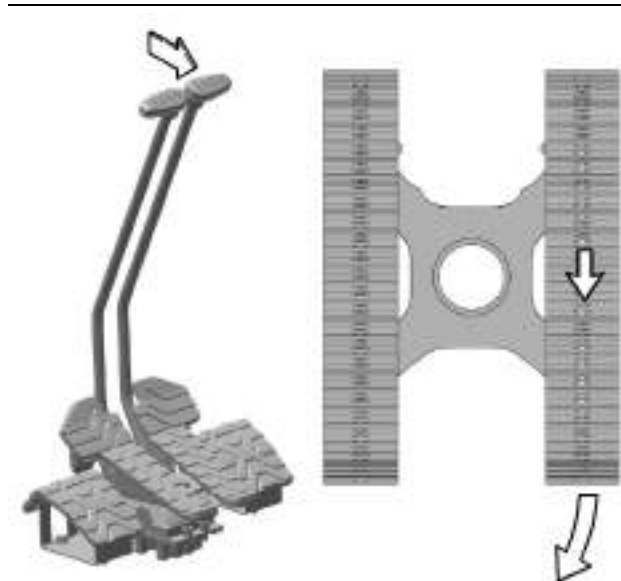


Illustration 169

g06178308

Pivot right turn (REVERSE)

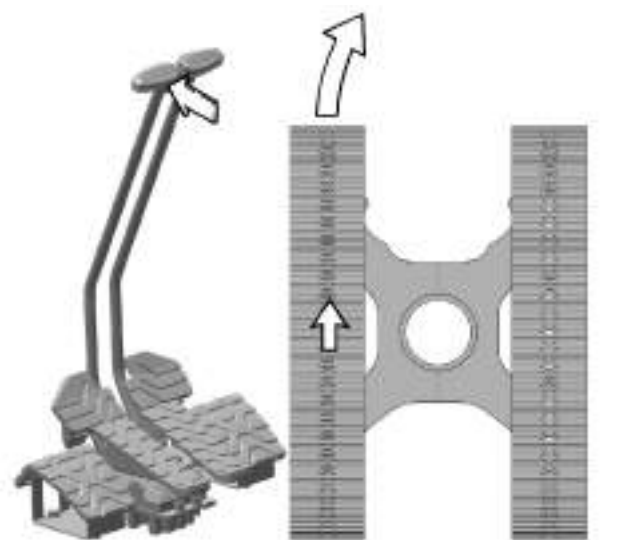


Illustration 168

g06178305

Pivot right turn (FORWARD)

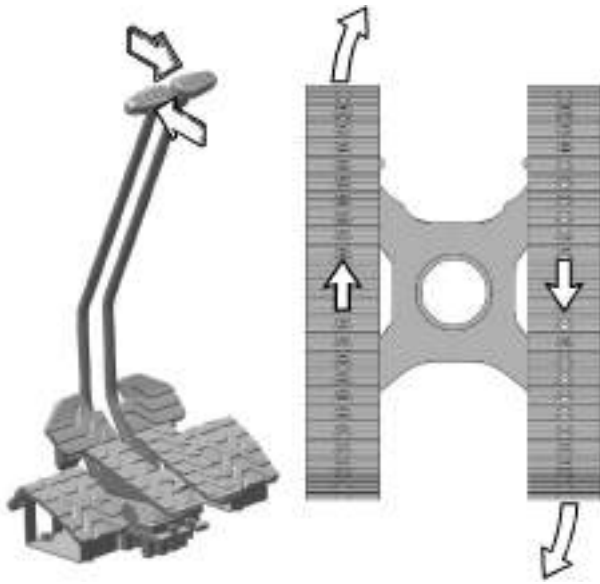


Illustration 170

g06178313

Counterrotate turn (RIGHT)

Monitor (5)

The monitor is used to display various operating information of the machine. For more information on the operation of the monitor, refer to Operation and Maintenance Manual, "Monitoring System".

Cat Grade Control Monitor (6) (if equipped)

Monitor (6) is used to display Cat Grade Control operating information. Cat Grade Control is designed to calculate bucket tip position and provide visual and audible feedback to the operator. This feedback allows the operator to achieve the desired grade safer, quicker and more accurately than traditional grading techniques. For more information on the operation of the monitor, refer to Operation and Maintenance Manual, M0082987, "Cat 2D and 3D GRADE System for Next Gen Hydraulic Excavators".

Engine Start Switch (8)

NOTICE

The engine start switch must be in the ON position and the engine must be running in order to maintain electrical functions and hydraulic functions. This procedure must be followed in order to prevent serious machine damage.

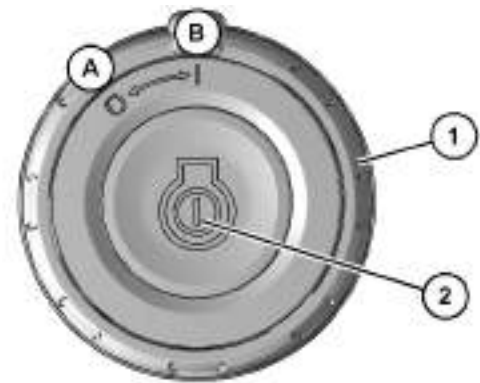


Illustration 171

g06180554

(A) Off

(B) On

(1) Engine start ring

(2) Start button



OFF – Turn the engine start ring (1) to the OFF position (A) to stop the engine.



ON – To activate the electrical circuits in the cab and enable engine starting, turn the engine start ring (1) clockwise to the ON position (B).



START – To start the engine, enter the code on the monitor. Press start button (2). After the engine starts, release the button.

Note: Pressing the start button with the engine on will also turn off the engine.

Engine Idle Shutdown

If the operator has not operated the machine for a period of time, this function shuts down the engine. Engine Idle Shutdown does not shut down other systems, such as the AC, which can run down the battery after idle shutdown. This function comes disabled from the factory but can be enabled and adjusted in the monitoring system. Refer to Operation and Maintenance Manual, "Monitoring System".

Note: Engine Idle Shutdown may be required for local regulations.

The Engine Idle Shutdown (EIS) shuts down the engine if the following conditions are met:

- The control levers are in neutral.
- The engine coolant temperature is greater than 70° C (158° F).
- The battery voltage is greater than 24.5V
- The engine speed is less than 2000 rpm.

- The ambient temperature range is between 0° C (32° F) and 30° C (86° F).
- The Back Pressure Valve (BPV) is not working.

Note: If any service tests or calibrations are running, the machine will not enter into engine idle shutdown.



Engine Idle Shut down – The action lamp will illuminate and the monitor will display a message 20 seconds before the engine shuts down. An operator can cancel the shutdown by pressing a button on the monitor or move one of the controls.

Operator's Seat (9)

There are different options for operators seats. Each operator seat and console have various adjustments to meet a wide range of operators. For more information, refer to Operation and Maintenance Manual, “Seat”.

Tilt-Up Console (9A)

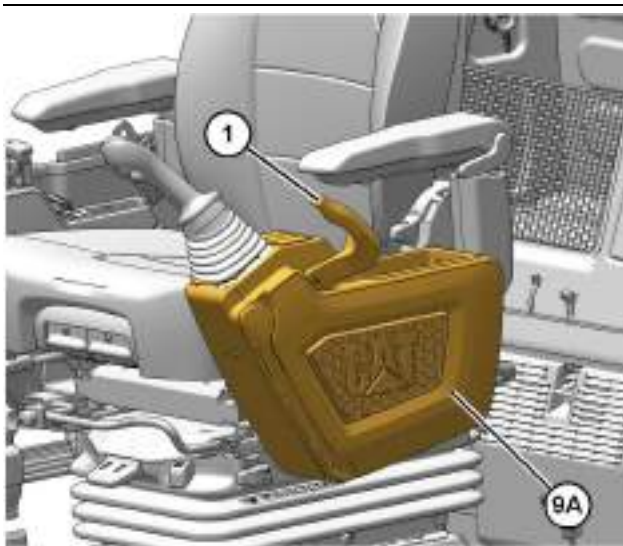


Illustration 172

g06226523

- (1) Hydraulic lockout control
(2) Tilt-up console

Some optional seats are equipped with a tilt-up console. The console can be tilted upward for easier exit and entry. The console is unlocked by pulling the hydraulic lockout control (1) to the rearmost position. The console will then tilt upward. Simply push the console downward until the console locks into place when ready for use.

Right Side Switch Panel (7)

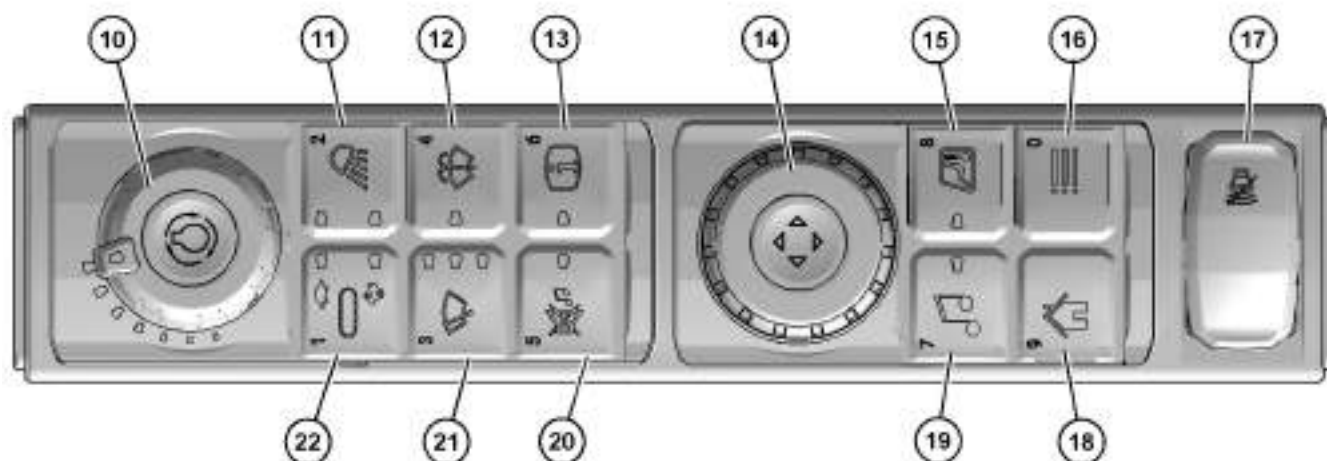


Illustration 173

g06178333

Right side switch panel

(10) Engine speed / power mode control	(15) Heating and air conditioning	(20) Radio mute switch
(11) Light switch	(16) Next menu	(21) Window wiper
(12) Window washer	(17) Travel alarm mute (If Equipped)	(22) Travel speed control
(13) Operator Information	(18) Home	
(14) Jog dial	(19) Radio control	

Note: In addition to the intended functions, the buttons on the switch panel are numbered from 0-9. The numbered buttons can be used to enter numbers into the monitor for screens such as the passcode screen.

Engine Speed / Power Mode Control (10)

Engine Speed Control – Turn the dial to control the engine speed (engine rpm). Select the desired position from the seven available positions. Turn the dial counterclockwise to decrease the engine speed (engine rpm). Turn the dial clockwise to increase the engine speed (engine rpm).



Power Mode Control – Push in the dial to change the power mode settings. The Power Mode Control allows the operator to choose what power mode to operate the engine. The modes that can be selected are: “ECONOMY”, “SMART”, and “POWER”.

Note: The default power mode setting can be set within the monitor. For more information, refer to Operation and Maintenance Manual, “Monitoring System”.

Note: “ECONOMY” mode is **not** available on GC models.

Light Switch (11)

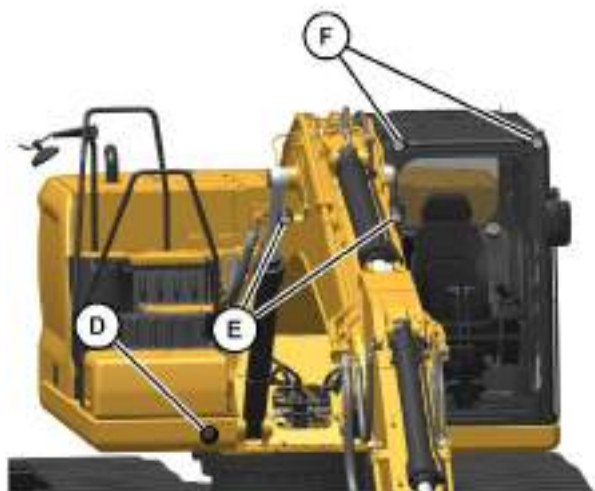


Illustration 174

g06178337



Light Switch – Push the switch to turn on the work lights.

Whenever you push the switch, you change the pattern of the work lights that are turned on. The indicator lights in the cab indicate the pattern of the work lights.

Pattern 1 – When you press the light switch once, the first indicator light turns on. When the first indicator light is on, the following work lights are turned on: work light (D), which is mounted on the chassis, and work lights (F), which are mounted on the cab.

Pattern 2 – When you press the light switch twice, the first indicator light and the second indicator light turn on. When the first indicator light and the second indicator lights are on, the following work lights are turned on: work light (D), which is mounted on the chassis, work lights (F), which are mounted on the cab, and work lights (E), which are mounted on the boom.

OFF – When both of the indicator lights are off, all the work lights are off.

Note: Your machine may be equipped with a premium surrounding lighting package with left side, right side and rear lights. Refer to M0109053, “Next Generation Hydraulic Excavator Monitoring System Supplement”, Function List Screen, Work Light Control for more information.

Note: Your machine may be equipped with a lighting system that has a time delay. When this system is installed, the exterior lights will not turn off for a predetermined amount of time after the engine start switch has been turned to the OFF position. Refer to M0109053, “Next Generation Hydraulic Excavator Monitoring System Supplement”, Application Menu, Lighting Shutdown Timer for more information.

Window Washer (12)



Window Washer (12) – Push the switch to activate the window washer. While the switch is depressed, the indicator light will come on and washer fluid will spray from the nozzle. The window wiper will also operate while the switch is depressed. After the switch is released for approximately 3 seconds, the window wiper will stop.

NOTICE

If the wiper does not operate with the switch in the ON position, turn the switch off immediately. Check the cause. If the switch remains on, motor failure can result.

NOTICE

If the washer is used continuously for more than 20 seconds or used when no washer solution comes out, motor failure can result.

Operator Information (13)



Operator Information Button (13) – Press and hold this button to view the operator information screen. The indicator light will illuminate when the button is pressed.

Jog Dial (14)

The jog dial can be used to select items displayed on the monitor screen. The dial can be rotated 360 degrees. The dial can also be moved left, right, up, and down. The dial can be pushed in to make a selection.

Air Conditioning and Heating (15)



Air Conditioning and Heating (15) – Press this button to bring up the air conditioning and heating menu. The indicator light will illuminate when the heating and cooling system is active. The jog dial (13) can be used to make selections. If equipped with a touch screen, the selections can be made by touching the monitor.

Refer to Air Conditioning and Heating Control for more information.

Next Menu (16)



Next Menu (16) – Press the next menu button to access the next higher menu. If there is not a menu above the current screen being viewed, the button will not do anything.

Refer to Monitoring System for more information.

Travel Alarm Mute Switch (17) (If Equipped)



Travel Alarm Mute Switch (17) – Press travel alarm mute switch (17) to mute the travel alarm.

Note: The travel alarm will sound when the travel levers or the travel pedals are activated.

Home (18)



Home Key (18) – Press the home key to return to the default display at any time.

Refer to Monitoring System for more information.

Radio Control (19)



Radio Control (19) – Press this button to display the radio controls on the monitor. The indicator light on the button will illuminate when the radio is turned on. Use jog dial (14) to make selections. If equipped with a touch screen display, touch the icons on the screens to make a selection.

Refer to Radio for more information.

Radio Mute (20)



Radio Mute (20) – Press radio mute switch (20) to mute the radio. The indicator light will illuminate when mute is activated. Press the button again to unmute the radio.

Window Wiper (21)



Window Wiper (21) – Push the switch to activate the window wiper. Whenever the switch is depressed, the mode of the window wiper will change according to the indicator light that is illuminated.

6 Second Delay – When the window wiper switch is depressed one time, the first indicator light will turn on. The window wiper will operate intermittently at six second intervals.

3 Second Delay – When the window wiper switch is depressed two times, the second indicator light will turn on. The window wiper will operate intermittently at three second intervals.

Continuous Operation – When the window wiper switch is depressed three times, the first indicator light and the second indicator light will turn on. The window wiper will operate continuously.

OFF – When the window wiper switch is depressed four times, the indicator lights will turn off. The window wiper stops.

Travel Speed Control (22)



WARNING

Do not change the setting of the travel speed control switch while you travel. Machine stability may be adversely affected.

Personal injury can result from sudden changes in machine stability.



Travel Speed Control Switch (22) – Press the travel speed control switch to select automatic travel speed or low travel speed. When the engine start switch is on, the travel speed control switch is always set at the LOW SPEED position. Whenever the travel speed control switch is pressed, the travel speed changes. The indicator lights illuminate to show which speed selection is active.



LOW SPEED – Select the LOW SPEED position if you travel on rough surfaces or on soft surfaces or if you require a great drawbar pull. Also, select the LOW SPEED position if you are loading a machine onto a trailer or you are unloading a machine from a trailer.



AUTOMATIC – If you travel on a hard, level surface at a fast speed, select the AUTO position.

Continuous driving at high speed should be limited to 2 hours. If you need to continue driving at high speed for more than 2 hours, stop the machine for 10 minutes. This process will cool down the travel drives before you resume driving.

USB/Aux Ports (23)



Illustration 175

g06204950

(23) USB/AUX/MIC port
(24) 12 V socket



USB – The USB port is used to play music from a portable device. The USB symbol on the radio screen on the monitor must be selected.

AUX – The AUX port is used to play music from a portable device. AUX must be selected on the radio screen on the monitor.

12V Power Receptacle (24) & (25)

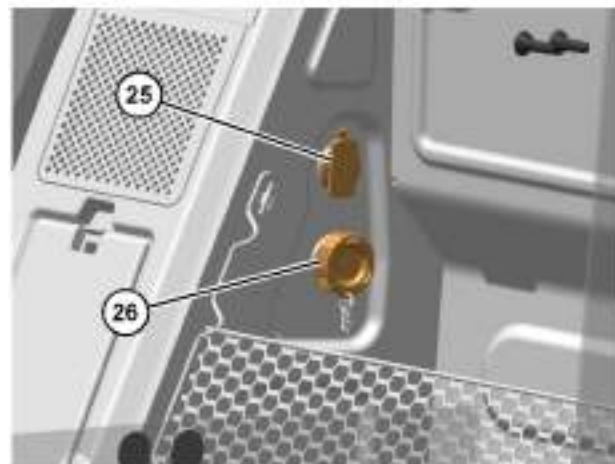


Illustration 176

g06178354

Electronic Technician service port



12V Power Receptacle – The power receptacles can be used to power automotive electrical equipment or accessories. The power receptacle only operates when the engine start switch is in the ON position.

Service Port (26)

An Electronic Technician (ET) service port is located inside the cab behind the seat. This service port allows service personnel to connect a laptop computer that is equipped with Electronic Technician. Service personnel can use electronic technician to diagnose machine and engine systems.

Contact your Cat dealer for additional information.

Dome Light (27)



Illustration 177

g06208645

The dome light has three different positions. When the dome light is in the center position (horizontal), the light will come on when the door is open and shut off when the door is closed.

When the left side of the light is pressed, the lamp will be inoperable.

When the right side of the light is pressed, the lamp will be illuminated until the lamp is switched to another position.

i07956549

Battery Disconnect Switch

SMCS Code: 1411-B11



Illustration 178

g06179792

The battery disconnect switch is on the left side of the machine behind the rear access door.

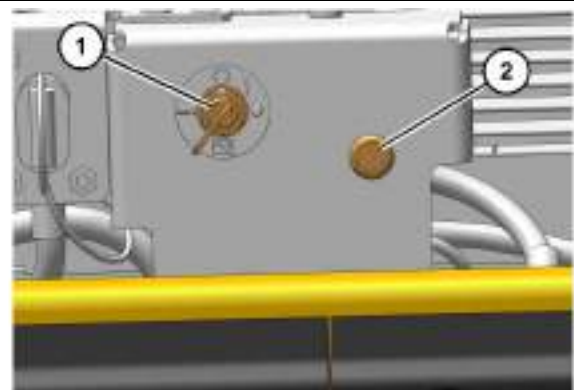


Illustration 179

g06179801

- (1) Battery disconnect switch
- (2) DEF purge light

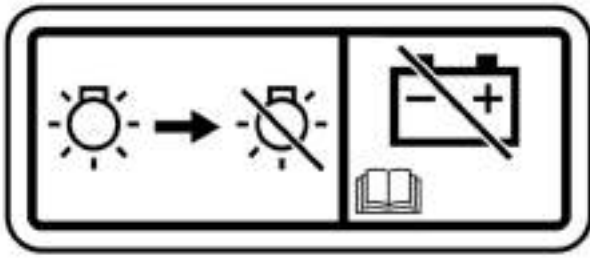


Illustration 180

g03408962

NOTICE

Do not turn off the battery disconnect switch until the indicator lamp has turned off. If the switch is turned off when the indicator lamp is illuminated the Diesel Exhaust Fluid (DEF) system will not purge the DEF. If the DEF does not purge, DEF could freeze and damage the pump and lines.

If DEF purge light (2) is illuminated, wait for the light to turn off before turning the disconnect switch to the OFF position. Waiting for the light to turn off allows the DEF system to fully purge the exhaust fluid and prevents damage to engine components.



Battery Disconnect Switch – The battery disconnect switch can be used to disconnect the battery from the machines electrical system. The key must be inserted into the battery disconnect switch before the battery disconnect switch can be turned.



ON – To activate the electrical system, insert the disconnect switch key and turn the battery disconnect switch clockwise. The battery disconnect switch must be turned to the ON to enable battery power to start the engine.



OFF – To deactivate the electrical system, turn the battery disconnect switch counterclockwise to the OFF position.

The battery disconnect switch and the engine start switch perform different functions. The entire electrical system is disabled when you turn the battery disconnect switch to the OFF position. The battery remains connected to the electrical system when you turn the engine start switch to the OFF position.

Turn the battery disconnect switch to the OFF position and remove the key when you service the electrical system or any other machine components. If installed with a cover lock, close the cover and install a padlock.

It is also good practice to use the disconnect switch after you operate the machine. This will prevent the battery from being discharged. The following problems can cause battery discharge:

- short circuits
- current draw via some components
- vandalism

i08001446

Product Link

SMCS Code: 7490; 7606

Note: Your machine may be equipped with the Cat® Product Link™ system.

The Cat Product Link communication device utilizes cellular and/or satellite technology to communicate equipment information. This information is communicated to Caterpillar, Cat dealers, and Caterpillar customers. The Cat Product Link communication device uses Global Positioning System (GPS) satellite receivers.

The capability of two-way communication between the equipment and a remote user is available with the Cat Product Link communication device. The remote user can be a dealer or a customer.

Data Broadcasts

Data concerning this machine, the condition of the machine, and the operation of the machine is being transmitted by Cat Product Link to Caterpillar and/or Cat dealers. The data is used to serve the customer better and to improve upon Cat products and services. The information transmitted may include: machine serial number, machine location, and operational data, including but not limited to: fault codes, emissions data, fuel usage, service meter hours, software, and hardware version numbers and installed attachments.

Caterpillar and/or Cat dealers may use this information for various purposes. Refer to the following list for possible uses:

- Providing services to the customer and/or the machine
- Checking or maintaining Cat Product Link equipment
- Monitoring the health of the machine or performance

- Helping maintain the machine and/or improve the efficiency of the machine
- Evaluating or improving Cat products and services
- Complying with legal requirements and valid court orders
- Performing market research
- Offering the customer new products and services

Caterpillar may share some or all the collected information with Caterpillar affiliated companies, dealers, and authorized representatives. Caterpillar will not sell or rent collected information to any other third party and will exercise reasonable efforts to keep the information secure. Caterpillar recognizes and respects customer privacy. For more information, please contact your local Cat dealer.

Operation in a Blast Site for Product Link Radios

WARNING

This equipment is equipped with a Cat® Product Link communication device. When electric detonators are being used for blasting operations, radio frequency devices can cause interference with electric detonators for blasting operations which can result in serious injury or death. The Product Link communication device should be deactivated within the distance mandated under all applicable national or local regulatory requirements. In the absence of any regulatory requirements Caterpillar recommends the end user perform their own risk assessment to determine safe operating distance.

Refer to your products Operation and Maintenance Manual Supplement, "Regulatory Compliance Information" for more information.

For information regarding the methods to disable the Cat Product Link communication device, please refer to your specific Cat Product Link manual listed below:

- Operation and Maintenance Manual, SEBU8142, "Product Link - PL121, PL321, PL522, and PL523"
- Operation and Maintenance Manual, SEBU8832, "Product Link PLE702, PLE602, PLE601, PL641, PL631, PL542, PL240, PL241, PL243, PL141, PL131, PL161, PL083 and PL042 Systems"

Note: If no radio disable switch is installed and the equipment will be operating near a blast zone, a Product Link radio disable switch may be installed on the equipment. The switch will allow the Cat Product Link communication device to be shut off by the operator from the equipment control panel. For more details and installation procedures, refer to the following:

- Special Instruction, REHS7339, "Installation Procedure for Product Link PLE640 Systems"
- Special Instruction, REHS8850, "Installation Procedure for the Elite Product Link PLE601, PLE641, and PLE631 Systems"
- Special Instruction, SEHS0377, "Installation Procedure for the Product Link PL131, PL141, and PL161 Systems"
- Special Instruction, REHS9111, "Installation Procedure for the Pro Product Link PL641 and PL631 Systems"
- Special Instruction, M0098124, "Installation Procedure for Pro Product Link PL243 Systems"
- Special Instruction, M0109130, "Installation Procedure for Product Link PL683 and PL783 Systems"

i07785958

Machine Security System

SMCS Code: 7631

General Information

NOTICE

This machine may be equipped with a Cat® Machine Security System (MSS) and may not start under certain conditions.



Illustration 181

g06223917

Machines that are equipped with Cat MSS can be identified by a decal in the operator station. Read the following information and know your machine settings. Your Cat dealer can identify your machine settings.

The Cat Machine Security System (MSS) discourages unwanted operation of a machine. When armed, the MSS requires operator login to start the engine. The following methods of operator login to disarm the security system are available:

- Cat Bluetooth® key fob
- Cat App: Fleet Management
- Passcode

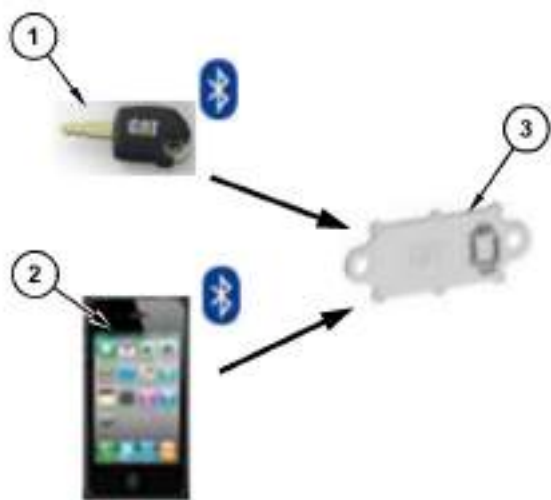


Illustration 182

g06212167

Bluetooth Connections

- (1) Cat Bluetooth key fob (CATBTFOB)
 (2) Cat App: Fleet Management mobile application
 (3) Cat Bluetooth transceiver (CATBTNT)

The Cat Bluetooth key fob (1) contains an electronic chip. The electronic chip has a unique identification number (ID). A Bluetooth transceiver is mounted in the cab to read the ID of the key. The Bluetooth transceiver module translates the information received from the key fob into a J1939 message. This message is sent to the Electronic Control Module (ECM) that is connected to the MSS. The ECM is typically the Machine ECM. The ECM is set up with the ID of the keys of the intended users.

When the MSS is armed, the ECM validates the ID of the key fob. If the key ID is on the list of authorized keys in the ECM and the key is valid, the machine will operate normally. If the key ID is not on the list of authorized keys in the ECM or is not valid, the MSS will keep the critical machine functions disabled.

Note: A Bluetooth enabled phone can disarm MSS if the phone is on the list. Operator Management System (OMS) is necessary to be able to add phones to the vehicle ID list. After the phone is added, OMS is no longer needed for the Cat App: Fleet management mobile application to function as a valid key.

If the MSS is not installed, the operator can skip the login and the machine will operate normally.

Components

The Machine Security System (MSS) consists of the following components:

- Electronic Control Module (ECM)
- Cat Bluetooth key fob (CATBTFOB)
- Machine display
- Bluetooth transceiver module (CATBTNT)
- Engine start switch

System Overview

The Machine Security System (MSS) is designed to restrict operation of a machine. A list of the authorized electronic keys and passcodes for a machine is contained in the ECM for the MSS. A valid Bluetooth key fob, mobile application, or passcode can disarm the MSS. If the MSS is disabled or not installed, any operator may access critical machine functions.

The Cat® Electronic Technician (Cat ET) Service Tool can be used to program the ECM with the authorized keys and passcodes. Bluetooth devices and passcodes can be registered using the in-cab display if the operator is logged in to the system using a master access account.

When the engine start switch is turned to the ON position, the display boots up. If Bluetooth detection is enabled, the transceiver will receive a signal from any Bluetooth key that is present or from the mobile application. The ECM will then compare this ID to the list of authorized keys.

Note: If multiple devices are present, the first valid device detected by the transceiver will be read.

If the ID of the key matches an authorized key, the status indicator on the engine start switch will turn a green color and the MSS will disarm. This disarming will allow the operator access to critical functions of the machine.

If the ID of the key that is read does not match the list in the ECM, the status indicator will remain a red color. The MSS remains in the “armed” state and the machine will remain disabled.

If the MSS is disabled and the ID of the key matches an authorized key, the operator will be identified and allowed access to the critical machine functions. The operator will be able to save configurations and start the machine.

If the MSS is disabled and the ID of the key that is read does not match an authorized key, the operator must log in as a guest. The operator will not be able to save custom configurations but will have access to starting the engine.

Activating Bluetooth Functionality

For shipping purposes, Bluetooth functionality is deactivated. Ensure that Bluetooth functionality is active on your machine using the following procedure:

1. Ensure that the function is active from the radio screen:

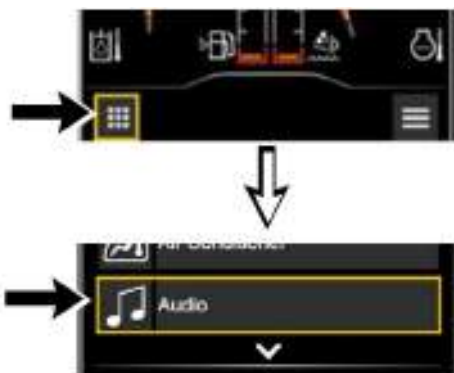


Illustration 183

g06319669

- a. From the home screen, press the navigation button in the lower left corner, then select "Audio" .

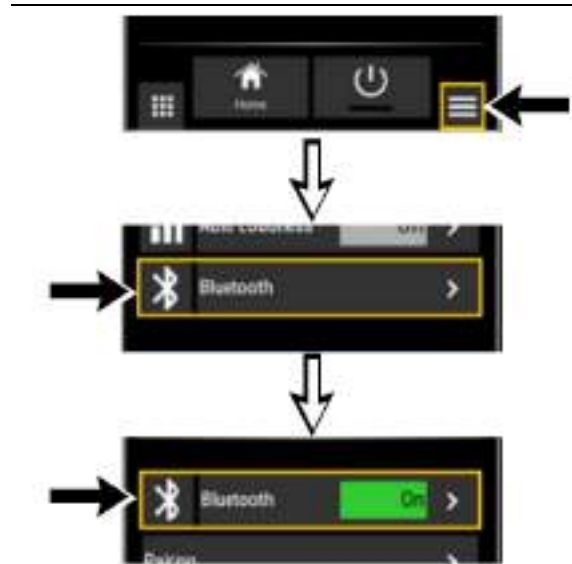


Illustration 184

g06319667

- b. Press the radio function list menu button in the lower right corner, then select "Bluetooth" . Ensure that "Bluetooth" is set to "ON" .

Pairing Your Device to the Machine

Use to following procedure to pair your device to the machine:

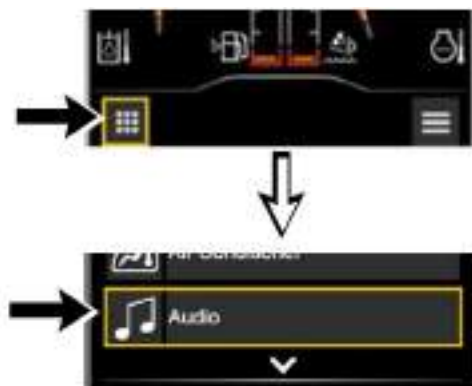


Illustration 185

g06319669

1. From the home screen, press the navigation button in the lower left corner, then select "Audio" .



Illustration 186

g06319672

2. Press the radio function list menu button in the lower right corner, then select "Bluetooth".

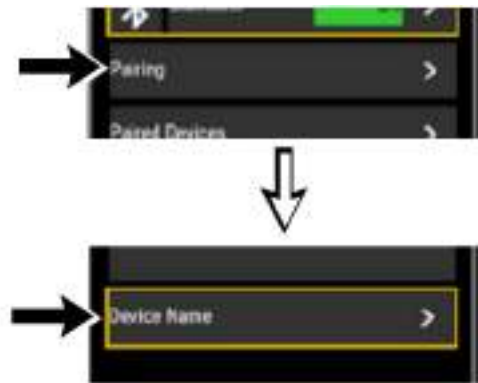


Illustration 187

g06319676

3. Select "Pairing", then "Device Name".



Illustration 188

g06319681

Machine name on monitoring system and operator device

4. Find your device on the list and pair the devices.
Ensure that the devices are paired on your phone as well.

Note: The device name on your phone should be "## CAT RADIO", with the number being from "00" to "99".

Reading the ID of a Key

The Machine Security System (MSS) must identify a valid passcode, Bluetooth key fob ID, or Cat App: Fleet management mobile application ID.

When the engine start switch ring is turned to the ON position, the MSS will check the ID of any key fob or mobile application. If the ID matches a key ID stored in the machine ECM, the critical ECM functions are enabled. An enable message is also sent via the Cat® data link or J1939 data link to the other ECMs on the machine. The machine will operate normally.

Note: If the machine ECM has failed or has been removed, the critical machine operations controlled by the other electronic control modules will not operate.

Armed

When the MSS is armed, critical machine functions are disabled. The MSS disables the power that is supplied to each component that is powered by the output drivers. The machine will not be able to operate normally.

There are two states of operation within the “armed” mode:

Engine Start Switch Ring Position OFF – When no power is applied to the MSS, the MSS will default to “armed” state. When power is applied to the MSS and the grace period has expired, the MSS will return to the “MSS Armed” .

Engine Start Ring Switch Position ON – When the engine start switch ring is first moved to the ON position, the display boots up and the system attempts to detect a Bluetooth key ID or mobile application ID. The ECM will continue reading until a valid key ID is read or a passcode is entered. If a valid key ID or passcode is not read, the MSS status indicator will remain red and the MSS remains armed.

Disarmed

When the MSS is disarmed, normal machine operation is allowed. A message is sent to the other machine ECMs over the Cat data link. or J1939 data link. The machine will be able to start. The green LED on the status indicator will illuminate.

There are multiple ways to disarm the machine:

- Use a valid passcode
- Use a valid Bluetooth key fob
- Use the Cat App: Fleet management mobile application
- Use the Cat® Electronic Technician (Cat ET) Service Tool to configure the MSS bypass schedule to allow machine operations during scheduled periods of time during the week.

Grace Period

After a machine has been started successfully, the operator will have a grace period after the machine is turned off before the MSS is automatically armed. The operator is not required to arm the system manually.

During the grace period an operator can start the machine without a key ID or passcode. When the grace period expires, the MSS will rearm automatically.

If the MSS is unable to read a key ID, the system will remain armed. When the MSS identifies a key with an invalid key ID, the system will remain armed.

The grace period for a machine can be configured with Cat ET if a factory password or master level account is available.

Navigating the User Interface Touchscreen Display



Illustration 189

g06210561

Startup sequence screens

The display will start up automatically after turning the battery disconnect switch to the ON position. The screen will prompt the operator to turn the engine start ring to the ON position. When the engine start ring is turned to the ON position, the display will navigate to the passcode entry screen.

If the operator has not turned the engine start ring to the ON position, the display will time out after 1 minute.

If the battery disconnect switch is already on and the display is off, the display will startup automatically after the engine start ring is powered on. The Cat screen will appear for a short time and then login keypad will appear.

Note: Avoid touching the screen with sharp objects.

The access level assigned to the operator can limit or expand the amount of freedom the user has to manage the system. The following paragraphs explain access levels.

There are three levels of operator access recognized by the touchscreen display. The following levels are available:

- Guest
- Standard
- Master

Guest – If an operator does not have an authenticated key or passcode, the user is able to bypass log in as a guest. Some menu features will not be available such as the options for saving

configurations and operator management. If the Machine Security System (MSS) is enabled, guest operators cannot start the machine.

Standard – A standard operator is a registered user of the machine. Operators with this access level can start the engine whether or not the MSS is installed. This user may save a control configuration for future application.

Master – Master accounts can perform operator management in addition to all standard level functions.

Any “Standard” or “Master” account may be created or removed by a “Master” level operator.

Table 14

Selections and Access for the Touchscreen Display	
Access Level	Operator Setting
Guest	“Operator Input Configuration” “Response” “Change Operator”
Standard	“Operator Input Configuration” “Response” “Controls Setup” “Change Operator”
Master	“Operator Input Configuration” “Response” “Controls Setup” “Change Operator” “Manage Operator”

Operation of Status Indicator



Illustration 190
g06215426
Engine start switch with integrated MSS indicator

The Machine Security System (MSS) uses a status indicator that is integrated into the engine start switch in the cab. This indicator provides a visible alert for the security system.

The operator can use the status indicator to determine the status of the system or for troubleshooting.



Illustration 191
g06226442
Status indicator when the MSS is armed

When the MSS is armed, the status indicator will be red. The red light warns the operator that the machine is armed with the security system and that an operator login is required. The red LED will remain ON until a valid key is read while the key switch or engine start switch ring is in the ON position.



Illustration 192
g06226444
Status indicator when the MSS is disarmed or uninstalled

When the MSS is disarmed, the status indicator will be green. The green light notifies the operator that an operator is logged on the machine and the security system has been disarmed. The status indicator will be green if the MSS is not installed on the machine. Also, the green LED will remain ON after power down for the duration of the grace period. After the grace period, the MSS automatically returns to the “armed” mode.

For machines with a standard key switch, a separate status indicator will be available.

Operator Login

Any user may start the engine if the Machine Security System (MSS) is disabled.

If the MSS is active, only a “Standard” or “Master” account can start the machine engine. Before starting the machine engine, the security system must identify a registered operator. An operator can access the machine display using one of the following methods:

- Passcode
- Cat Bluetooth key
- Cat App: Fleet management mobile application

Passcode Entry

To log in using a passcode, refer to the following steps:

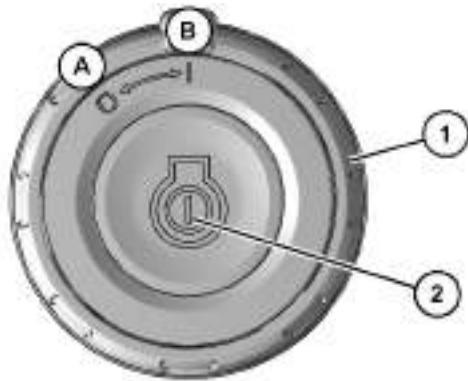


Illustration 193 g06180554

- (A) Off
- (B) On
- (1) Engine start switch ring
- (2) Engine start button

1. Turn engine start switch (1) to the ON position (B).



Illustration 194 g06209470

2. Enter a registered passcode using the monitor keypad and then press “Enter” .

Note: The jog dial or the numbered buttons on the right-side switch panel can also be used to enter the code.



Illustration 195

g06211194

3. Select "Enter" to confirm the passcode. If a registered passcode is recognized, the operator information screen will appear on the display. If the MSS is not installed, the passcode screen will be bypassed automatically after 10 seconds. The operator will be logged in to the system as a guest. Refer to Illustration 195 .

4. Select "OK" to continue to the display homescreen.



Illustration 196

g06209482

5. After an operator logs in to the system successfully, an "Engine Start Allowed" message will appear across the top of the monitor. Refer to Operation and Maintenance Manual, Engine Starting for instructions on starting the engine.

Invalid Passcode



Illustration 197

g06209472

Invalid passcode screen

If a passcode is not recognized, the display will notify the user with an "Invalid code" message. Refer to Illustration 197 .

The operator has five tries to enter a valid passcode successfully. After a fifth unsuccessful attempt, a lockout screen will appear and remain on the display for a duration of 5 minutes.

Note: If the Machine Security System (MSS) is not active, the user can select the “Skip Login” button to avoid the lockout period. Refer to the “Bypass login” section for further information.

Bypass login

Operator login can be bypassed if the user selects the “Skip Login” button on the display. The operator will be logged in to the machine with “Guest” level access.

If the MSS is inactive, the operator will be able to start the engine as normal and view all display screens.

If the MSS is active on the machine, the operator is able to view all display screens but will not have access to starting the engine.

Bluetooth Entry

Alternatively, a Bluetooth Operator ID can be used to log in to the machine. For a Bluetooth key to be detected by the system, ensure that the following qualifications are met:

- The key must be registered with the machine
- The key must be within the cab
- Bluetooth setting must be enabled on the display

Refer to the following steps when logging in to a machine using the Bluetooth key:

2. Wait several seconds for the system to detect the key when the passcode dialog appears. Once the key is detected, the “Operator Information” screen will display.

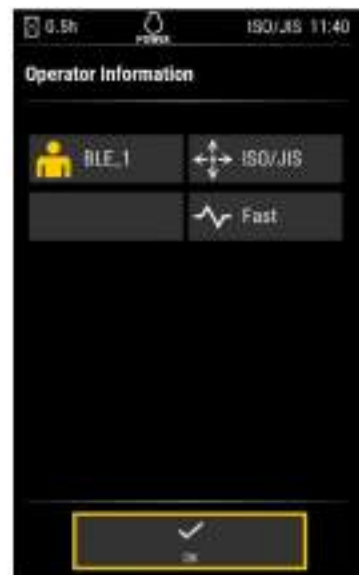


Illustration 199

g06209615

Bluetooth operator information screen

3. Select the “OK” button if the proper operator has been displayed.

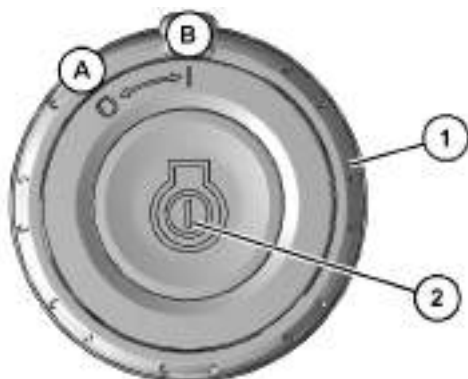


Illustration 198

g06180554

- (A) Off
- (B) On
- (1) Engine start switch ring
- (2) Engine start button

1. Turn engine start switch (1) to the ON position (B).



Illustration 200 g06209482

4. After an operator logs in to the system successfully, an “Engine Start Allowed” message will appear across the top of the monitor. Refer to Operation and Maintenance Manual, Engine Starting for instructions on starting the engine.

NOTICE

The access level will change to a “Guest” account automatically if the key is removed from the cab at any time. If the MSS is enabled and the engine is on when the key is removed from the cab, the operator will not be able to start the engine if turned off. To turn on the engine again without the Bluetooth key, the operator will need to log in a registered account using either the smart phone application or passcode.

Note: If multiple Bluetooth devices are within the cab, the system will select the first device detected by the Bluetooth transceiver as the active operator.

Cat® Fleet Management Mobile Application

Operators can also log in to a machine using the Cat App: Fleet management mobile application. For the application to be detected by the system, ensure that the following qualifications are met:

- The Mobile Device ID (MDID) of the mobile application must be assigned to the machine in the Operator Management System (OMS)

Note: It is not possible to assign mobile devices through the MSS interface.

- The mobile device must be within the cab

- “Operator Management Bluetooth Device Enabled Status” is enabled (Cat ET Configuration)

Note: For adding an operator, adding MDID to the machine key list, and pushing the machine key list from the OMS to the machine refer to the OMS documentation at:

<https://myoperators.cat.com/>

Mobile Device / Operating Software Compatibility

Table 15

Mobile Device / Operating Software Compatibility		
Make	Model	Operating Software
Android	Varies	Android 8.x Oreo and up (Preferably Android 9.x Pie)
Apple	iPhone 6/ iPhone 6 Plus and up	iOS 11.0 and up (Preferably 12)

Note: Android mobile hardware support for Bluetooth can vary, so it is possible that a mobile device running Android 8.x software or higher could have hardware that does not support Bluetooth 4.1.

Mobile Application Entry (Android Devices)

To log in using the Cat App: Fleet management mobile application, refer to the following steps:

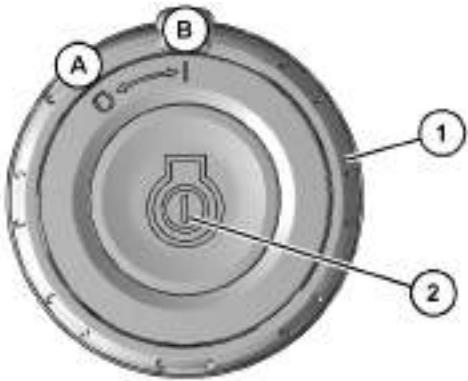


Illustration 201 g06180554

- (A) Off
- (B) On
- (1) Engine start switch ring
- (2) Engine start button

1. Turn engine start switch (1) to the ON position (B).



Illustration 202 g06400799

2. Open the Cat App: Fleet management mobile application on the mobile device.



Illustration 203 g06433500

3. Click "I Agree" to agree with the End-User License Agreement and sign in with Cat eCustomer account credentials.

Note: If you do not have a Cat eCustomer account, click "Get Started" to create one.

4. Select "Login" .



Illustration 204 g06214518

CWS login screen

5. Enter Cat eCustomer account credentials.



Illustration 205 g06400826

6. Click "Allow" to enable the Cat App: Fleet management mobile application to work as designed.

Note: Cat App: Fleet management requires access to the mobile device location to use Bluetooth radio to connect to Cat machines.



Illustration 206

g06433507

- (1) Menu Icon
- (2) Map Icon
- (3) Add Equipment Icon

7. Upon login, the Cat App: Fleet management mobile application will open onto the equipment tab.

Note: The “Equipment” tab will be empty on the first login.

The Menu Icon (1) includes “Preferences”, “Notifications and Alerts”, along with various documents covering the end-user license agreement, and privacy notice.

By tapping the Map Icon (2), the operator will be able to see the location of each vehicle on their “Equipment” tab on a map.

If a vehicle is not equipped with a telematics device, or the vehicle is a non-caterpillar machine it may be necessary to add it manually using the Add Equipment Icon (3).



Illustration 207

g06433513

8. Go to the keys tab.

Keys are necessary to connect to vehicles. If no keys are given, the screen in Illustration 207 will be displayed. The MDID is necessary to assign keys to the user account. The MDID of Android devices is linked to the app.

Note: Uninstalling the Cat App: Fleet management mobile application will result in the MDID and keys being deleted. The Sim card of the phone contains the MDID information, damage to the Sim card may result in keys being lost, if the phone is replaced transfer the Sim card to avoid key loss.

9. Pull the “Equipment Keys” down to refresh the list once the Fleet/Key configuration process has finished. Wait up to 30 seconds until the keys populate. If the keys do not populate, check that the MDID is correct and that the list was pushed properly through OMS.



Illustration 208

g06433520

- 10.** Ensure that the machine is ON to connect to a machine.

The machine display should prompt the operator for a password. In the “Keys” tab in the Cat App: Fleet management mobile application and tap the key that matches the machine. If a vehicle is OFF, currently occupied, or too far away the key will be grayed out and say “Out of range”.

Note: If the machine has a user signed in that is not in the cab and it has become necessary for a different user to operate the machine, change the operator in operator setting.



Illustration 209

g06433521

- 11.** Access the “Equipment” tab by tapping it. The machines associated with the keys should have populated. To learn more about a machine, tap it.



Illustration 210

g06433525

- 12.** Press the “Disconnect” button if the user wishes to disconnect. If the user wants to switch machines, tap the arrow in the upper left then tap the machine the operator wants to be switched to.

Note: Disconnect from vehicles if the user is not going to be using a vehicle again within a short time.



Illustration 211

g06209482

13. After an operator logs in to the system successfully, an “Engine Start Allowed” message will appear across the top of the monitor. Refer to Operation and Maintenance Manual, Engine Starting for instructions on starting the engine.

Mobile Application Entry (iOS Devices)

To log in using the Cat App: Fleet management mobile application, refer to the following steps:

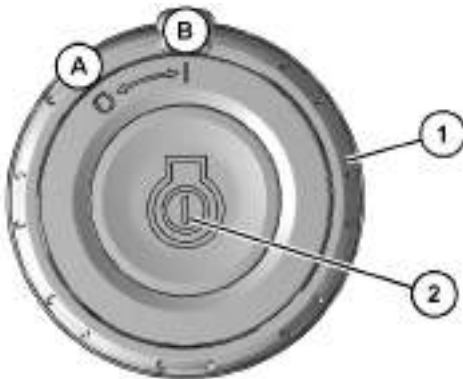


Illustration 212

g06180554

- (A) Off
(B) On
(1) Engine start switch ring
(2) Engine start button

1. Turn engine start switch (1) to the ON position (B).
2. Ensure that Bluetooth detection is enabled on the in-cab display.



Illustration 213

g06400799

Cat App: Fleet management mobile application icon

3. Open the Cat App: Fleet management mobile application on the mobile device.



Illustration 214

g06433528

4. Click “I Agree” to agree with the End-User License Agreement and sign in with Cat eCustomer account credentials.

Note: If you do not have a Cat eCustomer account, click “Get Started” to create one.

5. Select “Login” .



Illustration 215 g06214875

6. Enter eCustomer account credentials to log in.

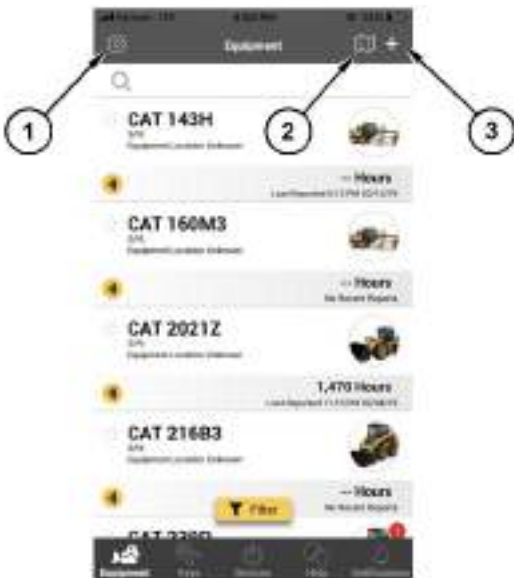


Illustration 216 g06433533

- (1) Menu Icon
- (2) Map Icon
- (3) Add Equipment Icon

7. Upon login the Cat App: Fleet management mobile application will open onto the equipment tab.

Note: The equipment tab will be empty on the first login.

The Menu Icon (1) includes “Preferences” , “Notifications and Alerts” , along with various documents covering the end-user license agreement, and privacy notice.

By tapping the Map (2), the operator will be able to see the location of each vehicle on the equipment tab on a map.

When using this for the first time, the Cat App: Fleet management mobile application will ask if it can use the location feature. Allow the location feature to use the map.

If a vehicle is not equipped with a telematics device, or the vehicle is a non-caterpillar machine it may be necessary to add it manually using the add equipment button (3).



Illustration 217 g06433536

8. Access the “Keys” tab. Keys are necessary to connect to vehicles. If no keys are given, the screen in Illustration 217 will be displayed. The MDID is necessary to assign keys to the user account. The MDID of IOS devices is linked to the user account.

9. Once the Fleet/Key configuration process has finished, tap the refresh button in the Cat App: Fleet management mobile application top right. Wait up to 30 seconds until the keys populate. If the keys do not populate, check that the MDID is correct and that the list was pushed properly in OMS.



Note: Disconnect from vehicle if the user will not be using the vehicle again within a short time.

Illustration 218

g06433538

- 10.** To connect to a machine, ensure that the machine is ON. The machine display should prompt the operator for a password. At this point on the Cat App: Fleet management mobile application go to the “Keys” tab and tap the key that matches the machine. If a vehicle is OFF, currently occupied, or too far away the key will be grayed out and say “Out of range” .



Illustration 219

g06433540

- 11.** Press the disconnect button if the user wishes to disconnect. If the user wants to switch machines tap the arrow in the upper left, then tap the key of the machine to switch to.



Illustration 220 g06209482

12. After an operator logs in to the system successfully, an “Engine Start Allowed” message will appear across the top of the monitor. Refer to Operation and Maintenance Manual, Engine Starting for instructions on starting the engine.

Engine Start Switch Troubleshooting

Table 16

Switch Status	Possible Cause	Resolution
Engine startswitch is not illuminated	Engine start accessory power not on	Turn engine start switch ring to ON position
	Power management triggered	Cycle engine start switch ring and try to restart
Engine start switch is green	Starting component failure	Contact your Cat dealer
Engine start switch is red	Machine interlock conditions not met	Hydraulic lock in LOCKED position
	Engine shut down without cycling start switch ring	Cycle engine start switch ring and try restart
	Operator not authenticated (Passcode login)	Add operator to machine authorized user list
		Switch operator from guest mode using display
	Operator not authenticated (Bluetooth key)	Add operator to machine authorized user list
		Replace key fob battery
		Ensure more than 4.5 m (15 ft) from other Bluetooth equipped machine
		Alternately login with display passcode or contact local Cat dealer

(continued)

(Table 16, contd)

Switch Status	Possible Cause	Resolution
	Operator not authenticated (Cat Fleet management app)	Add operator to machine authorized user list
		Ensure more than 4.5 m (15 ft) from other Bluetooth equipped machine
		Enable phone Bluetooth and connect Cat Fleet management app
		Change Bluetooth system enable status to enabled (Cat dealer)
		Contact local Cat dealer if unable to see machine Bluetooth device

i07491391

For more information refer to Operation and Maintenance Manual, “Monitoring System”.

Camera

SMCS Code: 7347; 7348

Rear View Camera



Illustration 221

g06184579

The rear view camera system consists of a camera that is located in the middle of the top of the counterweight.

Note: The rear view camera system has been set up by the factory or by a Cat dealer to provide views which comply with specified guidelines. Consult your Cat dealer before any adjustments are made to the system.

Side View Camera (If Equipped)



Illustration 222

g06214504

The side view camera system consists of a camera mounted on the panel next to the pump compartment.

Note: The side view camera system has been set up by the factory or by a Cat dealer to provide views which comply with specified machine side views. Consult your Cat dealer before any adjustments are made to the system.

For more information refer to Operation and Maintenance Manual, "Monitoring System".

360 Visibility (If Equipped)



Illustration 223

g06263449

Front camera



Illustration 224

g06263435

Left side camera

If equipped with the optional side and front cameras, the 360 visibility feature can be toggled on and off to enable or disable the 360 degree visibility view in the monitor.



Illustration 225

g06263096

From the main screen, press the Function List icon. In the Function List menu, select "360 Visibility".

Note: The 360 visibility system has been set up by the factory or by a Cat dealer to provide views which comply with specified machine side views. Consult your Cat dealer before any adjustments are made to the system.

For more information refer to Operation and Maintenance Manual, "Monitoring System".

i08257805

Monitoring System

SMCS Code: 7451; 7490

WARNING

Do not operate the machine if the monitor is not functioning (for example, monitor has a black screen or is not responding) when the key switch is in the ON position.

The monitor provides images from the camera system and other information for safe machine operation. Operating the machine without a properly functioning monitor may result in injury or death. If the monitor is not functioning, place the machine in a safe state by following the procedures for stopping and parking the machine. Determine the cause of the monitor malfunction and correct before returning the machine to service.

NOTICE

When the monitor provides a warning, immediately check the monitor and perform the required action or maintenance as indicated by the monitor.

The monitor indicator does not guarantee that the machine is in a good condition. Do not use the monitor panel as the only method of inspection. Maintenance and inspection of the machine must be performed on a regular basis. See the Maintenance Section of this Operation and Maintenance Manual.

General Information

Reference: For complete monitoring system information, refer to M0109053, "Next Generation Hydraulic Excavator Monitoring System Supplement".

The monitoring system is an input and an output of the Machine Control System. The monitor has a multi-touch 8 inch or 10 inch display. The Machine Control System communicates back and forth on the data link. The monitoring system consists of the following components:

- Display (with numerous screens and menus)
- Indicators
- Gauges
- Soft Switch Panel
- Jog Dial



Illustration 226

g06397192

- (1) Action Lamps
- (2) Status Information Area
- (3) Event Indicator Area
- (4) Camera View Area
- (5) Gauge Area
- (6) Navigation Area
- (7) Function List
- (8) Shortcuts

The monitoring system displays various warnings and information about the condition of the machine, and the machines surrounding with various camera views. There are gauges and several alert indicators included on monitoring system display. Each gauge is dedicated to a parameter within a machine system. The monitoring system will allow the user to do the following:

- View Surroundings
- Interpret status information
- Interpret parameters
- View OMM
- View service intervals
- Perform calibrations
- Troubleshoot machine systems

Action Lamps (1)

The action lamps illuminate to show that a problem has occurred with the machine.

Status Information Area (2)

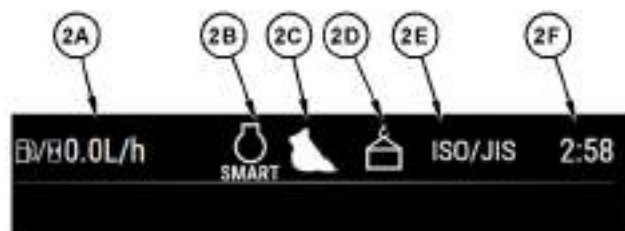


Illustration 227

g06464039

- (2A) Multi Status Information
- (2B) Seatbelt Switch Status (if equipped) / Power Mode
- (2C) Work tool
- (2D) Heavy Lift / Cat® Dig Boost (if equipped)
- (2E) Lever Pattern / Fuel Level
- (2F) Clock

Reference: For complete status information, refer to M0109053, "Next Generation Hydraulic Excavator Monitoring System Supplement".

Event Indicator Area (3)

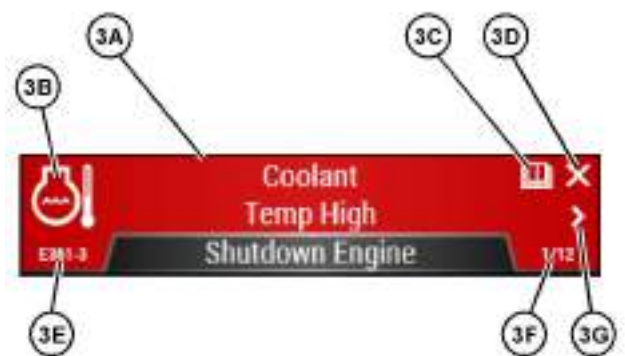


Illustration 228

g06223056

- (3A) Event Description
- (3B) Event Symbol
- (3C) e-OMM
- (3D) Close
- (3E) Event ID
- (3F) Order Number / Total Number
- (3G) Arrow (Next)

Event Description (3A) – This area will display the description of pop-up message of the impending problem.

- Line 1 : System
- Line 2 : Condition
- Line 3 : Action to be taken

Event Symbol (3B) – This area will display the symbol of the problem

e-OMM (3C) – This area will indicate that the e-OMM is available for this event. If e-OMM is not available for this event, the area will be blank.

Close (3D) – Select this to hide the pop-up message and display the event icon list.

Event ID (3E) – The identification number for the event will be shown here.

Priority Number / Total Number (3F) – The priority number of the pop-up message is displayed next to the total number of messages. The messages are ordered from the highest to the lowest priority.

Arrow (3G) – The arrow is shown when there is a next or previous message. Select the arrow to display the next or previous message.

Camera View (4)

This area on the monitor displays the view of the cameras. A rear view camera mounted on top of the counterweight and an optional side view camera mounted in the side panel next to the hydraulic tank.

If both rear view camera and side view camera are equipped, the monitor screen can be toggled to show:

- Rear only
- Side only
- Split vertically
- Split horizontally

The camera view can be toggled when the cursor is on the camera view area and the area is touched or the jog dial is turned.

Gauge Area (5)



Fuel Level – This gauge indicates the amount of fuel that is remaining in the fuel tank. When the fuel gauge is in the red range, add fuel immediately.



Hydraulic Oil Temperature – This gauge indicates the temperature of the hydraulic oil. The normal operating range is the green range. If the gauge is in the white range, the engine and machine warm-up is required. Refer to Operation and Maintenance Manual, “Engine and Machine Warm-up”. If the gauge reaches the red range, reduce the load on the system. If the gauge stays in the red range, stop the machine and investigate the cause of the problem.



Engine Coolant Temperature – This gauge indicates the temperature of the engine coolant. The normal operating range is the green range. If the gauge is in the white range, the engine and machine warm-up is required. Refer to Operation and Maintenance Manual, “Engine and Machine Warm-up”. If the gauge reaches the red range, stop the machine and investigate the cause of the problem.



Diesel Exhaust Fluid (DEF) Gauge – This gauge indicates the level of DEF fluid in the DEF tank. When the DEF gauge is in the red range, add DEF immediately.

Navigation Bar (6)



Apps Key – Allows you to display different information in the gauge area related to operation. Also contains air conditioner and audio controls. This key includes the settings screen allowing change of a multitude of parameters, some password protected.



Function List Key – Allows you to turn on and off various functions related to the active screen. This icon only appears in certain screens where additional settings are necessary.

Shortcuts – Allows you to set certain shortcuts on the navigation bar.

Machine Warnings



Illustration 229

g06223766

Event Indicator Area

- (1) Event Icon List
(2) Pop-up Event Message

The Monitor will display warnings, and log events for machine conditions that are not within normal operating parameters.

The event warnings are classified into three warning levels. Warning Level 1 represents the least severe problem and Warning Level 3 represents the most severe problem. The warning levels, monitor response, and the required operator actions are given below.

Warning Level 1 (Gray) – Requires operator awareness. The icon and pop-up message will both appear gray.

Warning Level 2 (Amber) – Requires a change in the operation of the machine or a change in the maintenance of the machine to correct the condition. The icon and pop-up message will both appear amber and the action lamp will blink.

Warning Level 3 (Red) – Requires immediate shutdown of the machine to prevent damage to the machine or personnel. The icon and pop-up message will both appear red, the action lamp will blink, and the buzzer will sound.

When multiple warnings are present in the system, the highest warning is shown first. Press the right or left key to view all the logged warnings. If no keys are pressed within a few seconds, the display will return to the highest warning.

Reference: For complete machine warning information, refer to M0109053, “Next Generation Hydraulic Excavator Monitoring System Supplement”.

Logging In



Illustration 230

g06242074

There are different ways to access the monitor which include:

- Guest access
- Passcode access
- Bluetooth access
- Cat[®] Fleet Management app

For more information on logging in, refer to Operation and Maintenance Manual, Machine Security System - Operator Login.

Navigation

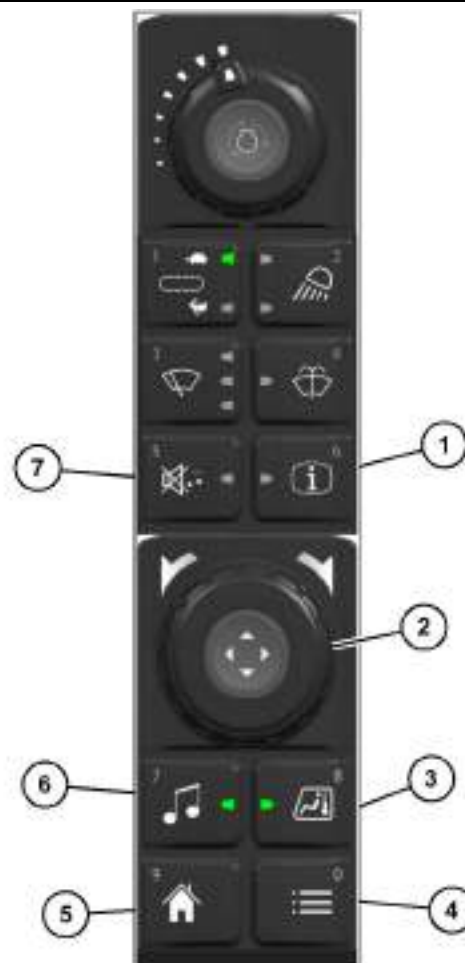


Illustration 231

g06464384

Right side switch panel

- (1) Operator information button
- (2) Jog dial
- (3) Air conditioner button
- (4) Next menu button
- (5) Home button
- (6) Audio button
- (7) Mute button

The monitor can be navigated by touch screen or the switch panel. Switch panel components can be used to interface with the monitor in the following ways:

Operator information button (1) – Press and hold this button to access the operator information screen. This screen shows information such as operator settings.

Jog dial (2) – Rotate the jog dial to highlight menu items in the monitor. Push the jog dial down to select the highlighted item.

Air conditioner button (3) – Press the button to access the air conditioner controls.

Next menu button (4) – This button is equivalent to the function list key on the monitor. This button can only be used on screens where the function list key is shown.

Home button (5) – Press this button to return to the main screen.

Audio button (6) – Press this button to access the audio controls.

Mute button (7) – Press this button to mute the audio. Press the button again to unmute the audio.

Each of the buttons is also assigned a number which is imprinted in the top corner of the button. These buttons can be used to enter the numerical passcodes used to log in to the monitor.

Application Menu



Illustration 232

g06391692

Press the application menu button to access the Application menu.



Illustration 233

g06247445

The Application menu “(Apps)” contains the list of applications. The available applications may differ depending on the machine configuration or software version.



Illustration 234

g06263058

Once an “App” has been selected, an operator can sort through the available “Apps” by swiping the selected area left or right.

Reference: For complete application menu information, refer to M0109053, “Next Generation Hydraulic Excavator Monitoring System Supplement”.

Setting Menu



Illustration 235 g06213909

From the main screen, press the application menu button. In the Application menu, select “Setting”.



Illustration 236 g06217518

A warning will appear notifying the operator that the camera is not visible in the Setting menu. After you have read the warning and understand the content, press the “OK” button.



Illustration 237 g06213929

The Setting menu contains the following menu items:

- Display Setting
- Information
- Machine Setting
- Operator Setting
- Service

Note: A dealer password is necessary to access the Service menu.

Machine Setting

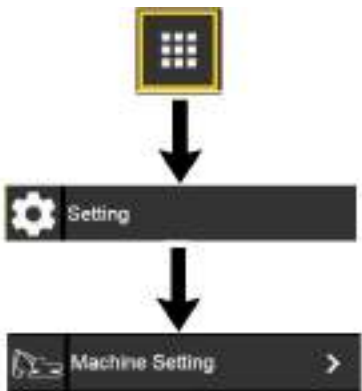


Illustration 238 g06217583

From the main screen, press the application menu button. In the Application menu, select “Setting”. Next, select “Machine Setting”.



Illustration 239

g06261306

The Machine Setting menu may differ depending on the machine configuration or software version. Basic settings are described below.

Reference: For complete machine settings information, refer to M0109053, "Next Generation Hydraulic Excavator Monitoring System Supplement".

Audio

The Audio screen allows the user to choose the radio region, enable Bluetooth, pair devices, and scan for Digital Audio Broadcast (DAB) channels.

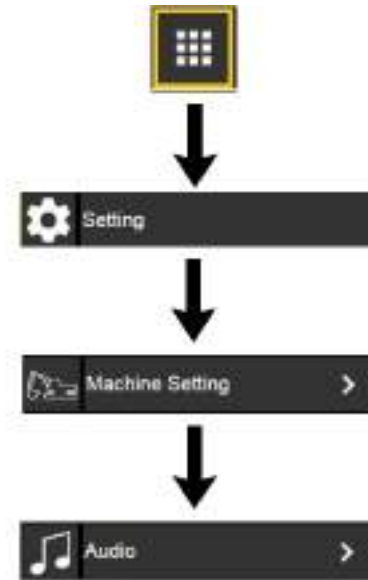


Illustration 240

g06261319

From the main screen, press the application menu button. In the Application menu, select "Setting". Next, select "Machine Setting", and then "Audio".



Illustration 241

g06241515

The Audio screen contains the following menu items:

- Radio Region Setting - Choose the radio region from the list of locations around the world.
- Bluetooth - Allows the operator to enable Bluetooth and pair a phone. This menu is also available through the main Audio screen. Refer to Operation and Maintenance Manual, Monitoring System - Bluetooth for information on the Bluetooth screen.

- DAB Channel Scan - Start a scan to find DAB channels in the area with good reception.
- Volume Gain - Allows the user to individually adjust the gain on various outputs such as the AM radio, FM radio, and the phone.

Auto Warm Up

The Auto Warm Up screen allows the user to enable and set the auto warm-up feature. This feature automatically starts a warm-up period when the engine is started and the hydraulic oil is below the set temperature.

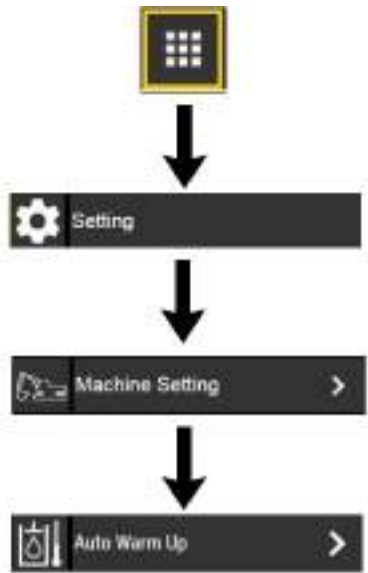


Illustration 242 g06261321

From the main screen, press the application menu button. In the Application menu, select “Setting”. Next, select “Machine Setting”, and then “Auto Warm Up”.



Illustration 243 g06219830

To set the auto warm-up temperature, press the “Auto Warm Up Target Temp” window, then enter the temperature. If the hydraulic oil is below the set temperature, the auto warm-up feature will activate after the engine is started.

Sleep Time



Illustration 244 g06360101

The Sleep time Setting feature allows the user to set a sleep timer for the engine start switch. If the start switch is left in the ON position, power will automatically shut off once the chosen timer interval has elapsed.

Security

Note: Master level access is required to adjust security settings.

The Security screen allows the user to set the operator lockout time. The lockout time is the amount of time after engine shutdown that an operator can start the engine without logging back in to the monitor.

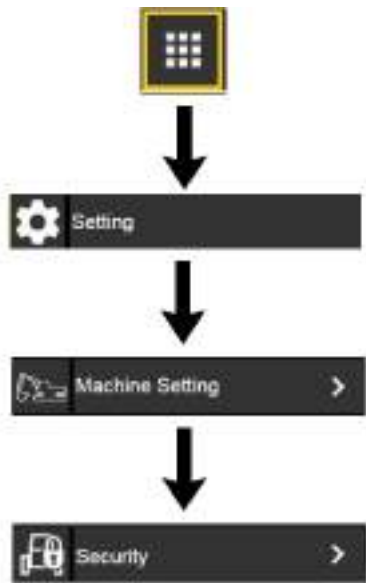


Illustration 245 g06261324

From the main screen, press the application menu button. In the Application menu, select “Setting”. Next, select “Machine Setting”, and then “Security”.

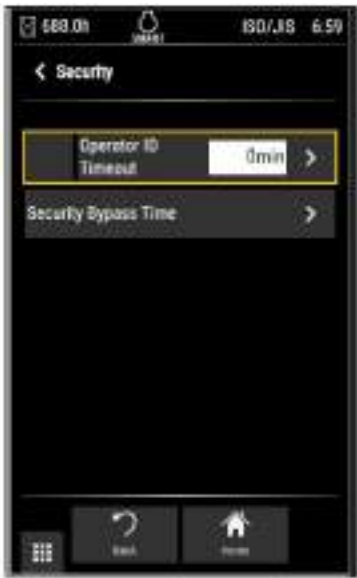


Illustration 246 g06242069

Select “Operator ID Timeout” to select the amount of time before the operators passcode times out after engine shutdown. To block out periods of time throughout the week to bypass security, select “Security Bypass Time”.



Illustration 247 g06242071

Enter the times and the days to bypass the security system.

Operator Setting



Illustration 248 g06217328

From the main screen, press the application menu button. In the Application menu, select “Setting”. Next, select “Operator Setting”.



Illustration 249 g06261330

The Operator Setting menu contains the following menu items:

- Operator Inputs Configuration
- Response

Reference: For complete operator settings information, refer to M0109053, “Next Generation Hydraulic Excavator Monitoring System Supplement”.

Operator Inputs Configuration

The operator inputs configuration screen allows the operator to configure the joystick buttons for personal preference. The settings will be stored in the preferences for that login ID.



Illustration 250 g06261334

From the main screen, press the application menu button. In the Application menu, select “Setting”. Next, select “Operator Setting”, then “Operator Inputs Configuration”.



Illustration 251 g06222026

Choose the operator input to configure.

Lever Pattern



Illustration 252 g06222026

From the Operator Inputs Configuration screen, select “Lever Pattern” .

Select the desired lever pattern from the menu items. Press the “Home” button to return to the main screen.

Restore to Factory Setting



Illustration 253 g06222026

From the Operator Inputs Configuration screen, select “Restore to Factory Setting” .



Illustration 254 g06222053

Select the item from the list to be restored.



Illustration 255 g06222061

A warning will appear asking if you want to proceed. Press “Restore” to restore the settings or press “Cancel” to abort. After pressing “Restore” , the operator information screen will appear to show the new button assignments. Press the “OK” button to return to the main screen.

Air Conditioner

Refer to Operation and Maintenance Manual, Air Conditioning and Heating Control for coverage of the air conditioner screen in the monitor.

Audio

Refer to Operation and Maintenance Manual, Radio for coverage of the audio screen in the monitor.

Phone



Illustration 256 g06213901

From the main screen, press the application menu button. In the Application menu, select “Phone” .



Illustration 257 g06340470

To make a call, select “Call” , then use the keypad to dial the number.

Note: There must be a paired phone in the cab and Bluetooth enabled to make a call.

Reference: For phone and Bluetooth settings, refer to M0109053, “Next Generation Hydraulic Excavator Monitoring System Supplement”.

Bucket/Work Tool Setting

The Bucket/Work Tool Setting screen allows the operator to choose the tool being used for work.



Illustration 258 g06220041

From the main screen, press the application menu button. In the Application menu, select “Bucket/Work Tool Setting” .



Illustration 259 g06220034

Select the desired tool.

Reference: For complete Bucket/Work Tool settings, refer to M0109053, “Next Generation Hydraulic Excavator Monitoring System Supplement”.

Electronic OMM

The Electronic OMM screen allows the operator to view the Operation and Maintenance Manual (OMM) for the machine.



Illustration 260

g06261340

From the main screen, press the application menu button. In the Application menu, select “Setting”. Next, select “Information” and then “Electronic OMM”.

Note: Contact your Cat Dealer for information to update the electronic OMM.

Function List Screen

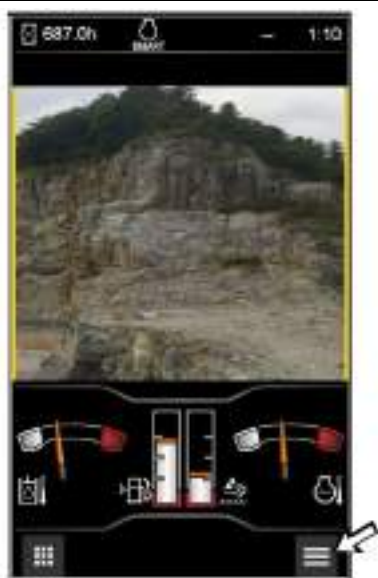


Illustration 261

g06213511

Press the Function List icon to access the Function List screen.

The Function List screen allows the user to turn on or off the available functions on the machine. Tap or select with the jog dial the item to turn on or off.

The Function list menu may differ depending on the machine configuration or software version.

Reference: For complete function list information, refer to M0109053, “Next Generation Hydraulic Excavator Monitoring System Supplement”.

i06951931

Fuel Transfer Pump (Refueling) (If Equipped)

SMCS Code: 1256

Use the following procedure to pump fuel and store the hose.

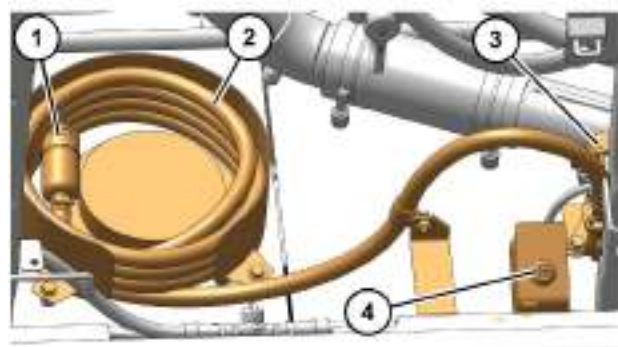


Illustration 262

g06180565

- (1) Suction valve
- (2) Suction hose
- (3) Electric refueling pump
- (4) ON/OFF switch



ON/OFF Switch – Push the ON/OFF switch to activate or deactivate the fuel transfer pump. A red indicator on the switch will illuminate when the fuel transfer pump is activated.

If one of the following conditions occur, the fuel transfer pump will not activate and/or stop operating:

- Battery disconnect switch is in the OFF position
- Engine is operating
- Engine start switch is moved to the START position.
- Engine start switch is in the OFF position
- Hydraulic lockout control is not in the LOCKED position
- Fuel tank level is full
- Fuel is not detected at the suction valve.
- 30 seconds following a detection of no fuel at the suction valve.

Use the following procedure to pump fuel and store the hose.

1. Park the machine on a level surface. Move the hydraulic lockout control to the LOCKED position. Stop the engine
2. Turn the engine start switch to the ON position without starting the engine.
3. Remove the fuel tank cap from the fuel tank.
4. Open the access that is on the right side of the machine.



Illustration 263

g06180748

Suction valve (1) is at the end of hose (2).

Turn the end of the suction valve clockwise to open the valve

5. Uncoil the hose and turn the end of the suction valve clockwise to open the suction valve.
6. Properly insert the end of the suction valve into a container of fuel.
7. Push switch (4) to activate the fuel transfer pump and supply the fuel to the tank. A red indicator on the switch will illuminate when the fuel transfer pump is activated.

When the fuel tank is full, the fuel transfer pump will automatically stop.

When the fuel container is empty, push the switch again to stop refueling. If additional fuel is needed, wait 30 seconds and return to step 6.

Note: The red indicator on the switch will no longer illuminate when the fuel transfer pump has stopped refueling.

Note: The fuel transfer pump will not activate for 30 seconds following a detection of no fuel at the suction valve.

8. Push the switch at any time to deactivate the fuel transfer pump.

Note: The red indicator on the switch will no longer illuminate when the fuel transfer pump has stopped refueling.

9. Drain excess fuel from the hose and turn the end of the suction valve counter-clockwise to close the suction valve.

10. Wind the hose and store in the hose container.

NOTICE

To prevent hose damage, do not coil the hose in a tight radius.

11. Close the access door.

12. Install the fuel tank cap onto the fuel tank.

13. Turn the engine start switch to the OFF position.

i07092848

Radio

SMCS Code: 7338

The radio is integrated into the monitoring system. All the radio controls are adjusted using the monitor. The actual radio is mounted in the right rear console behind the operator seat.



Illustration 264

g06213193

- (1) Jog dial
- (2) Home button
- (3) Radio button

The audio menu can be directly accessed by pressing radio button (3) on the right side switch panel. Input selections can be made using jog dial (1) or using the monitor touch screen. Home button (2) can be used to return to the main screen.



Illustration 265

g06213076

Press radio button (3) to go directly to the radio screen. To navigate to the radio screen from the main screen, press application menu button (4).



Illustration 266

g06213198

Use jog dial (1) to highlight "Audio" and then press the jog dial downward to select the entry. You may also access the screen by simply touching the "Audio" box on the touch screen.

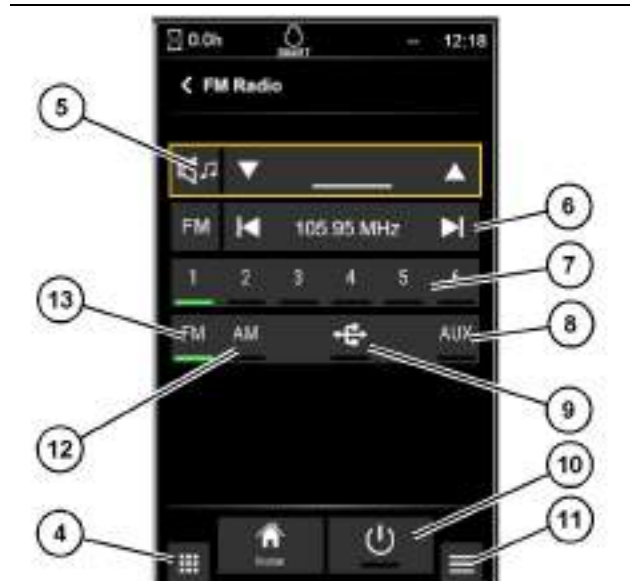


Illustration 267

g06213200

Radio screen

- (4) Application menu button
- (5) Volume control
- (6) Tuner
- (7) Preset stations
- (8) Auxiliary button
- (9) USB button
- (10) Power button
- (11) Radio Function List menu
- (12) AM button
- (13) FM button

Application menu button (4) – Use this button to return to the application menu.

Volume control (5) – The volume control is used to raise or lower the audio volume.

Tuner (6) – The tuner is used to tune the radio to the desired station.

Preset stations (7) – The preset stations store favorite radio stations for the operator. To set a station, tune to the desired station. Press and hold the preset number you want to assign to that station. Once a beep is heard, release the button. The indicator light for the active preset station will illuminate.

Auxiliary button (8) – When a device is plugged into the auxiliary port, press the auxiliary button to connect the device to the radio. The indicator light will illuminate when this mode is active.

USB button (9) – When a device is plugged into the USB port, press the USB button to connect the device to the radio. The indicator light will illuminate when this mode is active.

Power button (10) – Pressing this button turns the radio on and off. The indicator light on the monitor and on button (3) will illuminate when the power is on.

Radio function list menu button (11) – Pressing this button leads to the radio function list menu.

AM button (12) – Press this button to access AM radio. The indicator light will illuminate when this mode is active.

FM button (13) – Press this button to access FM radio. The indicator light will illuminate when this mode is active.

Radio Function List

To access the radio function list, press the function list button (11) in the lower right corner of the radio screen.



Illustration 268

g06223378

The function list menu consists of the following items:

Treble – Allows the user to adjust the treble.

Bass – Allows the user to adjust the bass.

Balance – Allows the user to adjust the balance between speakers.

Auto Loudness – When on, this feature automatically adjust treble and bass levels when reducing the volume setting. This effect allows the user to hear more clearly at a lower volume.

Bluetooth – Allows the user to pair a phone, view paired devices, and edit device names.

Refer to Operation and Maintenance Manual, Monitoring System - Bluetooth for information on the Bluetooth screen.

Selection Method

All settings can be made using the touch screen or by using the jog dial. The method depends on the preference of the operator. When using the touch screen, simply touch the icon you want to select. When using the jog dial, rotate the dial to switch to different selections within the screen. Press the jog dial downward to choose a selection.

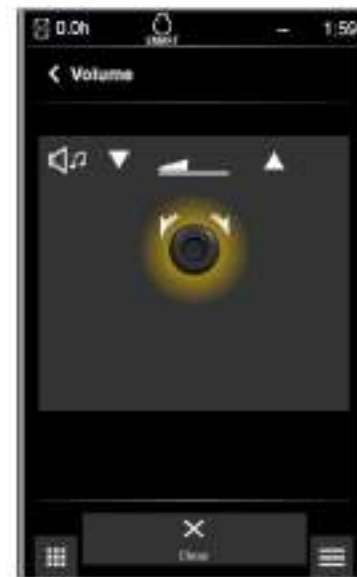


Illustration 269

g06213233

When using the jog dial to set the volume or tuner, rotate the dial clockwise to increase and counter-clockwise to decrease. Press downward on the dial to enter the desired setting.

Radio Operation

1. To operate the system, press power button (10).
2. Select between the AM button for AM stations or select the FM button for FM stations.
3. Use tuner (6) to adjust to the desired station. If presets stations (7) are set, press the desired preset station.
4. Use volume control (5) to adjust the volume.

5. When the machine is in operation turn down the volume of the radio.

USB/AUX Operation



Illustration 270

g06213245

1. To play music from a device such as an MP3 player or a phone, connect the device using an auxiliary cable or a USB cable. Depending on the cable being used, plug the cable into the appropriate port on the console.
2. Select either USB or AUX depending on which type of cable was used. Play the music from the device. The music should be playing over the radio speakers if properly connected. Adjust the volume as necessary.

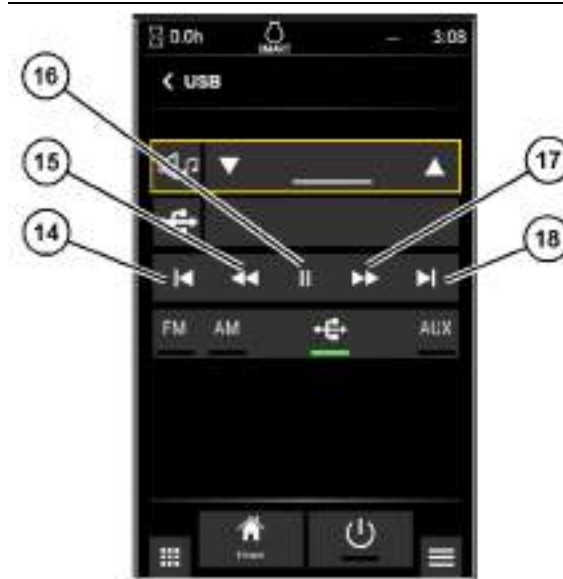


Illustration 271

g06213254

Note: If USB is selected, extra controls appear on the screen for playing music. They include the following:

- 14** – Skip to the beginning of the track
- 15** – Rewind the track
- 16** – Pause/Play the track
- 17** – Fast forward the track
- 18** – Skip to the end of the track

i08031142

Air Conditioning and Heating Control

SMCS Code: 7304; 7320; 7337

Consult with your Cat dealer for periodic maintenance of the heating and air conditioning system.



Illustration 272

g06178710

- (1) Jog dial
- (2) Heating and air conditioning button
- (3) Home button

Air conditioning and heating functions are controlled through the monitor. The heating and cooling menu can be directly accessed by pressing button (2) on the right side switch panel. Input selections can be made using jog dial (1) or using the monitor touch screen. Home button (3) can be used to return to the main screen.



Illustration 273

g06213076

Press the Air Conditioning and Heating button (2) to go directly to the air conditioner screen. To navigate to the air conditioner screen from the main screen, press application menu button (4).



Illustration 274

g06213088

Use jog dial (1) to highlight "Air Conditioner" and then press the jog dial downward to select the entry. You may also access the screen by simply touching the "Air Conditioner" box on the touch screen.

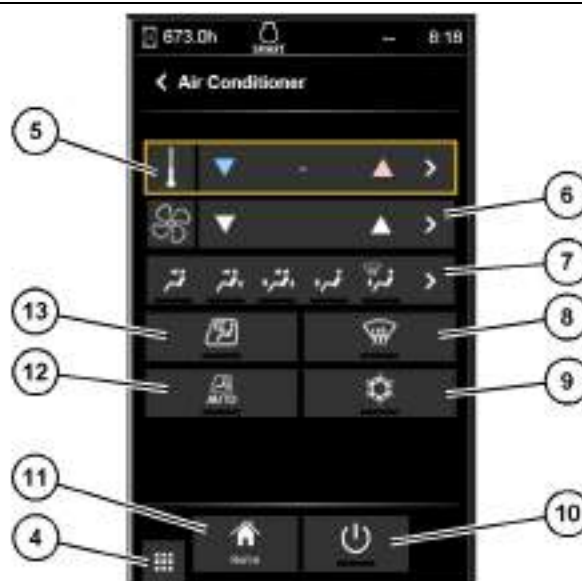


Illustration 275

g06213092

Air conditioner screen

- (4) Application menu button
- (5) Temperature control
- (6) Fan blower speed control
- (7) Air outlet settings
- (8) Defroster
- (9) Compressor ON/OFF
- (10) Power
- (11) Home button
- (12) Auto
- (13) Recirculation

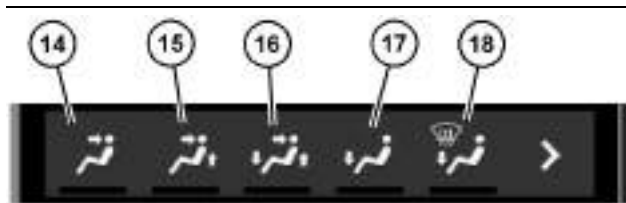


Illustration 276

g06213104

- (14) Front vents
(15) Front and rear vents
(16) Front, foot, and rear vents
(17) Foot vents
(18) Defrost and foot mode

Application menu button (4) – Use this button to return to the application menu.

Temperature control (5) – The temperature control is used to raise or lower the desired temperature.

Fan blower speed control (6) – The blower control is used to increase or decrease the desired blower speed.

Air outlet settings (7) – The desired air outlet setting can be chosen from this panel. The indicator light will illuminate to show the active setting.

Defroster (8) – Pressing this button activates and deactivates the defroster. Use the defroster to remove steam and frost from the windows. The indicator light will illuminate when this mode is active.

Compressor ON/OFF (9) – Pressing this button activates and deactivates the air conditioner. The indicator light will illuminate when this mode is active.

Power (10) – Pressing this button turns the heating and cooling system on and off. Push and hold the power button for 3 seconds to turn OFF the HVAC system. The indicator light on the monitor and on button (2) will turn green when power is on.

Home button (11) – Use this button to return to the main screen.

Auto (12) – Select this option to hold the system at the desired temperature. The system will modulate to keep the cab at the temperature that the system is set to. The indicator light will illuminate when this mode is active.

Recirculation (13) – This option recirculates air from the cab instead of pulling air from the outside. This mode is more efficient because the system is recycling conditioned air from the cab. However, no fresh air is coming into the cab when in this mode. The indicator light will illuminate when this mode is active.

Front vents (14) – In this mode, air will only circulate from the front vents.

Front and rear vents (15) – In this mode, air will circulate from the front vents and rear vents.

Front, foot, and rear vents (16) – In this mode, air will circulate from the front vents, rear vents, and foot vents.

Foot vents (17) – In this mode, air will only circulate from the foot vents.

Defrost and foot mode (18) – In defrost mode, air will circulate from the defrost vents and foot vents.

Selection Method

All settings can be made using the touch screen or by using the jog dial. The method depends on the preference of the operator. When using the touch screen, simply touch the icon you want to select. When using the jog dial, rotate the dial to switch to different selections within the screen. Press the jog dial downward to choose a selection.

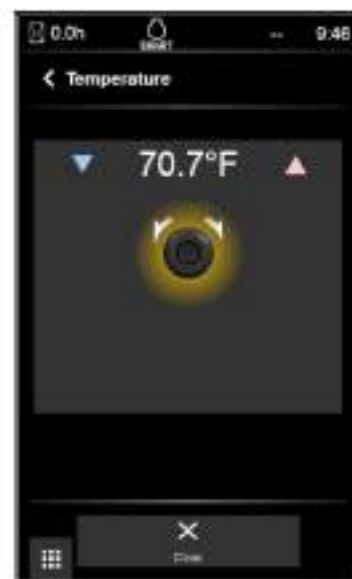


Illustration 277

g06213141

When using the jog dial to set the temperature or blower speed, rotate the dial clockwise to increase and counter-clockwise to decrease. Press downward on the dial to enter the desired setting.

Operation

1. To operate the system, press power button (10).
2. Use temperature control (5) to adjust to the desired temperature.
3. Select the desired mode and outlet vents.
4. Use fan blower speed control (6) to adjust the blower. If the system is in "Auto" mode, the blower fan speed and air outlet setting will automatically be adjusted. But recirculation air intake is not changed automatically.

Note: In cold ambient temperature condition, fan speed is stopped or restricted depend on coolant temperature.

5. Redirect the louvers for air outlets (A) and (C) by hand to the desired direction. The louvers for air outlet (B) cannot be redirected.

i07088628

Mirror

SMCS Code: 7319

WARNING

Adjust all mirrors as specified in the Operation and Maintenance Manual. Failure to heed this warning can lead to personal injury or death.

Note: Your machine may not be equipped with all the mirrors that are described in this topic.

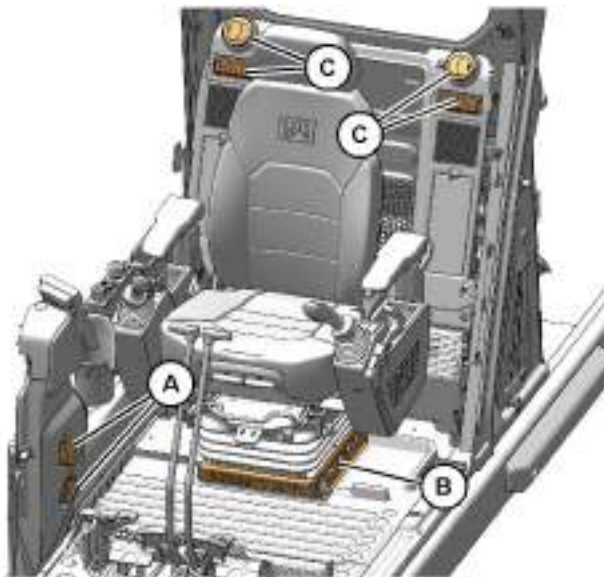


Illustration 278

g06178705

- (A) Defrost vent (front window)
(B) Foot air vents
(C) Rear air vents

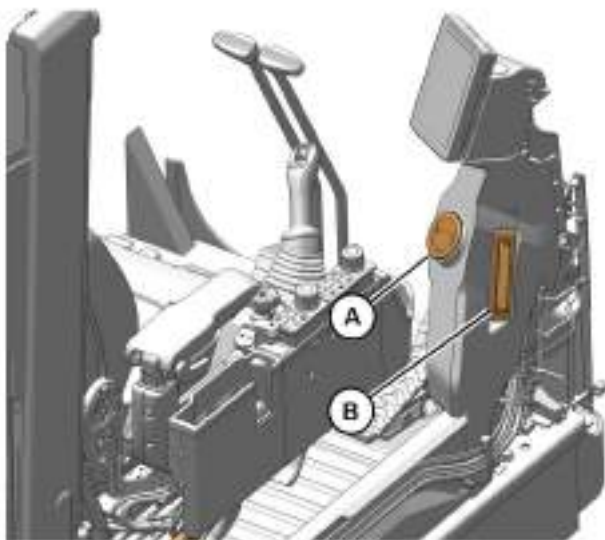


Illustration 279

g06287632

- (A) Front vent
(B) Defrost vent (RH window)



Illustration 280

g06220616

- (1) Right Side View Mirror on the Cab
(2) Left Side View Mirror on the Cab

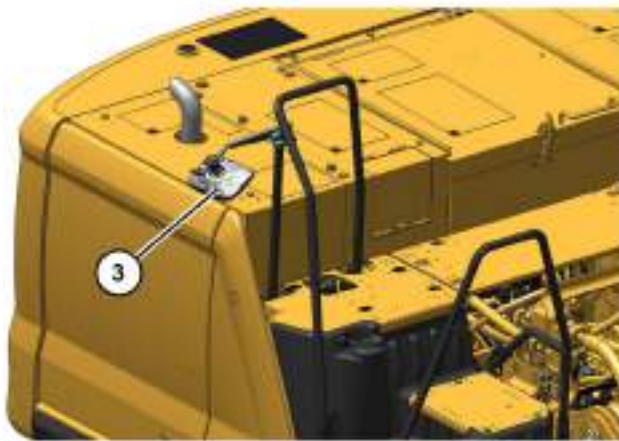


Illustration 281

g06220627

(3) Tank mirror

Mirrors provide additional visibility around your machine. Make sure that the mirrors are in proper working condition and that the mirrors are clean. Adjust all mirrors at the beginning of each work period and adjust the mirrors when you change operators.

Modified machines or machines that have additional equipment or attachments may influence your visibility.

Mirror Adjustment

- Park the machine on a level surface.
- Lower the work tool to the ground.
- Move the hydraulic lockout control to the LOCKED position. For further details on this procedure, refer to Operation and Maintenance Manual, "Operator Controls".
- Stop the engine.
- Adjust rear view mirrors to provide visibility behind the machine at a maximum distance of 30 m (98 ft) from the rear corners of the machine.

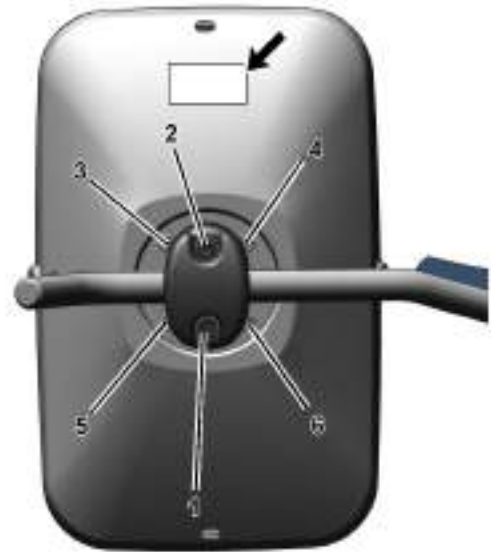


Illustration 282

g06220634

Tightening sequence

After adjustment of the mirror angle, make sure that the CAT logo is at the top.

It may be necessary to periodically tighten the mirror mounting bolts. If the bolts are loose, tighten the bolts in the sequence shown in Illustration 282. Tighten bolts (1) and (2) to $11 \pm 2 \text{ N}\cdot\text{m}$ ($8.1 \pm 1.5 \text{ lb}\cdot\text{ft}$).

Tighten the bolts (3) through (6) to $2 \pm 0.4 \text{ N}\cdot\text{m}$ ($1.5 \pm 0.3 \text{ lb}\cdot\text{ft}$).

Right Side View Mirror on the Cab (3)



Illustration 283

g06223277

If equipped, adjust the right side view mirror on the cab (1) so the front of the right track can be seen from the operator seat. A view of at least 1 m (3.3 ft) from the right front of the machine should be seen from the operator seat.

Left Side View Mirror on the Cab (4)



Illustration 284

g06223279

If equipped, adjust the left side view mirror on the cab (4) so the left side of the cab, access door, and rear of left track can be seen from the operator seat. A view of at least 1 m (3.3 ft) from the side of the machine should be seen from the operator seat. Additionally, provide as much visibility to the rear as possible.

Tank Mirror (3)



Illustration 285

g06223284

If equipped, adjust the tank mirror so the fuel tank and the hydraulic tank can be seen from the operator seat. A view of at least 1 m (3.3 ft) from the side of the machine should be seen from the operator seat.

i07427990

Window (Front)

SMCS Code: 7310-FR

To provide full ventilation inside the cab, the upper window and the lower window can be fully opened.



WARNING

When opening or closing the windows, be extra careful to prevent any personal injury. The hydraulic lockout control must be in the LOCKED position in order to prevent any possibility of sudden movement of the machine due to inadvertent contact with the hydraulic control(s).

Do not change the position of the window until the following items have been done:

- Park the machine on a level surface.
- Lower the work tool to the ground.
- Move the hydraulic lockout control to the LOCKED position.
- Stop the engine.

Perform Step 1 through Step 3 to open the upper window.

Note: If equipped, the Cat Grade Control monitor may interfere with the window when opening. Ensure that the monitor is adjusted out of the way before opening the window.

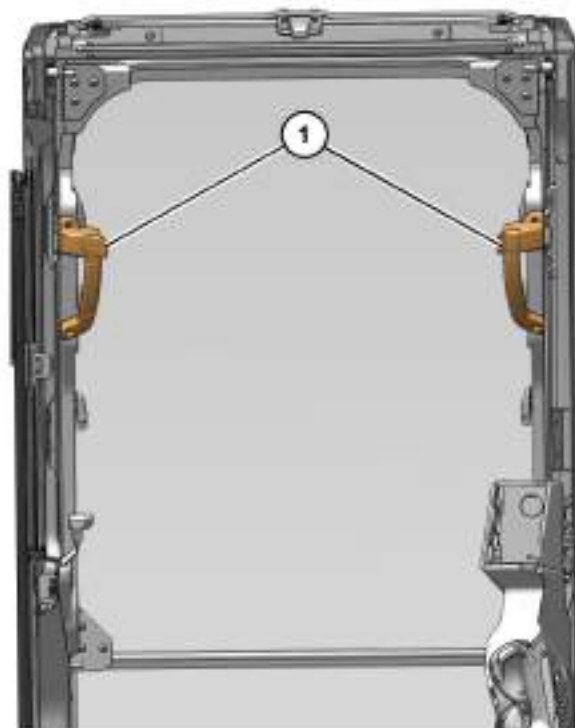


Illustration 286

g06185052

(1) Release lever

1. Release the auto-lock latches by pressing release levers (1) on the window handles.
2. Holding both handles on the window frame, pull the window upward.
3. Hold both grips that are provided on the window frame and move the window into the storage position until the auto-lock latches near the ceiling are engaged.

Perform Steps 4 through 5 to close the upper window.

Note: If equipped, the Cat Grade Control monitor may interfere with the window when closing. Ensure that the monitor is adjusted out of the way before closing the window.

4. Release the auto-lock latches by pressing release levers (1) on the window handles.
5. Reverse Steps 1 through 3 to close the upper window.

Perform Steps 6 through 8 to open the lower window and close the lower window.

6. Raise the lower window out of the window frame.

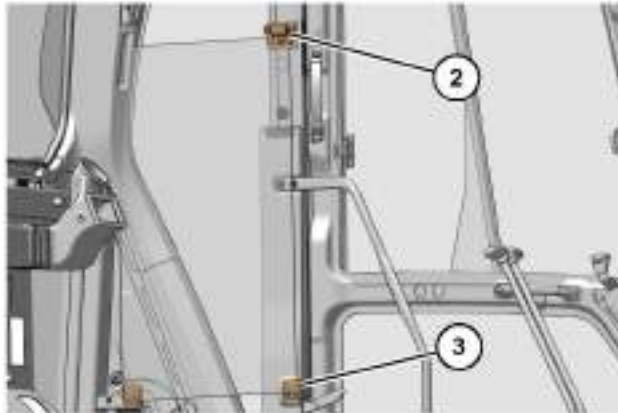


Illustration 287

g06185076

- (2) Catch
(3) Brackets

7. Store the lower window in the holder that is located in the rear of the left side cab frame. To store the lower window, locate one end of the lower window into brackets (3). Secure the opposite end of the lower window with catch (2).

8. To close the lower window, reverse the procedure that is used for opening the lower window.

Note: The lower window is curved. The lower window can only be positioned one way in the holders.

i07538754

Sun Screen

SMCS Code: 7165-ZZ

WARNING

When opening or closing the windows, be extra careful to prevent any personal injury. The hydraulic lockout control must be in the LOCKED position in order to prevent any possibility of sudden movement of the machine due to inadvertent contact with the hydraulic control(s).

NOTICE

Do not change the position of the sun screen without performing the following actions:

- Park the machine on a level surface.
- Lower the work tool to the ground.
- Move the hydraulic lockout control to the LOCKED position.
- Stop the engine.



Illustration 288

g06179846

Pull sun screen (1) down from the ceiling. Hook the sun screen to the brackets (2) at both sides of the front window. The sun screen may be positioned at two different heights.

i07538807

i06949447

Roof Hatch

SMCS Code: 7303

WARNING

When opening or closing the windows, be extra careful to prevent any personal injury. The hydraulic lockout control must be in the **LOCKED** position in order to prevent any possibility of sudden movement of the machine due to inadvertent contact with the hydraulic control(s).

NOTICE

Do not change the position of the roof hatch without performing the following actions:

- Park the machine on a level surface.
- Lower the work tool to the ground.
- Move the hydraulic lockout control to the **LOCKED** position.
- Stop the engine.

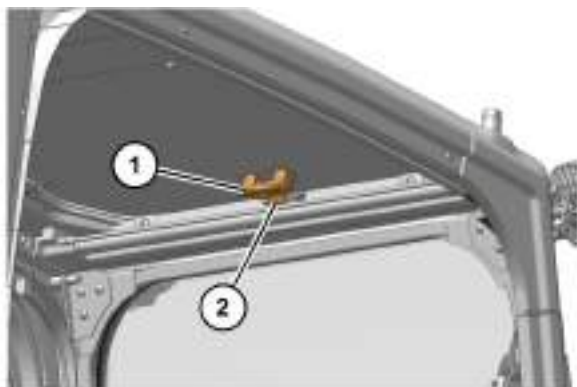


Illustration 289

g06179871

- (1) Grip
(2) Lock

To open the roof hatch, release lock (2). Hold grip (1) and push the roof hatch upward.

To close the roof hatch, hold grip (1) and pull the roof hatch downward. Engage lock (2) securely.

NOTICE

Do not stand or walk on the hatch or the roof of the cab. Serious damage may occur.

Cab Door

SMCS Code: 7308



Illustration 290

g06180275

To open the cab door from the outside of the cab, pull outward on the door handle.



Illustration 291

g06179959

To open the cab door while inside the cab, push forward on the lever for the cab door latch.

For additional ventilation, open the cab door all the way to engage the catch on the exterior wall of the cab.

i06946782

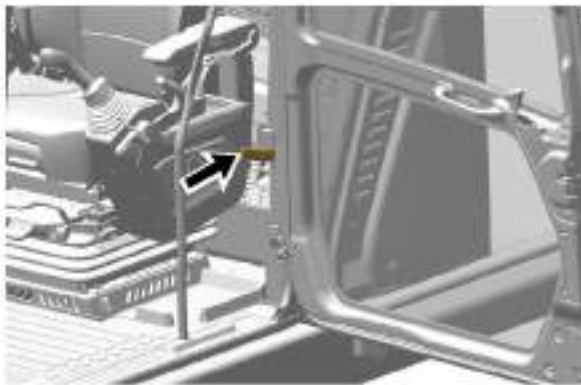


Illustration 292

g06180267

To release the cab door from the catch, pull downward on the cab door release lever.

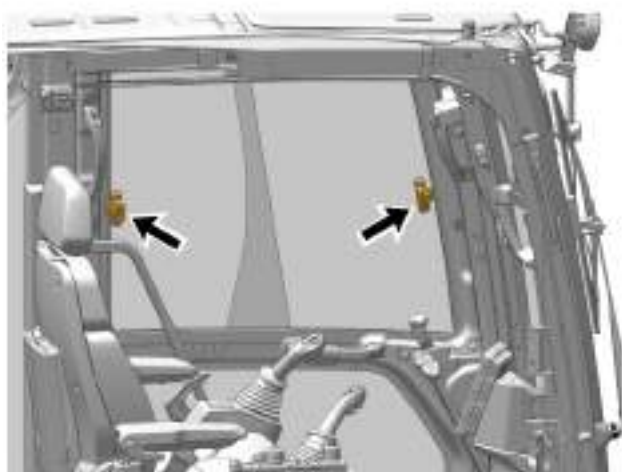


Illustration 293

g06179957

To open a window, release the window latch, and then slide the window to the desired position.

Travel Control (Straight Travel Pedal (If Equipped))

SMCS Code: 5462

WARNING

With certain attachment combinations, the third pedal can have different functions. Always check for third pedal function before using the third pedal. Improper operation of the third pedal could result in serious injury or death.



Illustration 294

g06178249

Position for normal travel

- (A) Rear of machine
- (B) Final drive
- (C) Idler

When you travel, make sure that final drive sprockets (B) are under the rear of the machine.

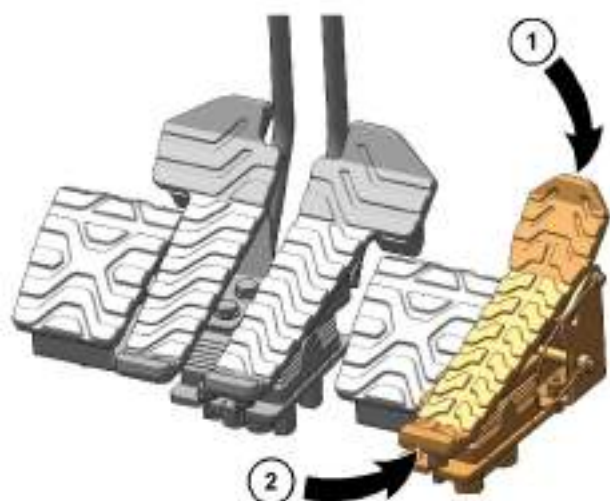


Illustration 295

g06178758

- (1) Forward Travel
- (2) Reverse Travel

The third pedal is to the right of the right travel pedal. The third pedal controls the forward and backward movement of the machine.

Note: If the third pedal is depressed and a travel pedal or a travel lever is operated, the machine will turn accordingly.

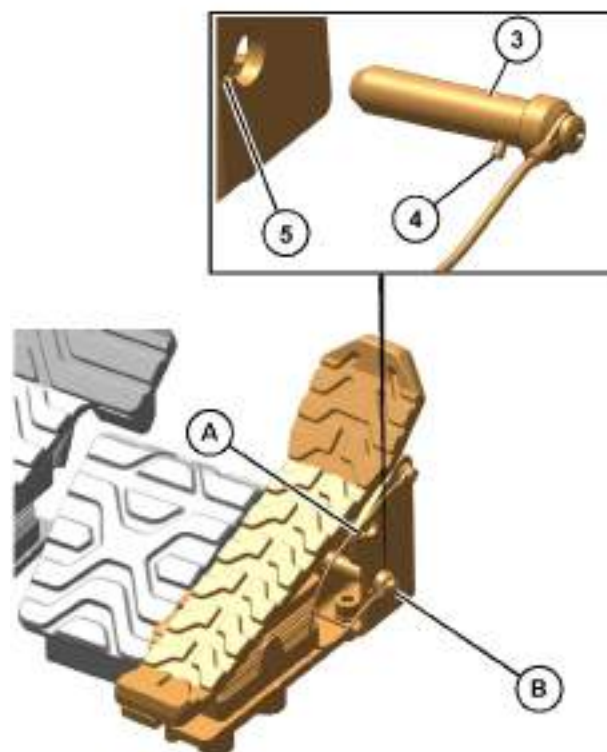


Illustration 296

g06178798

- (3) Lock pin
- (4) Pin
- (5) Notch
- (A) LOCKED position
- (B) UNLOCKED position

When the machine is not operated with the third pedal, install lock pin (3) at the LOCKED position to prevent accidental operation.

Note: To prevent lock pin (3) from being pulled out, insert pin (4) through notch (5) and turn lock pin (3) counterclockwise by 1/4 turn.

i08015260

Joystick Controls

SMCS Code: 5705

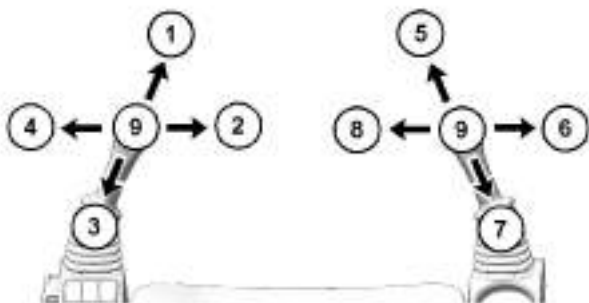


Illustration 297

g06180324

- (1) STICK OUT
- (2) SWING RIGHT
- (3) STICK IN
- (4) SWING LEFT
- (5) BOOM LOWER
- (6) BUCKET DUMP
- (7) BOOM RAISE
- (8) BUCKET CLOSE
- (9) HOLD

WARNING

The joystick and controls on the joystick can be configured with different functions. Always make sure to check the joystick configuration on the monitor before using the machine to avoid unexpected machine movement. These unexpected machine movements could cause a hazard resulting in serious injury or death.

WARNING

The Fine Swing Control delays the engagement of the swing parking brake.

If the machine is operating on a slope with the Fine Swing Control in the ON position, the swing motion may become uncontrollable which could result in property damage, personal injury or death.

Turn the Fine Swing Control to the OFF position when the machine is operating on a slope.

When you release the joysticks from any position, the joysticks will return to HOLD position (9). Movement of the upper structure will stop unless the fine swing control (if equipped) is ON. When the fine swing control is ON, the swing parking brake will not activate until 6.5 seconds after the joystick control for the swing function returns to the HOLD position.

Two functions may be performed at the same time by moving a joystick diagonally.

The machine control pattern is initially set at the factory to the SAE system, as shown. The pattern on the left pertains to the left joystick and the pattern on the right pertains to the right joystick.

The machine control pattern can be varied. Refer to Operation and Maintenance Manual, "Joystick Controls Alternate Patterns" for more information.

Manual Low Idle – Activate the manual low idle to reduce the engine speed to approximately 1000 rpm. Pressing the switch again will allow the engine speed to return to the original setting of the engine speed dial.

The manual low idle allows the operator to reduce the rpm without touching the engine speed dial. Manual low idle is useful when the operator wants to reduce the engine speed to talk to someone or while the operator is waiting for a truck.

Vertical Slider Joystick Controls



Illustration 298

g06224200

Vertical Slider Joystick Controls

- (1) Left joystick switch 3
(2) Left joystick switch 4
(3) Left joystick switch 1
(4) Left joystick switch 2
- (5) Left joystick thumbwheel
(6) Right joystick thumbwheel
(7) Right joystick switch 2
(8) Right joystick switch 1
- (9) Right joystick switch 4
(10) Right joystick switch 3

Table 17

Joystick Configurations				
Switch Location	Machine Configuration			
	Grade	Grade Assist	Grade Payload	Grade Assist Payload
1 ⁽¹⁾	Hammer	Hammer	Hammer	Hammer
2	Standby / Weigh	Standby / Weigh	Standby / Weigh	Standby / Weigh
3	Horn	Horn	Horn	Horn
4	Store	Store	Store	Store
5 ⁽¹⁾	Work Tool Rotation	Work Tool Rotation	Work Tool Rotation	Work Tool Rotation
6 ⁽¹⁾	Work Tool Open / Close	Work Tool Open / Close	Work Tool Open / Close	Work Tool Open / Close
7	Bucket Recall and Store	Bucket Recall and Store	Bucket Recall and Store	Bucket Recall and Store
8	Bench Mark	Bench Mark	Bench Mark	Bench Mark
9	Grade and Bucket Assist Activation	Grade and Bucket Assist Activation	Grade and Bucket Assist Activation	Grade and Bucket Assist Activation
10	Laser and Touch Point	Laser and Touch Point	Laser and Touch Point	Laser and Touch Point

⁽¹⁾ Button is configurable on machines without tool control.

Note: The following functions can be assigned to the configurable buttons: radio mute, one-touch low idle, work tool select, and HVAC.



Illustration 299

g06225116

Vertical Slider Joystick Controls

- (7) Left joystick switch 3
(8) Left joystick switch 4
(9) Left joystick switch 1
(10) Left joystick switch 2
- (11) Left joystick thumbwheel
(12) Right joystick thumbwheel
(13) Right joystick switch 2
(14) Right joystick switch 1
- (15) Right joystick switch 4
(16) Right joystick switch 3

Table 18

Joystick Configurations	
Switch Location	Joystick With Tool Control Sliders
7 ⁽¹⁾	Hammer
8	Configurable
9	Horn
10	Configurable
11 ⁽¹⁾	Work Tool Rotation
12 ⁽¹⁾	Work Tool Open / Close
13	Configurable
14	Configurable
15	Configurable
16	Configurable

(Table 18, contd)

(1) Button is configurable on machines without tool control.

Medium Pressure (If Equipped)
Rotating Tool Control

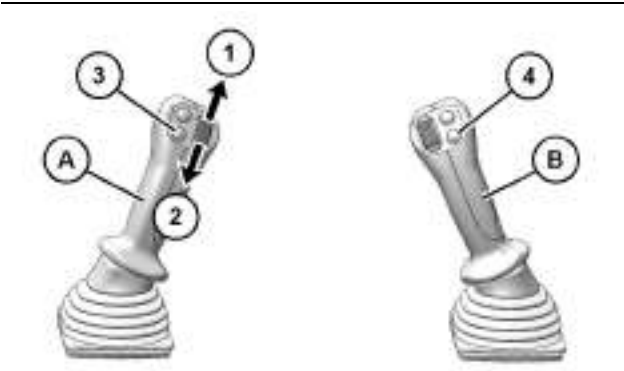


Illustration 300

g06260903

- (A) Left joystick
(B) Right joystick
- (1) Thumb wheel (Clockwise)
(2) Thumb wheel (Counterclockwise)
(3) Horn switch
(4) AEC switch

(continued)



(1) **ROTATE CLOCKWISE** – Move the thumb wheel upward to rotate the work tool clockwise.



(2) **ROTATE COUNTERCLOCKWISE** – Move the thumb wheel downward to rotate the work tool counterclockwise.



(3) **HORN** – Press the horn switch on the left joystick to activate the horn.



(4) **AEC SWITCH** – Press the AEC switch on the right joystick to activate low engine speed. Press the switch again to activate high engine speed.

i08233391

Joystick Controls (Tilt-Rotator System (TRS) (If Equipped))

SMCS Code: 5705

WARNING

Verify the joystick control pattern and functionality parameters before operating machine.

Ensure that the joystick control film on the cab window matches the control functions of your machine. Consult your Cat dealer for additional information regarding the joystick control film.

Become familiar with the joystick controls before operating the machine.

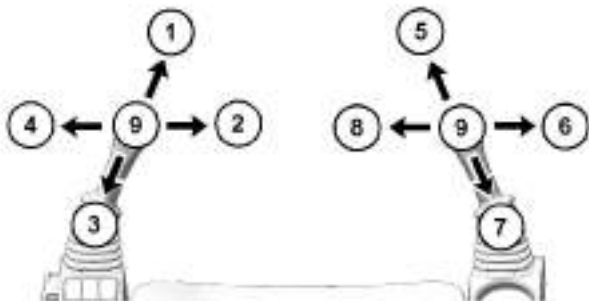


Illustration 301

g06180324

- (1) STICK OUT
- (2) SWING RIGHT
- (3) STICK IN
- (4) SWING LEFT
- (5) BOOM LOWER
- (6) BUCKET DUMP
- (7) BOOM RAISE
- (8) BUCKET CLOSE
- (9) HOLD

WARNING

The Fine Swing Control delays the engagement of the swing parking brake.

If the machine is operating on a slope with the Fine Swing Control in the ON position, the swing motion may become uncontrollable which could result in property damage, personal injury or death.

Turn the Fine Swing Control to the OFF position when the machine is operating on a slope.

When you release the joysticks from any position, the joysticks will return to HOLD position (9). Movement of the upper structure will stop unless the fine swing control (if equipped) is ON. When the fine swing control is ON, the swing parking brake will not activate until 6.5 seconds after the joystick control for the swing function returns to the HOLD position.

Two functions may be performed at the same time by moving a joystick diagonally.

The machine control pattern is initially set at the factory to the SAE system, as shown. The pattern on the left pertains to the left joystick and the pattern on the right pertains to the right joystick.

The machine control pattern can be varied. Refer to Operation and Maintenance Manual, "Joystick Controls Alternate Patterns" for more information.

Manual Low Idle – Activate the manual low idle to reduce the engine speed to approximately 1000 rpm. Pressing the switch again will allow the engine speed to return to the original setting of the engine speed dial.

The manual low idle allows the operator to reduce the rpm without touching the engine speed dial. Manual low idle is useful when the operator wants to reduce the engine speed to talk to someone or while the operator is waiting for a truck.

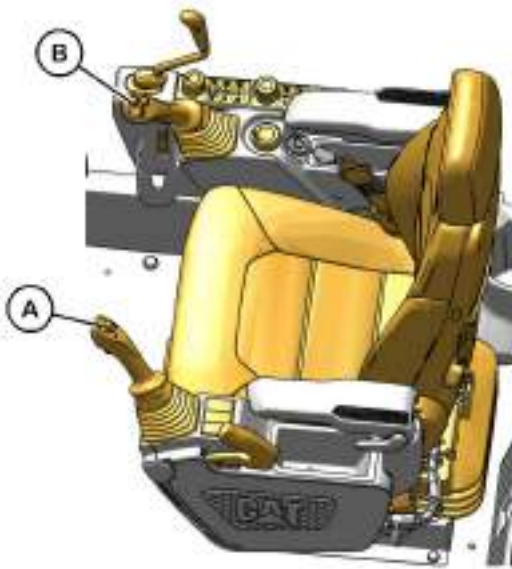


Illustration 302 g06595876

(A) Left Joystick
(B) Right Joystick

Rear View of Joystick Controls

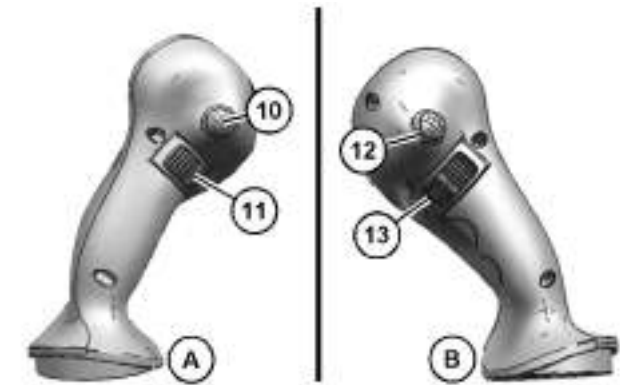


Illustration 303 g06596328

(A) Rear View Left Joystick
(B) Rear View Right Joystick
(10) Left Joystick Switch
(11) Left Joystick Thumb Wheel
(12) Right Joystick Switch
(13) Right Joystick Thumb Wheel

Left Joystick Control Patterns

The left joystick has seven buttons.



Illustration 304 g06595878

Typical Example
(A) Left Joystick

Table 19

Joystick Control	Left Joystick Function
(14)	Tilt-Rotator Bucket
(15)	Horn
(16)	Weigh Mode
(17)	One Touch
(18)	-

Right Joystick Control Patterns

The right joystick has seven buttons.

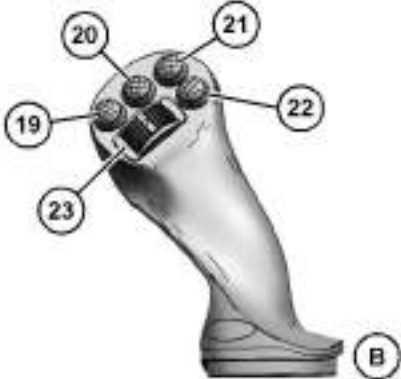


Illustration 305 g06595879

Typical Example
(B) Right Joystick

Table 20

Joystick Control	Right Joystick Patterns
19	Laser and Touch
20	Grade and Bucket
21	Bench Mark
22	Tilt-Rotator Rec
23	-

i06951419

SmartBoom Control (If Equipped)

SMCS Code: 5461-ZS; 7332

WARNING

Personal injury or death can result from not following the proper procedures.

To avoid the possibility of injury or death, follow the established procedure.

WARNING

Activating the SmartBoom function and using the work tool joystick control while the front of the machine is elevated could result in unexpected machine motion. Unexpected machine motion could result in serious injury or death. Do not activate the SmartBoom function if the front of the machine is elevated by the front linkage.

WARNING

Do not elevate or lower the track when in the SmartBoom mode. Follow the operation procedures for the SmartBoom in the Operation and Maintenance Manual. Failure to follow these instructions can result in serious injury or death.

WARNING

Always make sure that the boom control joystick is in the NEUTRAL position before activating the SmartBoom control. Activating the SmartBoom control with the joystick out of the neutral position could result in unexpected machine motion which could result in serious injury or death.

WARNING

Do not select any SmartBoom mode, using the SmartBoom selector switch located on the console, while the tracks are elevated. Selecting the SmartBoom mode with the tracks elevated could result in a sudden drop of the machine which could result in serious injury or death.

WARNING

If any SmartBoom mode is active and the boom control joystick is in the BOOM DOWN position (forward) with a bucket or a work tool on the ground, pressing the disable button that is located on the front of the right hand joystick could cause a sudden boom down motion. This control function could lift the machine upward, with unexpected machine movement that could result in serious injury or death. Do not press the disable button while the SmartBoom mode is active and the boom control joystick is in the BOOM DOWN position (forward) with a bucket or a work tool on the ground.

WARNING

Do not attempt to lift the tracks of the machine by using the disable button and applying downward force with the boom lowering control while the machine is in any SmartBoom mode. Releasing the disable button will immediately return the machine to the active SmartBoom mode. This action could cause the machine to drop down abruptly which could result in serious injury or death.



Illustration 306 g06210059

From the home screen, press the function list button.



Illustration 307 g06210090

Tap the smart boom option, or if using the jog dial, select the smart boom option and press down on the dial.



Illustration 308 g06210095

Select either “Up & Down” or “Down Only” from the list. The two options work as follows:

“Up & Down” mode: When the joystick is moved to the BOOM DOWN position, the boom will lower by the weight of the boom. The boom can move upward freely.

“Down Only” mode: The boom will lower by the weight of the boom when the control lever is moved to the BOOM LOWER position. This mode prevents the boom from moving upward. To move the boom upward, the operator must use the boom control joystick to activate the BOOM UP mode.

Press the home button when finished.

During operation of the SmartBoom function, the operator may wish to apply downward force to the boom. The operator can disable the SmartBoom function temporarily with the SmartBoom disable switch. While the trigger switch is pressed, BOOM RAISE and BOOM LOWER will operate in the normal modes. The SmartBoom disable switch is a configurable switch.

i08222281

Work Tool Control (One-Way Flow) (If Equipped)

SMCS Code: 6700

The following information pertains to work tools that require hydraulic oil flow in one direction. Hydraulic hammers are an example of work tools that require hydraulic oil flow in one direction.

Note: For information that pertains to work tools that require hydraulic oil flow in two directions, refer to Operation and Maintenance Manual, "Work Tool Control (Two-Way Flow)".

Joystick

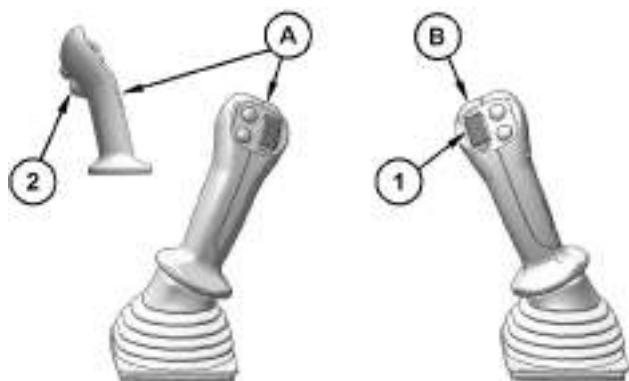


Illustration 309

g06588792

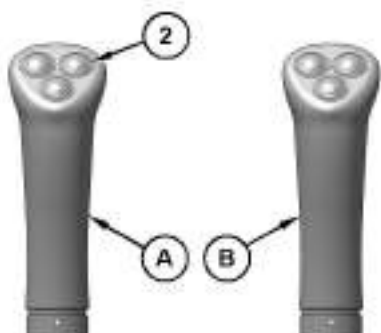


Illustration 310

g06588793

(A) Left joystick
(B) Right joystick



(1) Variable Speed – Move the thumb wheel downward to activate the work tool. Move the thumb wheel further to increase the speed of the work tool.



(2-1) On/Off (Momentary) – While pressing this switch, the work tool will remain activate at a constant rate. Release the switch to turn off the work tool.



(2-2) On/Off (Toggled) – Press the switch once to activate the work tool. Press the switch again to turn off the work tool.

Work Tool Pedal

WARNING

With certain attachment combinations, the work tool pedal can have different functions. Always check for work tool pedal function before using the work tool pedal. Improper operation of the work tool pedal could result in serious injury or death.

The work tool pedal can be installed on either side of the travel pedals. The work tool pedal allows the operator to modulate the speed of the work tool.

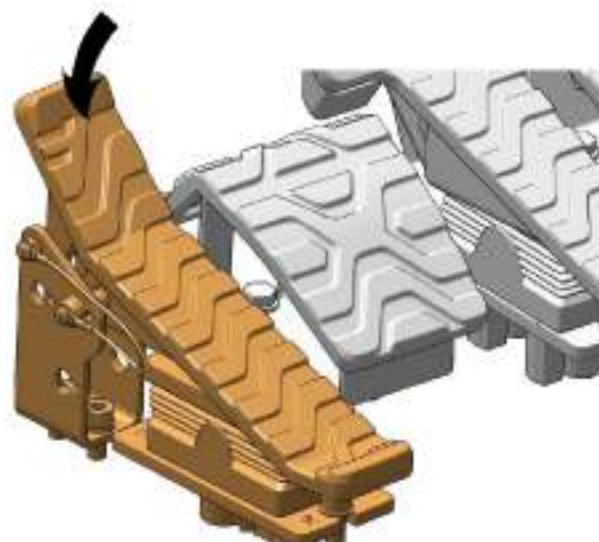


Illustration 311

g06180447



Variable Speed – Push down on the front of the pedal to activate the work tool. Move the pedal further to increase the speed of the work tool. Release the pedal to turn off the work tool.

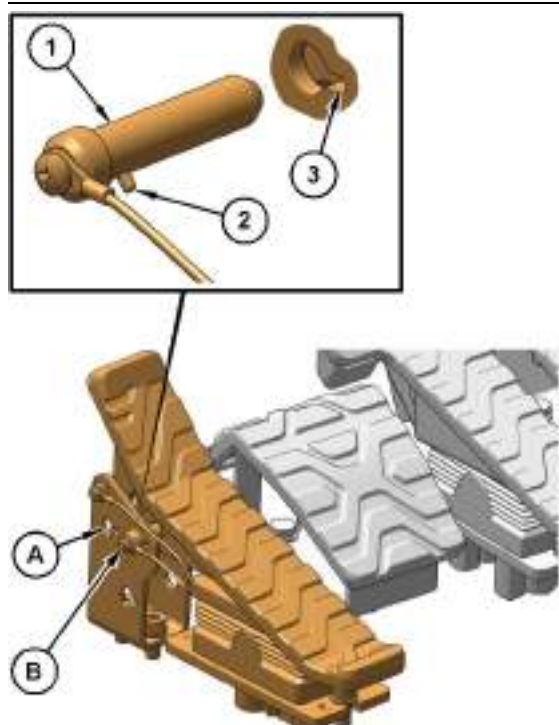


Illustration 312

g06591307

- (1) Lock pin
- (2) Pin
- (3) Notch
- (A) UNLOCKED position
- (B) LOCKED position

When you are not using the work tool, put the lock pin (1) in LOCKED position (B). This will lock the work tool pedal to prevent any unexpected operation of the work tool.

Note: To prevent lock pin (1) from being accidentally pulled out, insert pin (2) through notch (3) and turn lock pin (1) counterclockwise by 1/4 turn.

i07243676

Work Tool Control (Two-Way Flow) (If Equipped)

SMCS Code: 6700

WARNING

The joystick and controls on the joystick can be configured with different functions. Always make sure to check the joystick configuration on the monitor before using the machine to avoid unexpected machine movement. These unexpected machine movements could cause a hazard resulting in serious injury or death.

The following information pertains to work tools that require hydraulic oil flow in two directions. These work tools can also be equipped with a rotate circuit. Hydraulic shears, pulverizers, crushers, and grapples are examples of work tools that require hydraulic oil flow in two directions.

Note: For information that pertains to hydraulic hammers, refer to Operation and Maintenance Manual, "Work Tool Control (One-Way)".

Joystick

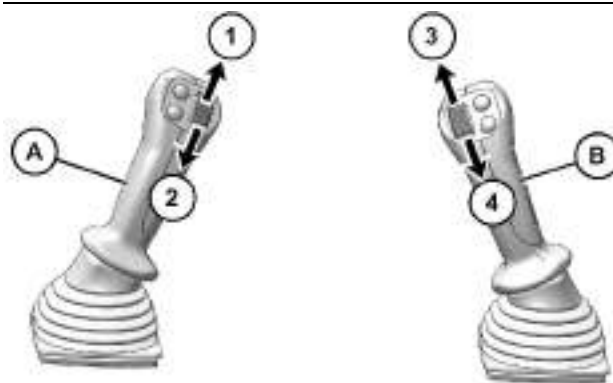


Illustration 313

g06180488

- (A) Left joystick
- (B) Right joystick



(1) ROTATE CLOCKWISE – Move the thumb wheel upward to rotate the work tool clockwise.



(2) ROTATE COUNTERCLOCKWISE – Move the thumb wheel downward to rotate the work tool counterclockwise.



(3) CLOSE – Move the thumb wheel upward to close the work tool.



(4) OPEN – Move the thumb wheel downward to open the work tool.

Work Tool Pedal

WARNING

With certain attachment combinations, the work tool pedal can have different functions. Always check for work tool pedal function before using the work tool pedal. Improper operation of the work tool pedal could result in serious injury or death.

The work tool pedal can be installed on either side of the travel pedals. The work tool pedal allows the operator to vary the speed of the work tool.

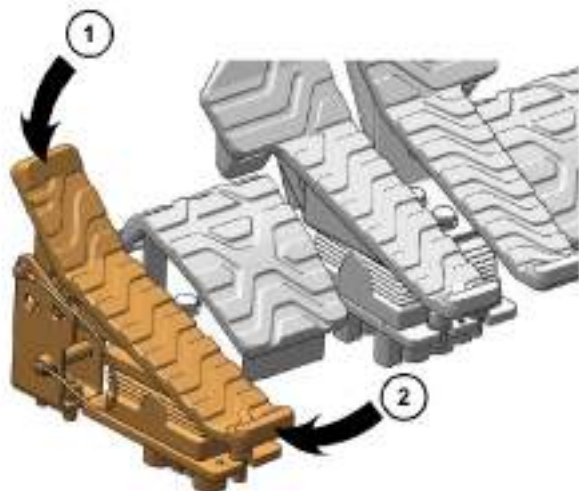


Illustration 314

g06180510



(1) CLOSE – Push down on the front of the pedal to close the work tool.



(2) OPEN – Push down on the rear of the pedal to open the work tool.

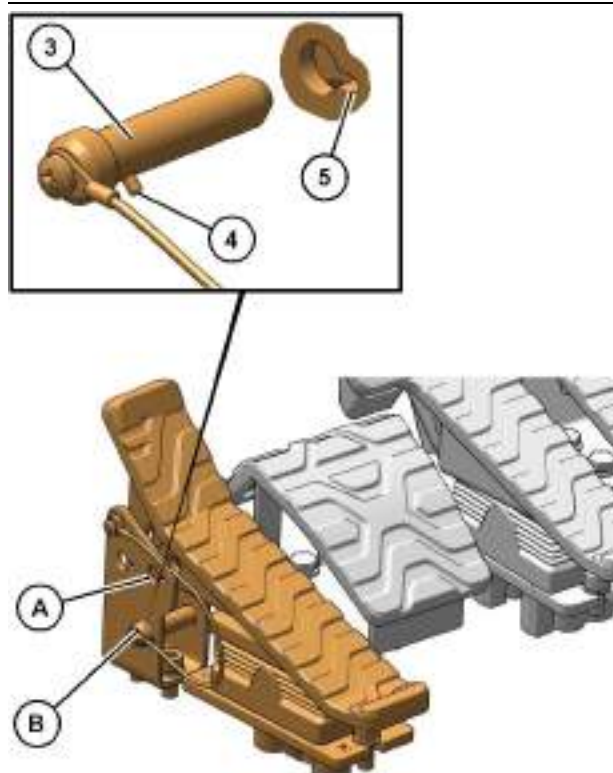


Illustration 315

g06180514

- (3) Lock pin
- (4) Pin
- (5) Notch
- (A) LOCKED position
- (B) UNLOCKED position

When you are not using the work tool, put the lock pin (3) in LOCKED position (A). This will lock the work tool pedal to prevent any unexpected operation of the work tool.

Note: To prevent lock pin (3) from being accidentally pulled out, insert pin (4) through notch (5) and turn lock pin (3) by 1/4 turn.

i08209549

Joystick Controls Alternate Patterns

SMCS Code: 5059; 5137

Changing Machine Control Pattern (If Equipped)

WARNING

Whenever a change is made to the machine control pattern, also exchange the pattern card in the cab to match the new pattern.

Check the machine control pattern for conformance to the pattern on the card in the cab. If the pattern does not match, change the card to match the machine control pattern before you operate the machine. Failure to do so could result in personal injury.

The machine control pattern can be changed to the ISO/JIS pattern, BHL pattern, MHI pattern, KOBE pattern, or the former SCM pattern. To change the joystick controls between the patterns, refer to Operation and Maintenance Manual, Monitoring System for more information.

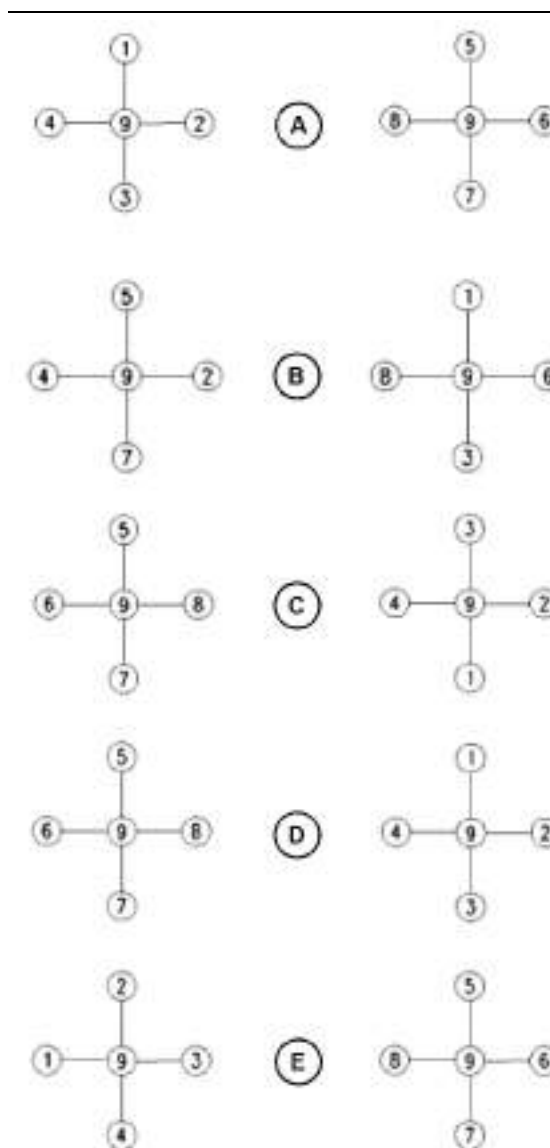


Illustration 316

g06136699

- (A) ISO/JIS machine control pattern
- (B) BHL machine control pattern
- (C) MHI machine control pattern
- (D) KOBE machine control pattern
- (E) Former SCM machine control pattern

The patterns on the left side of the Illustration show the possible configurations for the left control lever. The patterns on the right side of the Illustration show the possible configurations for the right control lever.



STICK OUT (1) – Move the control lever to this position to move the stick outward.



SWING RIGHT (2) – Move the control lever to this position to swing the upper structure to the right.



STICK IN (3) – Move the control lever to this position to move the stick inward.



SWING LEFT (4) – Move the control lever to this position to swing the upper structure to the left.



BOOM LOWER (5) – Move the control lever to this position to lower the boom.



BUCKET DUMP (6) – Move the control lever to this position to dump the bucket.



BOOM RAISE (7) – Move the control lever to this position to raise the boom.



BUCKET CLOSE (8) – Move the control lever to this position to close the bucket.

HOLD (9) – When the control lever is released from any position, the control lever will return to the HOLD position. Movement of the upper structure will stop.

Two functions may be performed at the same time by moving a control lever diagonally.

If the machine is equipped with a hydraulic hammer, the function of position (6) and of position (8) is different.

HYDRAULIC HAMMER RAISE (6) – Move the control lever to this position to raise the hydraulic hammer.

HYDRAULIC HAMMER LOWER (8) – Move the control lever to this position to lower the hydraulic hammer.

If the machine is equipped with a grapple, the function of position (6) and of position (8) is different.

GRAPPLE OPEN (6) – Move the control lever to this position to open the grapple arms.

GRAPPLE CLOSE (8) – Move the control lever to this position to close the grapple arms.

If the machine is equipped with a clamshell, the function of position (6) and of position (8) is different when in “Clamshell” mode.

Note: When in “Clamshell” mode, the work tool can only be operated if Work Tool Select also has clamshell selected.

CLAMSHELL OPEN (6) – Move the control lever to this position to open the clamshell.

CLAMSHELL CLOSE (8) – Move the control lever to this position to close the clamshell.

i07362012

Work Tool Flow Control

SMCS Code: 7007-WTL

Many hydraulic attachment circuits are adaptable on this machine. Various types of work tools can be installed. Select a suitable arrangement of the hydraulic circuit in order to provide the requirements for flow and the requirements for action for the work tool that is used.

One-way flow is available for work tools such as hydraulic hammers.

Two-way flow is available for work tools such as hydraulic shears.

A manually controlled ball valve is provided in the return line.

Before attachment hydraulic circuits are serviced, place the machine in the servicing position. Stop the engine.

Place the ball valve in the correct position. To determine the correct position, refer to the requirements for the work tool on Illustrations 317 , 318 , and 319 .

Use the manual lever to turn the ball valve. Make sure that you fully turn the ball valve until the ball valve stops.

Never use the manual lever as a step when the manual lever is attached to the ball valve. Remove the manual lever from the valve after the valve is adjusted.

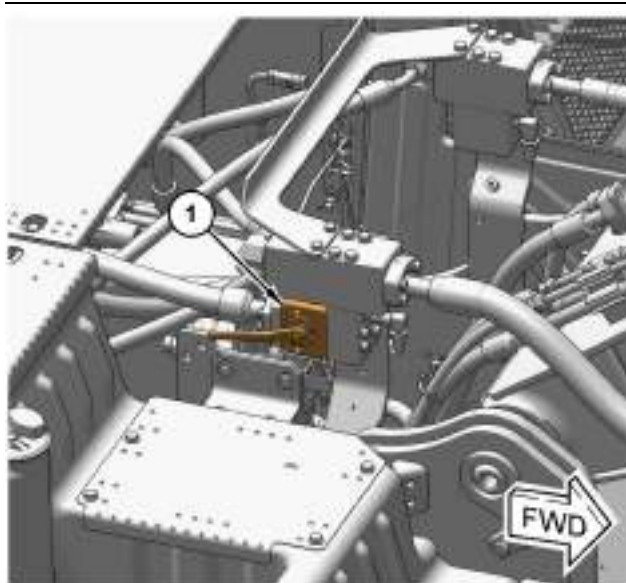


Illustration 317
Ball valve location
(1) Ball valve

g06295566

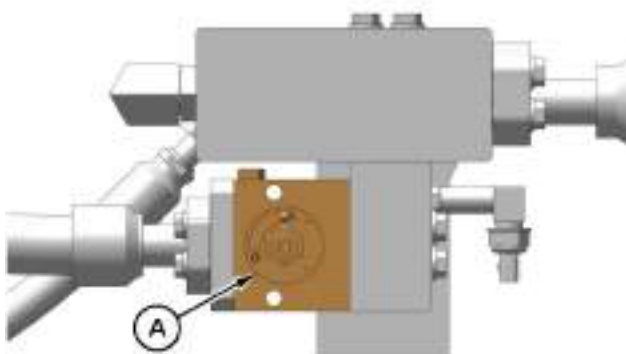


Illustration 318
Ball valve (one-way flow position)
(A) Ball valve open

g06295579

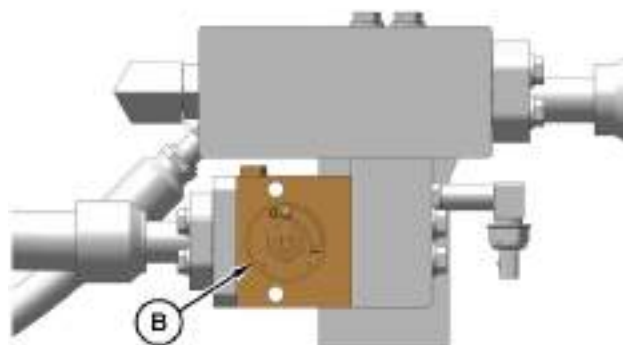


Illustration 319
Ball valve (two-way flow position)
(B) Ball valve closed

g06295576

i06951805

Fuel Tank Shutoff and Drain Control

SMCS Code: 1273

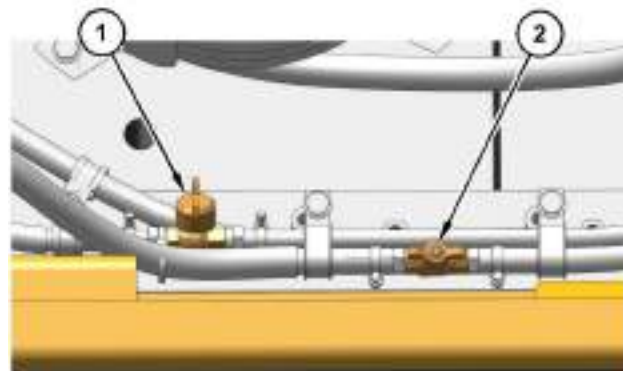


Illustration 320
Fuel tank drain valve and shutoff

g06214473

Fuel Tank Drain Valve (1) – The drain valve for the fuel tank is located behind the right side access door. To drain the water and sediment from the fuel tank, turn the fuel drain valve counterclockwise. To close the fuel tank drain valve, turn the drain valve clockwise.

Fuel Shutoff Valve (2) – The fuel shutoff valve is located behind right side access door. To shut off the fuel supply, turn the fuel shutoff valve clockwise. To turn on the fuel supply, turn the fuel shutoff valve counterclockwise.

Note: For more detailed information that pertains to draining the water and sediment from the fuel tank, refer to Operation and Maintenance Manual, "Fuel Tank Water and Sediment - Drain".

Engine Starting

i08185791

Engine Starting

SMCS Code: 1000; 1090; 1456; 7000

NOTICE

This machine is equipped with a Cat[®] Machine Security System (MSS) and may not start under certain conditions.

NOTICE

The engine start switch must be in the ON position and the engine must be running in order to maintain electrical functions and hydraulic functions. This procedure must be followed in order to prevent serious machine damage.

Note: The engine can start in areas that have temperatures as low as -18°C (0°F). For areas that are colder, a starting kit for cold weather is available.

1. Move the hydraulic lockout control to the LOCKED position.

This machine is equipped with an engine neutral start system. The system only allows the engine to start when the lever for the hydraulic lockout control is in the LOCKED position.

2. Ensure that the joysticks and travel controls are in the HOLD position.



Illustration 321

g06209482

3. The operator passcode, Bluetooth key or Cat App: Fleet management app must be authenticated before starting the engine. Once authenticated, an "Engine Start Allowed" message will appear across the top of the monitor and the start switch LED will turn green.



Illustration 322 g06579150

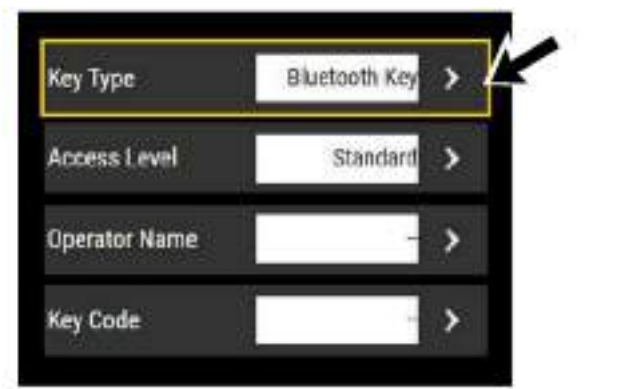


Illustration 323 g06579155

4. Bluetooth devices and passcodes can be registered using the in-cab display if the operator is logged in to the system using a master access account. Contact your Cat dealer for additional information.

Reference: Refer to Operation and Maintenance Manual, Machine Security System, Operator Login for instructions.

5. Before you start the engine, check for the presence of bystanders or maintenance personnel. Ensure that all personnel are clear of the machine. Briefly sound the horn before you start the engine.

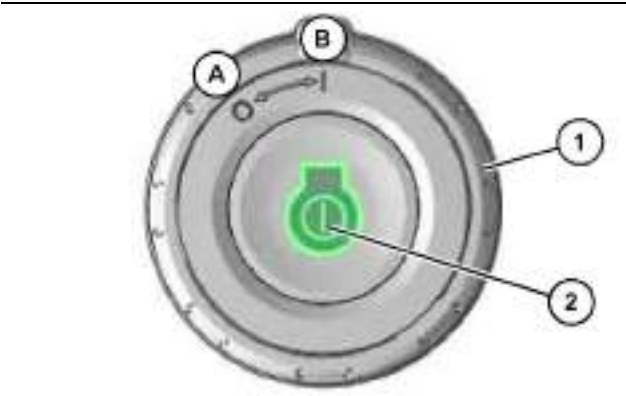


Illustration 324 g06226447

- (A) Off
- (B) On
- (1) Engine start ring
- (2) Engine start button

6. Turn the engine start ring(1) to the ON position, then press and hold start button (2) to start the engine. Release the button after the engine has started.

If the engine is having trouble starting, do not crank the engine for more than 30 seconds. Cranking the engine for more than 30 seconds can damage starting system components.

i07552385

Engine and Machine Warm-Up

SMCS Code: 1000; 7000

NOTICE

Keep engine speed low and do not operate until the message "Warm-Up Mode Power Derate" on the monitor goes out. If it does not go out within thirty seconds, stop the engine and investigate the cause before starting again. Failure to do so, can cause engine damage.

NOTICE

Always run the engine at low idle for at least ten minutes before performing any other operations in cold conditions or each time the engine oil and oil filter are changed in order to protect your engine and hydraulic components.

NOTICE

Depending on the ambient temperature, in order to prevent the machine operation with high speed without sufficient lubrication at the turbo bearing, the engine speed may be set to low speed and the hydraulic power minimized for a pre-determined time after the engine starts. Refer to turbo protection feature.

The engine may automatically change speeds when the machine is stationary and idling in cold ambient temperature for an extended time. This is to:

- Maintain desired coolant temperature.
- Maintain desired operation of engine systems.

During extended idling in cold ambient conditions, engine speed may operate between 900 rpm and 1000 rpm. Operation at 1000 rpm is minimal and will only last for up to 20 minutes.

Hydraulic System

Automatic Warm-Up

This machine comes with an automatic warm-up feature that can be enabled or disabled. If the feature is enabled, and the hydraulic oil temperature is below the threshold that has been set, a prompt will appear on the monitor after starting the machine. Follow the prompts on the monitor. If this feature is disabled or you would like to change the temperature setting, refer to Operation and Maintenance Manual, Monitoring System.



Illustration 325

g06219830

Manual Warm-Up

WARNING

When you cycle the machine controls, the machine can move suddenly. Contact between the machine and external objects or ground personnel can result in serious injury or death. Before you cycle the machine controls, the machine should be located in an unobstructed, hazard-free work area that is away from external objects and ground personnel.

1. Make sure that the area is clear of personnel and equipment.

Note: The hydraulic lockout control must be in the UNLOCKED position before the hydraulic controls will function.

2. Allow the engine to warm up at low idle for at least 5 minutes. Engage the work tool controls and disengage the work tool controls. This will speed up the warm-up of the hydraulic components.

When you idle the machine for warm-up, observe the following recommendations:

- If the temperature is greater than 0°C (32°F), warm up the engine for approximately 15 minutes.
- If the temperature is less than 0°C (32°F), warm up the engine for approximately 30 minutes.

- If the temperature is less than -18°C (0°F) or if hydraulic functions are sluggish, additional time may be required.

NOTICE

The hydraulic oil temperature should be higher than 25°C (77°F) before performing work with the machine. Make sure that the warm-up procedure is performed.

If the hydraulic oil temperature is less than 25°C (77°F) and the machine is operated abruptly, serious damage to the hydraulic components may occur.

Note: The recommended operating temperature of the hydraulic fluid for this machine is 55°C (131°F).

3. To warm up the hydraulic oil, turn the engine speed dial to the medium engine speed. Run the engine for approximately 5 minutes and move the joystick intermittently from the BUCKET DUMP position to the HOLD position. Do not hold the joystick in the BUCKET DUMP position with the bucket cylinder fully extended for more than 10 seconds.

This allows the oil to attain relief pressure, which causes the oil to warm up more rapidly.

4. Turn the engine speed dial to the maximum engine speed and repeat Step 3.
5. Cycle all controls to circulate warm oil through all hydraulic cylinders and all hydraulic lines, and through the swing motor and travel motors.
6. Observe the gauges and the indicators frequently during the operation.

Turbo Protection Power Derate – After an engine start, the engine speed will be set to low speed and the hydraulic power limited for a time period. During this period, the monitor displays the message "Warm-Up Mode Power Derate". (Maximum is around 30 seconds). After the turbo bearing lubrication is sufficient, the engine speed goes to the setting dial speed and the monitor stops to display the message.

Improve Cold-Weather Performance

Covers installed over the vents in the radiator compartment door will help to control overcooling in ambient temperatures below -15°C (5°F).

The materials used for the covers and the method used to install the covers is at the installers discretion.

Install the covers if overcooling is observed while the machine is idling in ambient temperatures below -15°C (5°F).

Stop the machine, and remove the covers under the following conditions:

- The ambient temperature is above -15°C (5°F).
- The engine temperature gauge indicates overheating.
- The hydraulic oil temperature gauge indicates overheating.

Recommendation for Crankcase Breather Protection (Machines with C4.4 and C7.1)

Crankcase ventilation gases contain a large quantity of water vapor. This water vapor can freeze in cold ambient conditions and can plug or damage the crankcase ventilation system. If the engine is operated in temperatures below -25°C (-13°F), measures must be taken to prevent freezing and plugging of the breather system. Insulated hoses and a heated canister assembly should be installed.

Consult with your Cat dealer for the recommended breather components for operation from -25° to -40°C (-13° to -40°F).

Installation



Illustration 326

g06181368

Vent locations on the radiator compartment door.

1. Clean the surface of the radiator compartment door.

2. Install the covers in the locations shown in Illustration 326 . The covers should fully cover the door vents.

Operation

i07348768

Operation Information

SMCS Code: 7000

Note: Operating Temperature Range for the Machine The machine must function satisfactorily in the anticipated ambient temperature limits that are encountered during operation. The standard machine configuration is intended for use within an ambient temperature range of -18°C (0°F) to 43°C (109°F). Special configurations for different ambient temperatures may be available. Consult your Cat dealer for additional information on special configurations of your machine.

Make sure that no personnel are on the machine or near the machine to prevent any personal injury. Keep the machine under control at all times to prevent injury.

Sound the horn and allow adequate time for bystanders to clear the area before moving the machine into a restricted visibility area. Follow local practices for your machine application. For more information refer to Operation and Maintenance Manual, "Restricted Visibility".

Reduce the engine speed when you maneuver the machine in tight quarters and when you drive over an incline.

Select the necessary travel speed range before you drive downgrade. Do not change the travel speed range while you drive downhill.

Use the same travel speed on a downgrade and on an upgrade.

When you travel for any distance, keep the stick inward and carry the boom in a low position.

When you drive up a steep grade, keep the boom as close to the ground as possible.

When you travel uphill or you travel downhill, keep the boom on the uphill side of the machine.

1. Adjust the operator seat.
2. Fasten the seat belt.



Illustration 327

g06181515

3. Turn the engine speed dial to the desired operating range.
4. Move the hydraulic lockout control to the UNLOCKED position.



Illustration 328

g06181525

5. Raise the boom enough to provide sufficient ground clearance.



Illustration 329

g06181517

6. Select the desired travel speed by operating the travel speed control switch. The indicator will light to display the active mode.
7. Make sure that the position of the upper structure and of the undercarriage is known before you move the machine. The drive sprockets should be at the rear of the machine.

Note: The directional steering controls will operate normally if the drive sprockets are at the rear of the machine and the idlers are at the front of the machine and under the cab. When the sprockets are under the cab, the travel controls will operate backward.

8. Turn the engine speed dial to increase the engine speed (rpm) to the desired speed.
9. Push both travel levers forward at the same time to travel forward. If both travel levers are pushed farther, the travel speed at the selected engine speed (rpm) will be faster.

Note: If the machine does not operate or if the machine does not travel in a straight line, consult your Cat dealer.

10. See Operation and Maintenance Manual, "Operator Controls" for information about spot turning and about pivot turns.

11. When you make turns in soft material, travel in a forward direction occasionally to clear the tracks.
12. Slowly move both of the travel levers or both of the travel pedals to the CENTER position to stop the machine.

Lifting Objects

If the machine is equipped with the CE plate per requirements for the European Union, used to lift objects, then the machine must be equipped with a boom lowering control valve, a stick lowering control valve, and an overload warning device.

A fit for purpose test was completed to confirm that a properly equipped machine meets the requirements of the European Union Machinery Directive "2006/42/EC" for lifting objects.

The overload warning device (if equipped) must be adjusted for the bucket linkage and bucket size that is installed on the machine. Adjust the overload warning device for proper operation.

The setting for the overload warning device (if equipped) should be checked by an authorized dealer.

i06981624

Frozen Ground Conditions

SMCS Code: 7000



Illustration 330

g06185895

To free the tracks from frozen ground, swing the boom to the front of the machine. Use boom down pressure to free the idler end of the machine.

Swing the boom to the rear of the machine. Use boom down pressure to free the sprocket end of the machine.

i07474576

Equipment Lowering with Engine Stopped

SMCS Code: 7000

To lower the boom, place the hydraulic lockout control in the UNLOCKED position. Move the joystick to the BOOM LOWER position. If the accumulator is still charged, the boom will lower.

If the boom does not lower, the accumulator is empty. Use one of the following procedures to lower the boom.

Machines Equipped with Boom Lowering Control Valves

WARNING

Boom load may cause cylinder oil pressure to reach relief pressure of the boom lowering control device when the boom is supported by one cylinder. Boom can lower suddenly, causing possible injury or death.

To avoid possible injury or death, be sure no one is under or near the work tool before manually lowering the boom.

Keep all personnel away from the boom drop area when lowering the boom with the engine stopped.

WARNING

Be sure no one is under or near the work tools before manually lowering the boom. Keep all personnel away from the boom drop area when lowering the boom with the engine stopped in order to avoid possible personal injury.

WARNING

Personal injury can result from hydraulic oil pressure and hot oil.

Hydraulic oil pressure can remain in the hydraulic system after the engine has been stopped. Serious injury can be caused if this pressure is not released before any service is done on the hydraulic system.

Make sure all of the work tools have been lowered to the ground, and the oil is cool before removing any components or lines. Remove the oil filler cap only when the engine is stopped, and the filler cap is cool enough to touch with your bare hand.

If the engine or the hydraulic system is disabled and the boom is up, the boom can be lowered manually. Boom lowering control valves allow the boom to be manually lowered. The boom lowering control valves are located at the head end port on the boom cylinders.

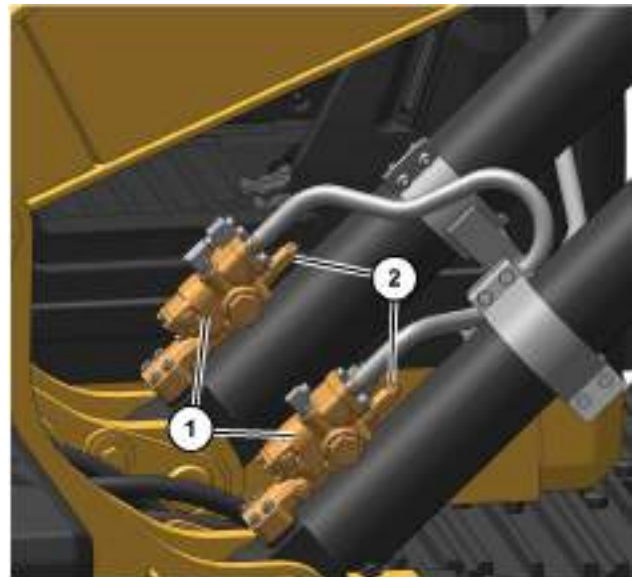


Illustration 331

g06263683

- (1) Boom lowering control valve
- (2) Line relief

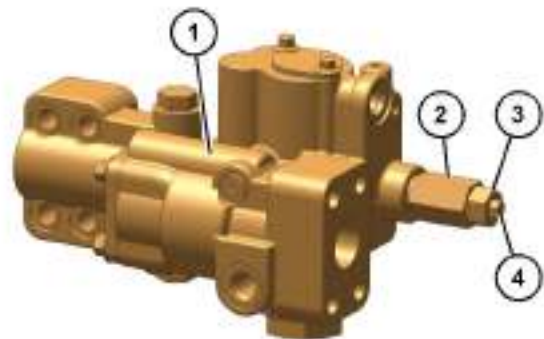


Illustration 332

g06263723

- (1) Boom lowering control valve
- (2) Line relief
- (3) Locknut
- (4) Set screw

1. Loosen the locknut (3) at each of the boom lowering control valves.

2. Slowly, turn set screw (4) counterclockwise until the boom begins to lower onto the ground.

Note: Once the boom begins to lower, stop turning set screw (4).

3. After the boom has lowered completely onto the ground, turn set screw (4) back to the original position.
4. Tighten locknut (3) to 40 ± 4 N·m (29.5 ± 3 b ft).
5. Before operating the machine, make any necessary repairs.

For additional information, consult your Cat dealer.

Machines without a Boom Lowering Control Valve

WARNING

Be sure no one is under or near the work tools before manually lowering the boom. Keep all personnel away from the boom drop area when lowering the boom with the engine stopped in order to avoid possible personal injury.

Use the following procedure to manually lower the boom due to an engine malfunction.

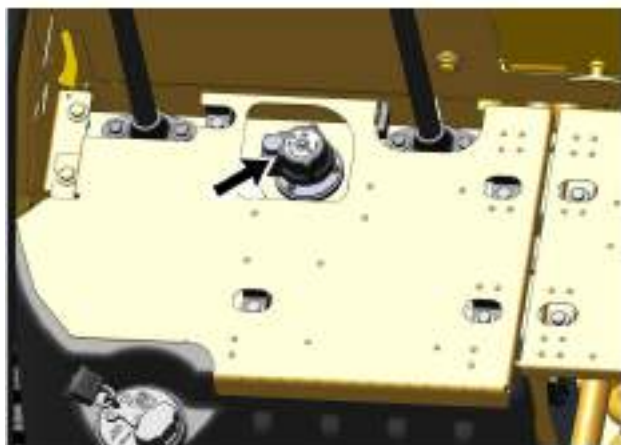


Illustration 333

g06184080

Hydraulic tank filler cap location

WARNING

Pressurized system!

The hydraulic tank contains hot oil under pressure. To prevent burns from the sudden release of hot oil, relieve the tank pressure with the engine off. Relieve pressure by slowly turning the cap until the cap reaches the secondary stop.

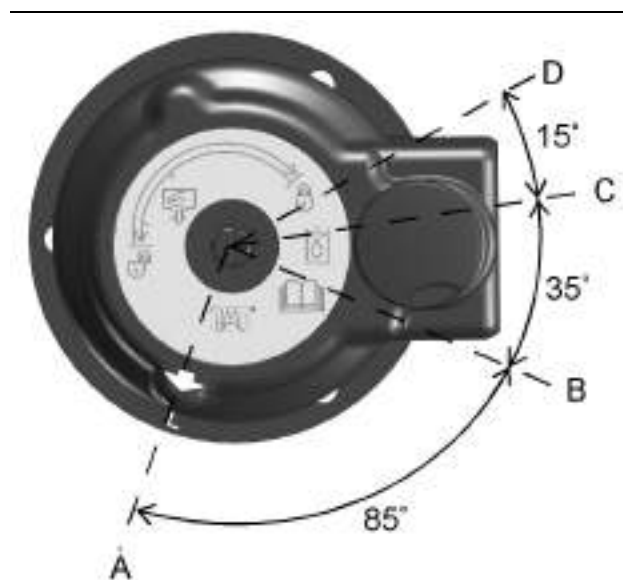


Illustration 334

g06184990

Filler cap

- (A) LOCK position
- (B) PRESSURE RELEASE - START position
- (C) PRESSURE RELEASE - END position
- (D) OPEN position

1. Release the pressure that may be present in the return hydraulic circuit with the following procedure. Refer to Illustration 334 for filler cap positions.
 - a. Turn the filler cap counterclockwise and move the arrow from position (A) to position (B).
 - b. Release the pressure for a minimum of 45 seconds by moving the arrow from position (B) to position (C).
 - c. Move the arrow from position (C) to position (D).
 - d. After the tank pressure is relieved, remove the filler cap.

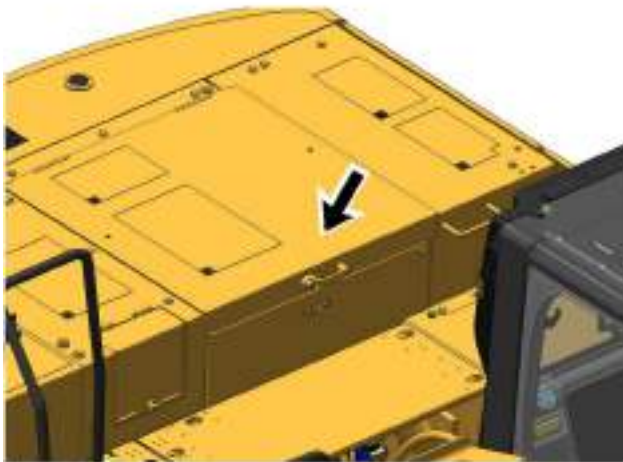


Illustration 335

g06225770

2. Open the engine hood.

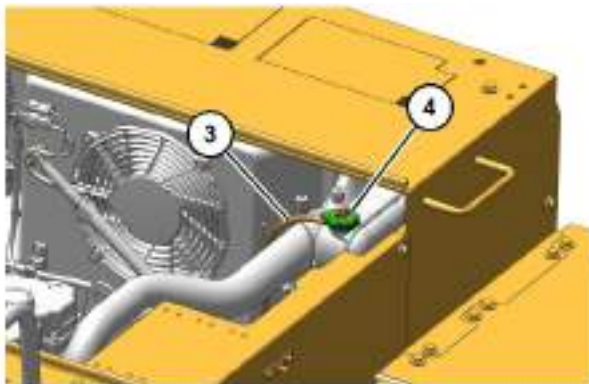


Illustration 336

g06184089

(3) Hose
(4) Clamp

3. Loosen clamp (4) and disconnect hose (3) from the reservoir. Remove the clamps and the cable straps that secure the hose to the machine.

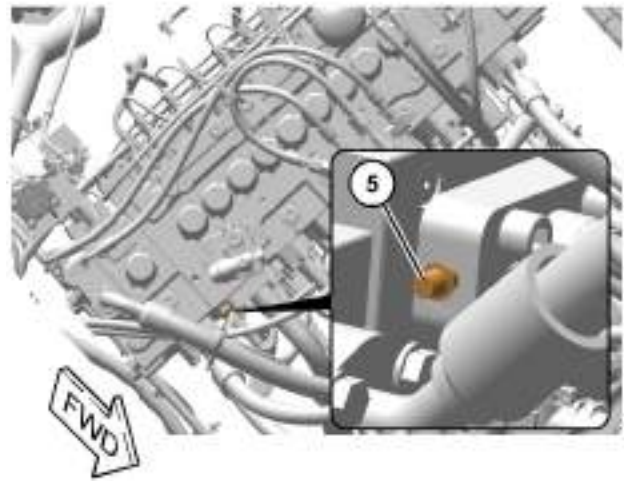


Illustration 337

g06205184

Main control valve

(5) Screw

4. Connect one end of the radiator hose to screw (5). Put the other end of the hose into the hydraulic tank opening. The screw is located at the front, right side of the main control valve.
5. Slowly loosen screw (5) by a maximum of 1/2 turn. This allows the hydraulic oil in the boom circuit to drain into the hydraulic tank. The boom will now start to lower.
6. Make sure that the work tool has lowered all the way to the ground. Tighten screw (5) to $13 \pm 2 \text{ N}\cdot\text{m}$ ($9 \pm 1 \text{ lb ft}$).
7. Disconnect the hose from the screw. Do not allow the oil that is contained in the hose to spill. Drain the oil into a suitable container.
8. Connect the hose to the original position on the radiator and install the hydraulic tank filler cap.
9. Close the engine hood.

After completion of the manual boom lowering, make necessary repairs before you operate the machine again.

Pressure Release of Auxiliary Lines



Personal injury can result from hot oil spray and raised work tools.

Make sure all the work tools have been lowered, the oil is cool and the pressure has been released from the hydraulic system before removing any components or lines.

Do not allow hot oil or components to contact skin.

Note: Refer to Operation and Maintenance, "General Hazard Information" for information on containing fluid spillage.

Refer to the procedure below before any of the following conditions.

- The work tool is changed.
 - The position of the ball valve is changed.
1. Turn the engine start switch to the OFF position.
 2. Place the hydraulic lockout lever in the UNLOCKED position.
 3. Release the pressure in the auxiliary lines by pressing the auxiliary control buttons or the auxiliary control pedal three times.
 4. Place the hydraulic lockout lever in the LOCKED position.
 5. Change the work tool.

Note: There should be movement in the auxiliary hydraulic lines as the pressure is released. If there is no movement in the auxiliary hydraulic lines, start the engine and run the engine for 20 seconds. Repeat steps 1 to 5.

For additional information, consult your Cat dealer.

Operating Techniques

i08069554

Operating Technique Information

SMCS Code: 7000

WARNING

Know the maximum height and the maximum reach of your machine. Serious injury or death by electrocution can occur if the machine or the work tools are not kept a safe distance from electrical power lines. Keep a distance of at least 3000 mm (118 inch) plus an additional 10 mm (0.4 inch) for each 1000 volts over 50000 volts.

For safety, one of the following may require a greater distance:

- Local codes
- State codes
- Requirements of the job site

NOTICE

When swinging into a ditch, do not use the ditch to stop the swinging motion. Inspect the machine for damage if the boom is swung into a bank or an object.

Repeated stopping by an object can cause structural damage if the boom is swung into a bank or an object.

With certain boom-stick-bucket combinations, the bucket or worktool can hit the cab and/or the front structure of the machine. Always check for interference when first operating a new bucket or a new work tool. Keep the bucket or work tool away from the cab and away from the front structure during operation.

Whenever the tracks of the machine raise off the ground while digging, lower the machine back to the ground smoothly. **DO NOT DROP OR CATCH IT WITH THE HYDRAULICS.** Damage to the machine can result.

With certain combinations of work tools, the third pedal can have different functions. Always check the function of the third pedal before you use the third pedal.

Know the location of any buried cables. Mark the locations clearly before you dig.

Consult your Cat dealer for special work tool tips that are available for use in severe applications.

Move the machine whenever the position for operating the machine is not efficient. The machine can be moved forward or backward during the operating cycle.

When you operate the machine in close places, utilize the bucket or the other work tool to perform the following functions:

- Pushing the machine
- Pulling the machine
- Lifting the tracks

Use a comfortable travel speed while you operate the machine.

Operating efficiency can be increased by using more than one machine control to perform a task.

Never swing a load over a truck cab or workers.

Position the truck so that material can be loaded from the rear of the truck or from the side of the truck. Load the truck evenly so that the rear axles are not overloaded.

An oversize bucket or a bucket that is equipped with side cutters should not be used in rocky material. These types of buckets slow down the cycle. Damage to the bucket and to other machine components could result.

Coaching Tips



Illustration 338

g06223763

Digging with a stable machine increases productivity. Create a stable work platform.

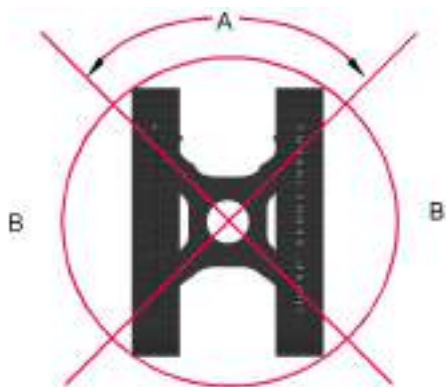


Illustration 339

g06210141

- (A) Most stable dig
(B) Dump

For improved stability: Do not dig over the drives or perpendicular to the tracks.

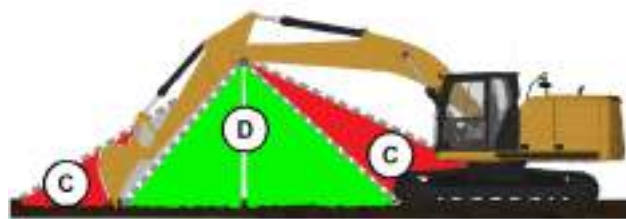


Illustration 340

g06212328

- (C) Weak crowd force
(D) Ideal crowd force

Dig from the top down in layers. Try to have a full bucket by the time the stick is vertical, but do not reach too far with the stick. The most crowd force is generated with the stick +/- 30 degrees from vertical.

Minimize unneeded movement. Only curl/dump the bucket as much as required to hold/dump material.

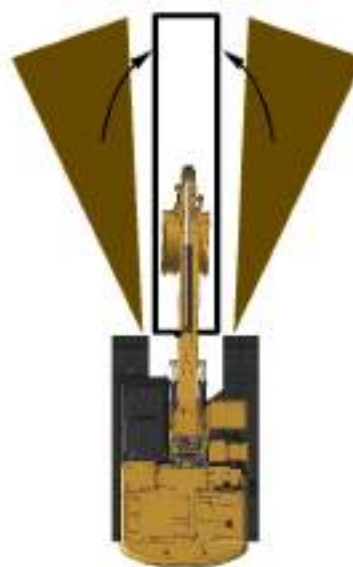


Illustration 341

g06210334

Minimize unneeded movement. During backfilling, start with the material closest to the trench.

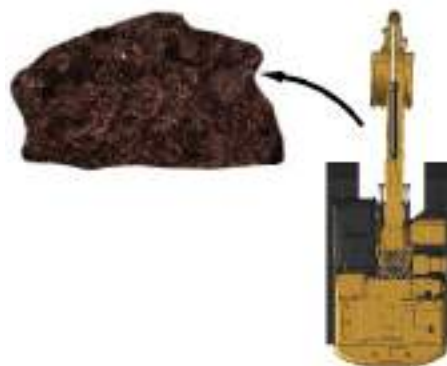


Illustration 342

g06210343

Watch your surroundings. Swing left to dump material for better visibility.

Watch the bucket. The bucket can contact the tracks or the cab.

Concentrate on being smooth, speed will come with practice.



Illustration 343

g06212604

Truck placement will affect efficiency: 45 degree truck loading is more efficient than 90 degree. Spotting the truck too far from the excavator causes excessive motion.

Load from a bench when possible. Bench loading is more efficient.

Restricted Operation



Illustration 344

g06222487

Do not use the swing force to perform the following operations:

- Soil compaction
- Ground breaking
- Demolition

Do not swing the machine while the bucket tips are in the soil.

These operations will damage the boom, the stick, and the work tool and the operations will reduce the life of the equipment.



Illustration 345

g06212594

Do not use the dropping force of the bucket or work tool as a hammer. This will bring excessive force on the rear of the machine. Possible damage to the machine could result.



Illustration 346

g06222492

If the cylinder is operated at the end of the stroke during operations, excessive force will occur on the stopper on the inside of the cylinder. This will reduce the life of the cylinder and structures. To avoid this problem, always leave a small margin of play when the cylinder is operated.



Illustration 347

g06222498

If the stick IN function is operated at full speed with a fully loaded bucket or heavy work tool attachment to the end of the cylinder stroke, excessive force will occur inside the stick cylinder. This action will reduce the life of the stick cylinder. To avoid this problem, always operate a stick IN function with moderate speed towards the end of cylinder stroke.



Illustration 349

g06222505

Do not use the dropping force of the rear of the machine for excavation. This operation will damage the machine.

Operating Precaution



Illustration 348

g06222500

While the bucket is in the ground, do not use the travel force for any excavation. This operation will cause excessive force on the rear of the machine.



Illustration 350

g06222507

NOTICE

Do not allow the machine to swing from the force of traveling when you use the bucket, the stick, or the boom to assist in travel. If the force from traveling causes the machine to swing, damage may occur to the swing motor and to the swing drive.

Do not use the force of the bucket, the stick, or the boom to assist in turning the machine while the machine is traveling. This technique is referred to as "jump steering". This technique will damage the swing motor and the swing brake.



Illustration 351

g06222509

When deep holes are dug, do not lower the boom so that the bottom side of the boom touches the ground.

When deep holes are dug, do not allow the boom to interfere with the tracks.

Grade and Assist Operating Tips

The following image displays proper stick speeds for accurate grading. One of the factors to accuracy is the grade assist speed setting. The setting can be set to Quick, Normal, or Fine. The settings are found in the Grade Assist screen on the monitor.

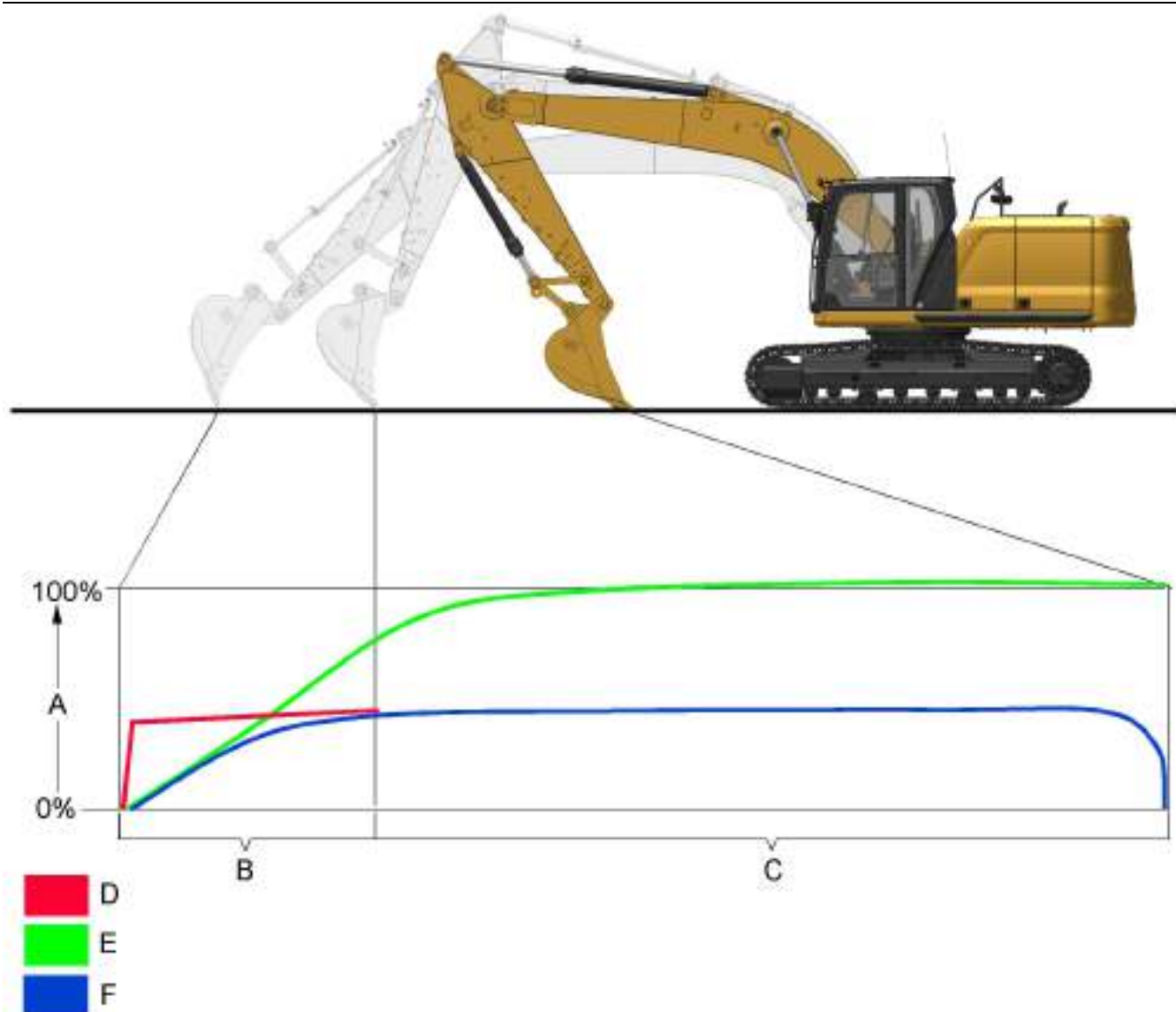


Illustration 352

g06250472

Stick speed vs. accuracy

(A) Stick joystick movement

(B) Joystick movement must be gradual

(C) In fine or normal mode, joystick input can be at 100 percent.

(D) Joystick movement too fast

(E) Good for fine or normal mode

(F) Good in any mode

For best results using Cat Grade, it is important to be cognizant of stick speed in order to obtain accurate results. When the bucket touches the ground before digging, the initial dig movement must be gradual. If operating in Fine or Normal mode, joystick speed can be increased to 100 percent after the slow initial engagement. Approximately 50 percent stick speed is necessary to maintain accuracy when in Quick mode after the slow initial engagement.

Cut/fill error can be minimized if the work tool is properly calibrated and the operator maintains a deliberate speed of operation.

Smart Boom

When using the smart boom function, it is necessary to slow down stick speed. Smart boom cannot keep up when the stick is operating at a rapid pace. This is particularly noticeable when the boom is at the raise/lower transition point and the stick is near vertical.

i07058371

Travel in Water and Mud

SMCS Code: 7000-V6

NOTICE

When working in or around any body of water, around a stream or river, or in conditions of heavy mud, be careful that the swing bearing, the swing drive gear, and the swivel joint do not dip into water, mud, sand, or gravel. If the swing bearing dips into water, mud, sand, or gravel, immediately grease the swing bearing until the used grease leaks from the outer circle of the swing bearing. Failure to carry out this procedure may cause premature wear in the swing bearing.



Illustration 353

g06223764

Depth of water to the center of the track carrier roller.

The following guidelines pertain to travel across water and travel through mud, sand, or gravel.

The machine can travel across a river only under the following conditions:

- The bed of the river is flat.
- The flow of the river is slow.
- The machine dips into the water only to the center of the track carrier roller (dimension A).

NOTICE

Do not allow the fan on the engine to contact the water while the machine travels through the water. Do not allow the fan on the engine to contact the water during a swing while the machine is in the water. Damage to the fan may occur if the fan contacts the water.

While you cross the river, carefully confirm the depth of the water with the bucket. Do not move the machine into an area that has a water depth that is greater than Dimension A.

The machine may sink gradually on soft ground. Therefore, you should frequently check the height of the undercarriage from ground level and the depth of water on the ground.

Check the swing gear by looking through the port for inspection that is on the upper frame. If there is water in the swing gear, contact your Cat dealer for the required maintenance on the swing gear.

After you travel through water, carefully clean the machine to remove any salt, sand, or other foreign matter.

Procedure for Removing the Machine from Water or Mud

NOTICE

Do not allow the machine to swing from the force of traveling when you use the bucket, the stick, or the boom to assist in travel. If the force from traveling causes the machine to swing, damage may occur to the swing motor and to the swing drive.



Illustration 354

g06222519

1. You may not be able to move the machine by using the travel controls only. In this case use both the travel control levers/pedals and the stick to pull the machine out of the water or ground.



Illustration 355

g06222525

2. The machine may slip because of a steep slope. The procedure in Step 1 may not work. In this case, first rotate the upper structure by 180°. Then use both the travel control levers/pedals and the stick to move the machine up the slope.



Illustration 356

g06212337

3. It may be impossible to travel because the bottom of the frame comes into contact with the ground or the undercarriage is clogged with mud or gravel. In this case, operate the boom and the stick together. Raise the track and rotate the track forward and backward to remove the mud and the gravel.

i07107419

Boom, Stick and Bucket Operation

SMCS Code: 7000

Digging



Illustration 357

g06212506

1. Position the stick at a 70 degree angle to the ground.



Illustration 358

g06212513

2. Position the bucket cutting edge at a 120 degree angle to the ground. Maximum breakout force can now be exerted with the bucket.



Illustration 359

g06222533

3. Move the stick toward the cab and keep the bucket parallel to the ground.



Illustration 360

g06222535

4. If the stick stops due to the load, raise the boom and/or perform a curl to adjust the depth of the cut.

5. To apply the greatest force at the cutting edge, decrease the down pressure as you move the stick toward the cab.

6. Maintain a bucket attitude that ensures a continuous flow of material into the bucket.

7. Continue the pass in a horizontal direction so that material peels into the bucket.



Illustration 361

g06222538

8. Close the bucket and raise the boom when the pass has been completed.



Illustration 362

g06223077

9. Engage the swing control when the bucket is clear of the excavation.



Illustration 363

g06223078

10. To dump a load, move the stick outward and open the bucket in a smooth motion.

Lifting Objects

WARNING

To prevent injury, do not exceed the rated load capacity of the machine. If the machine is not on level ground, load capacities will vary.

NOTICE

Damage to bucket cylinder, bucket or linkage could result if slings are placed incorrectly.

There may be local regulations and/or government regulations that govern the use of machines which lift heavy objects. Obey all local and government regulations.

If this machine is used to lift objects within an area that is controlled by the European Directive "2006/42/EC", the machine must be equipped with a boom lowering control valve, a stick lowering control valve, and an overload warning device.

Japan regulations require a shovel crane configuration to lift certain objects.

Contact your Cat dealer for additional information.

Short slings will prevent excessive load swing.



Illustration 364

g06212526

Use the lifting eye that is provided on the linkage to lift objects.

If the lifting eye is used, the connection must be made with a sling or with a shackle.



Illustration 365

g06212532

An unstable condition can exist if a load exceeds the machine load rating or if a heavy load is swung over an end or over a side.



Illustration 366

g06212530

The most stable lifting position is over a corner of the machine.

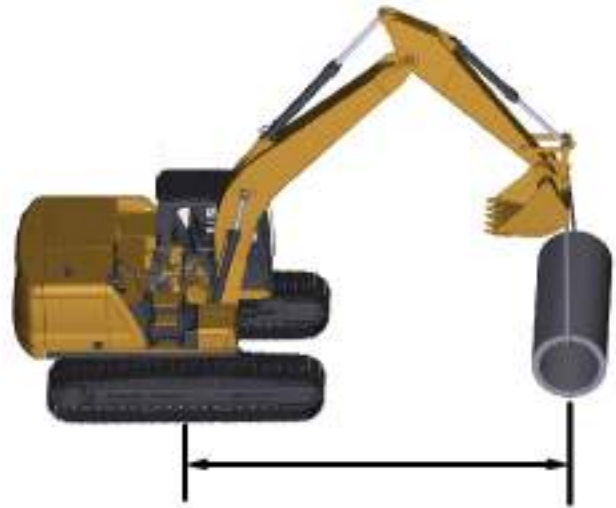


Illustration 368

g06212539

Lift capacity decreases as the distance from the swing centerline is increased.

Machines that are Equipped with a Long Reach Configuration

Machines with a long reach configuration require larger swing drift than standard machines when stopping, because inertial force in time of swing is large. Taking this into account, adjustments are made in timing for applying the swing brakes and speed of swinging.

Machines with a long reach configuration could be damaged and stability of the machine would be adversely affected if a control was suddenly operated, because inertial force of work tool is large.

i03875131



Illustration 367

g06212535

For the best stability, carry a load close to the machine and to the ground.

SmartBoom Operation (If Equipped)

SMCS Code: 5461-ZS; 7332

WARNING

Personal injury or death can result from not following the proper procedures.

To avoid the possibility of injury or death, follow the established procedure.

 WARNING

Activating the SmartBoom function and using the work tool joystick control while the front of the machine is elevated could result in unexpected machine motion. Unexpected machine motion could result in serious injury or death. Do not activate the SmartBoom function if the front of the machine is elevated by the front linkage.

 WARNING

Do not elevate or lower the track when in the SmartBoom mode. Follow the operation procedures for the SmartBoom in the Operation and Maintenance Manual. Failure to follow these instructions can result in serious injury or death.

 WARNING

Always make sure that the boom control joystick is in the NEUTRAL position before activating the SmartBoom control. Activating the SmartBoom control with the joystick out of the neutral position could result in unexpected machine motion which could result in serious injury or death.

 WARNING

Do not select any SmartBoom mode, using the SmartBoom selector switch located on the console, while the tracks are elevated. Selecting the SmartBoom mode with the tracks elevated could result in a sudden drop of the machine which could result in serious injury or death.

 WARNING

If any SmartBoom mode is active and the boom control joystick is in the BOOM DOWN position (forward) with a bucket or a work tool on the ground, pressing the disable button that is located on the front of the right hand joystick could cause a sudden boom down motion. This control function could lift the machine upward, with unexpected machine movement that could result in serious injury or death. Do not press the disable button while the SmartBoom mode is active and the boom control joystick is in the BOOM DOWN position (forward) with a bucket or a work tool on the ground.

 WARNING

Do not attempt to lift the tracks of the machine by using the disable button and applying downward force with the boom lowering control while the machine is in any SmartBoom mode. Releasing the disable button will immediately return the machine to the active SmartBoom mode. This action could cause the machine to drop down abruptly which could result in serious injury or death.

The Caterpillar SmartBoom provides significant advantages in the following operations:

Excavation and Loading

The operator should select the SmartBoom UP AND DOWN mode for excavating operations and for loading operations. This mode is effective during the return cycle. The BOOM DOWN movement is assisted by gravity, and the pump flow that is normally required for the boom circuit is available for faster STICK OUT and SWING functions. More work is performed for the amount of hydraulic oil flow that is provided by the pumps. This results in faster cycle times and improved fuel efficiency.

When the SmartBoom UP AND DOWN mode is active, no downward hydraulic force is applied to the boom. The operator can intermittently apply downward hydraulic force when the force is required for bucket penetration. A button on the right joystick enables the operator to override the SmartBoom mode.

Hammering

The operator should select the SmartBoom DOWN mode for hammering operations. In the SmartBoom DOWN mode, the weight of the hammer plus the boom and the stick provides sufficient downward force for effective hammering. This mode prevents the hammer from rebounding. The boom follows the hammer downward freely as the tool penetrates the rock. This mode also reduces strain on the machine structures.

Advantages

In hammering, the SmartBoom provides the following advantages:

- The mode reduces shock in the cab.
- The mode reduces strain on machine structures.
- The mode prevents blank shots.
- The mode maintains optimum frequency.

In rock cleaning, the SmartBoom provides the following advantages:

- The mode reduces strain on machine structures.

- The mode reduces wear on the bucket and the teeth.
- The mode maintains optimum frequency.

In a leveling operation, the SmartBoom eases the operation. Only STICK IN actuation and bucket actuation are required to level the surface.

In material handling, the SmartBoom reduces the chance of damage below the material.

i06978374

Bucket - Remove and Install

SMCS Code: 6001-011; 6001; 6001-012; 6101; 6102; 6523

Removal Procedure

WARNING

Failure to follow the instruction below for the installation of a work tool may result in personal injury or death. Special care must be taken if more than one person is installing the work tool.

- Confirm the verbal communication and the hand signals that will be used during the installation.
- Be alert for sudden movement of the front linkage and the work tool.
- Do not insert fingers into the bores of the support pins when the support pins and the bores are being aligned.

NOTICE

To facilitate removal of the bucket pins without causing damage to the pins, the bearings, and/or the O-ring seals put the bucket on the floor and the stick in a vertical position, as shown.



Illustration 369

g06181120

1. Start the engine. Park the machine on a hard, level surface. Position the bucket, the stick, and the bucket control linkage, as shown. Shut off the engine.

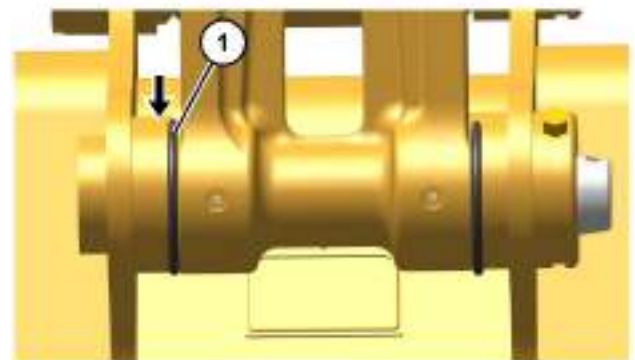


Illustration 370

g06192508

2. Slide O-ring seals (1) off the pin joints and onto the flanges of the bucket.

WARNING

When the pin assembly is removed, the linkage assembly may swing out of the bucket. To prevent possible personal injury, do not stand in front of the linkage assembly when the pin assembly is being removed.

Note: Removing the support pin may be difficult due to excessive pressure on the support pin. Remove the pressure on the support pin by adjusting the front linkage.

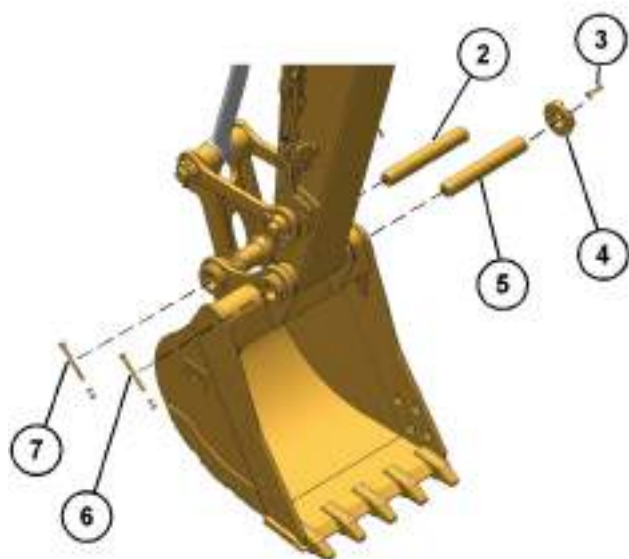


Illustration 371

g06186090

3. Remove nuts and retaining bolt (7) from support pin (2). Remove the support pin.
4. Remove bolts (3) and adapter plate (4). Remove the shims.
5. Remove nuts and retaining bolt (6) from support pin (5). Remove the support pin.
6. Start the engine and raise the stick out of the bucket.
7. Remove the O-ring seals (1) from the flanges on the bucket.

Note: After the support pins have been removed, make sure that the support pins do not become contaminated with sand or dirt. Make sure that the seals on the end of the stick and the seals on the end of the link do not become damaged.

Installation Procedure

1. Clean each pin and each pin bore. Lubricate each pin bore with molybdenum grease.

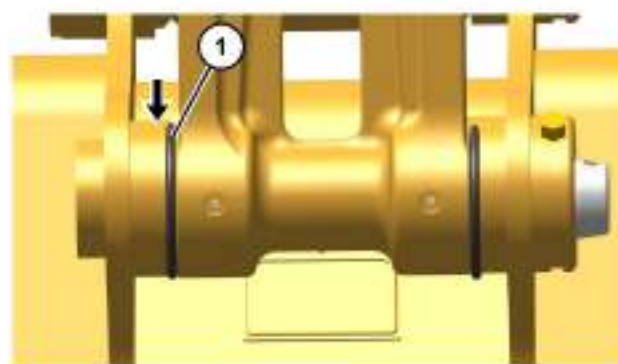


Illustration 372

g06192508

2. Position the O-ring seals (1) onto the flanges of the bucket.
3. Start the engine and lower the stick into the bucket until the pin bores are in alignment with each other. Stop the engine.

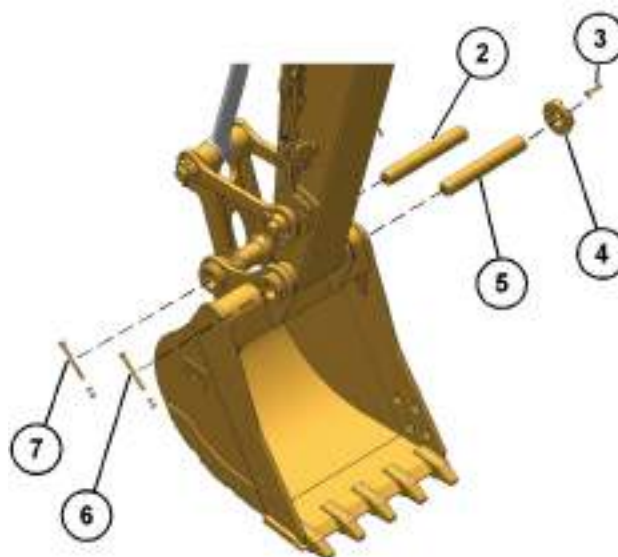


Illustration 373

g06186090

4. Install support pin (5). Align the retaining bolt hole in the support pin with the retaining bolt hole in the bucket.
5. Install the retaining bolt and nuts (6). Install adapter plate (4) without the shims, and without bolts (3) that hold the adapter plate.
6. Refer to Operation and Maintenance Manual, "Bucket Linkage - Inspect/Adjust" to adjust the bucket clearance.
7. Slide O-ring seals (1) in position over the pin joints between the bucket and the stick.

8. Start the engine and position the bucket linkage into the bucket until the pin bores are in alignment with each other. Stop the engine.
9. Install support pin (2). Align the retaining bolt hole in the bucket pin with the retaining bolt hole in the bucket.
10. Install retaining bolt and nuts (7).
11. Slide the O-ring seals (1) over the pin joints between the bucket and the link assembly.

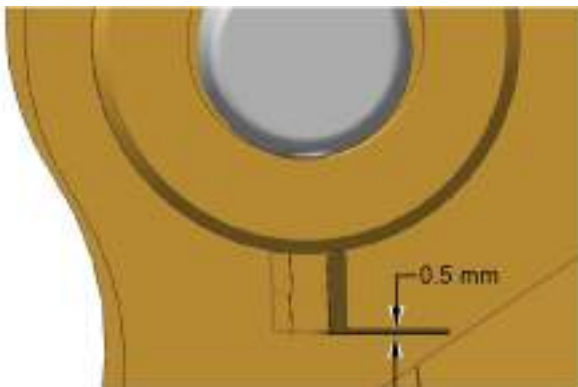


Illustration 374

g06192530

12. Tighten retaining nuts (6) and (7). Position the outside nut even with the end of the retaining bolt or 0.5 mm (0.02 inch) beyond the end of the retaining bolt. Tighten the inside nut against the outside nut.
13. Lubricate the bucket pins. Refer to Operation and Maintenance Manual, "Bucket Linkage - Lubricate".

i07757775

Quick Coupler Operation (Circuit for CW Coupler (If Equipped))

SMCS Code: 6129; 6522; 7000

NOTICE

The Cat Quick Coupler (CW Coupler) is not designed to be used in applications where there is long exposure to excessive vibration. The vibration caused by extensive use of a hydraulic hammer as well as the added weight of certain demolition tools such as shears, crushers, and pulverizers may cause premature wear and decreased service life of the coupler.

Be sure to carefully inspect the coupler daily for cracks, bent components, wear, distressed welds, etc. when operating with any of the above work tools.

General Operation

The quick coupler is used to change work tools while the operator remains in the cab. The quick coupler can be used with a broad range of buckets and work tools. Each work tool must have a set of pins in order for the quick coupler to work properly.

The work tools are held onto the quick coupler by hydraulic pressure. If pressure is lost, a locking bar keeps the work tool locked with the force of built-in springs. Ensure that the hydraulic system and the blocking bar are working properly before using the quick coupler.

A lifting eye is included on the quick coupler. Release the work tool from the quick coupler to use the lifting eye to pick up loads. To lift a load with the lifting eye, extend the bucket cylinder until the quick coupler is in a VERTICAL position. Do not exceed the rated load for the machine.

NOTICE

Once the work tool has been properly attached to the coupler, no loosening of the work tool should occur. Refer to the "Quick Coupler Installation and Removal" section of the quick coupler Operation and Maintenance Manual for additional information. If at any point after the proper attachment and back drag testing of the work tool, should the work tool then become loose or if the rear pin of the work tool detaches from the movable hook, stop work immediately and safely ground and detach the work tool. Consult your Cat dealer to inspect the coupler prior to putting the coupler back into service. This situation could indicate potential coupler damage that may not be readily visible to the customer or operator of the machine and coupler.

Electric Switch Operation

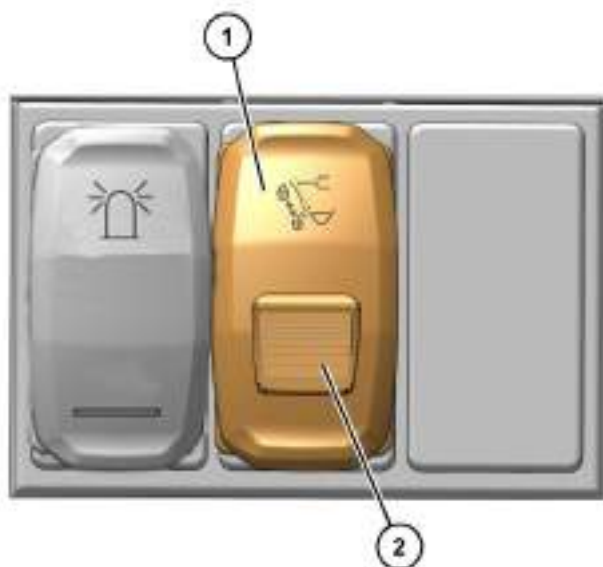


Illustration 375

g06184557

Quick coupler switch (1) is located inside the cab on the switch panel to the left of the operator's seat. The electric switch has only one position for coupling the work tool and uncoupling the work tool. The switch is equipped with a safety lock (2). The locking tab must be pushed forward before the switch can be pressed.

Coupling the Work Tool

WARNING

Inspect the coupler wedge engagement before you operate the excavator.

Serious injury or death may result from an improperly engaged coupler.

Inspect coupler wedge engagement from the cab by rotating the bucket or the work tool inward. Extend the bucket cylinder to bring the coupler actuator into view and bring the stick in until the wedges are visible.



Illustration 376

g06220881

1. Position the work tool on a level surface.
2. Retract the bucket cylinder. Position the quick coupler in alignment between the hinges of the work tool.

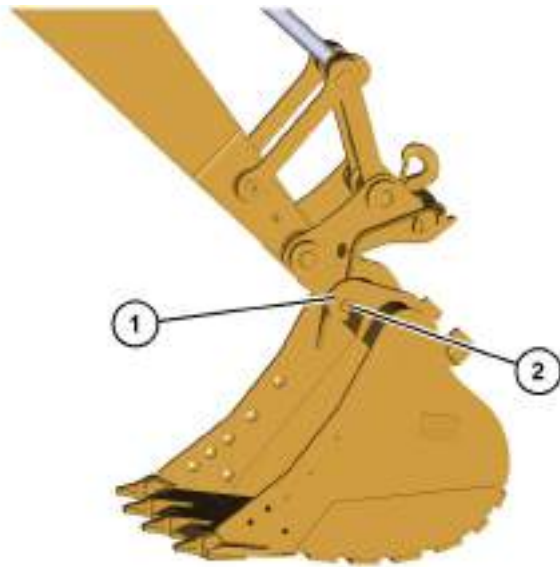


Illustration 377

g06220883

- (1) Hinges
(2) Lower bosses

3. Move the stick forward and raise the stick until the lower bosses (2) engage the hinges (1) of the work tool.
4. There are two possible settings for locking the quick coupler in Cat ET, "Alarm" and "Hold to Run". For the "Hold to Run" setting, push the locking tab on the switch forward and then depress and hold the rear of the switch until the quick coupler engages the work tool. The message "Quick Coupler Locking" will display on the monitor. For the "Alarm" setting, push the locking tab on the switch forward and then depress, but do not hold, the rear of the switch until the quick coupler engages the work tool. The message "Quick Coupler Locking" will display on the monitor.

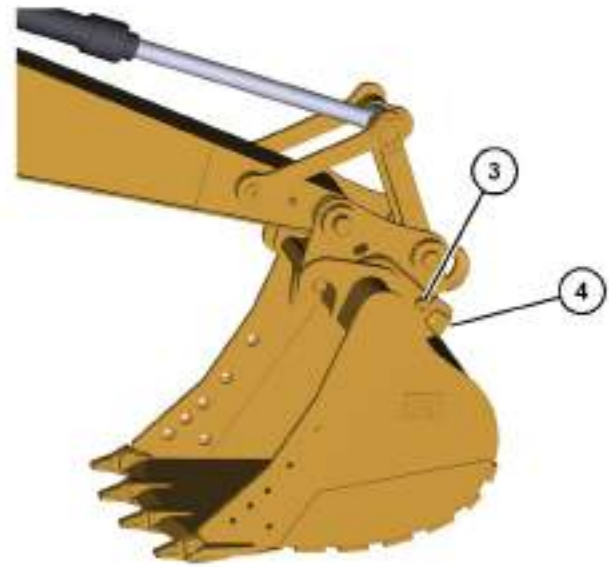


Illustration 378

g06220887

- (3) Center bosses
(4) Locking area

5. Extend the bucket cylinder to rotate the quick coupler toward the work tool.

Center bosses (3) must engage with the cutout of the hinge.
6. Release the quick coupler switch to lock the work tool.

The springs in the quick coupler will move the wedge into the locking area (4).

The monitor will display the message "Verify Tool Locking" .

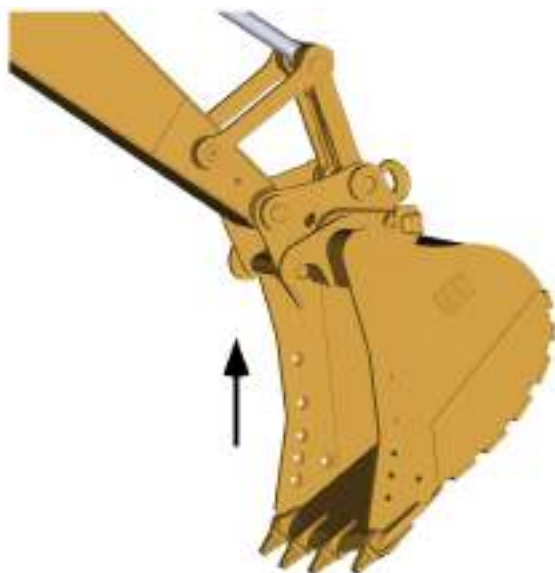


Illustration 379

g06220888

7. Raise the boom or raise the stick. Retract the bucket cylinder to confirm that the wedge is fully engaged. If the wedge is fully engaged, the work tool is locked in place. The work tool is ready to use.

Uncoupling the Work Tool

WARNING

Place the work tool or bucket in a safe position before disengaging the coupler. Disengaging the coupler will release the work tool or bucket from control of the operator.

Serious injury or death may result from disengaging the work tool or bucket when it is in an unstable position or carrying a load.



Illustration 380

g06220889

1. Level the bucket or level the work tool on the ground.
2. Push the locking tab on the switch forward and then depress the rear of the switch until the quick coupler releases the work tool. The message "Quick Coupler Unlock" will display on the monitor. For the "Alarm" setting, push the locking tab on the switch forward and then depress, but do not hold, the rear of the switch until the quick coupler engages the work tool. The message "Quick Coupler Locking" will display on the monitor.



Illustration 381

g06220891

3. Retract the bucket cylinder to move the quick coupler toward the machine.
4. Release the quick coupler switch to retract the wedge.



Illustration 382

g06220892

5. Lower the stick and move the stick toward the machine to disengage the quick coupler.

i07852525

Quick Coupler Operation (Hydraulic Pin Grabber Quick Coupler (If Equipped))

SMCS Code: 6129; 6522; 7000

NOTICE

The Cat Quick Coupler (Hydraulic Pin Grabber) is not designed to be used in applications where there is long exposure to excessive vibration. The vibration caused by extensive use of a hydraulic hammer as well as the added weight of certain demolition tools such as shears, crushers, and pulverizers may cause premature wear and decreased service life of the coupler.

Be sure to carefully inspect the coupler daily for cracks, bent components, wear, distressed welds, etc. when operating with any of the above work tools.

General Operation

The quick coupler is used to change work tools while the operator remains in the cab. The quick coupler can be used with a broad range of buckets and work tools. Each work tool must have a set of pins in order for the quick coupler to work properly.

Operation Section

Hydraulic Pin Grabber Quick Coupler (If Equipped)

The work tools are held onto the quick coupler by hydraulic pressure. If pressure is lost, a check valve in the hydraulic cylinder traps oil in the cylinder. Ensure that the hydraulic system is working properly before using the quick coupler.

A lifting eye is included on the quick coupler. Release the work tool from the quick coupler to use the lifting eye to pick up loads. To lift a load with the lifting eye, extend the bucket cylinder until the quick coupler is in a VERTICAL position. Do not exceed the rated load for the machine.

NOTICE

Once the work tool has been properly attached to the coupler, no loosening of the work tool should occur. Refer to the "Quick Coupler Installation and Removal" section of the quick coupler Operation and Maintenance Manual for additional information. If at any point after the proper attachment and back drag testing of the work tool, should the work tool then become loose or if the rear pin of the work tool detaches from the movable hook, stop work immediately and safely ground and detach the work tool. Consult your Cat dealer to inspect the coupler prior to putting the coupler back into service. This situation could indicate potential coupler damage that may not be readily visible to the customer or operator of the machine and coupler.

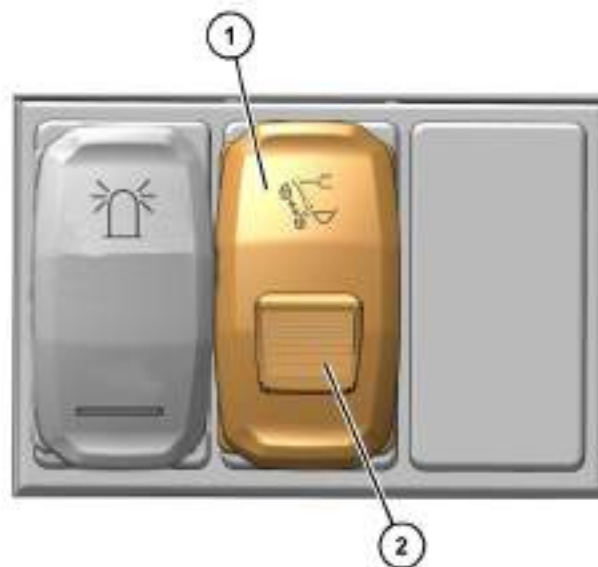
Quick Coupler Operation**Electric Switch Operation**

Illustration 383

g06184557

Quick coupler switch (1) is located inside the cab on the switch panel to the left of the operator's seat. The electric switch has only one position for coupling the work tool and uncoupling the work tool. The switch is equipped with safety lock (2). The locking tab must be pushed forward before the switch can be pressed.

Coupling the Work Tool

WARNING

Place the work tool or bucket in a safe position before engaging the quick coupler. Ensure that the work tool or bucket is not carrying a load.

Serious injury or death may result from engaging the work tool or bucket when it is in an unstable position or carrying a load.

WARNING

Inspect the quick coupler engagement before operating the machine.

Serious injury or death may result from improperly engaged coupler.

WARNING

Crush injury. Could cause serious injury or death. Always confirm that the quick coupler is engaged onto the pins. Read the Operator's Manual.

WARNING

The alarm will go off when the coupler is locked and the monitor will display a message. These assurances do not confirm that the coupler pins are engaged. A physical test is required by dragging the attachment on the ground to confirm the coupler pins are engaged.

NOTICE

With certain work tool combinations, including quick couplers, the work tool can hit the cab or the front of the machine. Always check for interference when first operating a new work tool.

1. Position the bucket or the work tool on a level surface.
2. Make sure that the pins are in the bucket or the work tool. Make sure that the pin keepers are installed correctly.



Illustration 384

g06187057

3. Extend the stick cylinder and fully extend the bucket cylinder until the quick coupler is curled past a vertical position. This action must be performed before pressing the switch.



Illustration 385

g06300078

4. Push the lock mechanism on the switch forward and then depress the rear of the switch. The alarm will sound continuously and the message "Quick Coupler Unlock" will display on the monitor.
5. Hold the control lever for the bucket cylinder in the EXTEND position for 5 seconds to unlock the hook.



Illustration 386

g06187063

6. Align the quick coupler with the work tool.

Operation Section
Hydraulic Pin Grabber Quick Coupler (If Equipped)



Illustration 387

g06187068

7. Rotate the quick coupler to grab the top pin.



Illustration 388

g06187086

8. Rotate the quick coupler downward to grab the bottom pin.



Illustration 389

g06187108

9. Extend the stick cylinder and extend the bucket cylinder until the work tool is curled past a vertical position.



Illustration 390

g06300088

10. Push the lock mechanism on the switch forward and then depress the rear of the switch. The alarm will sound continuously and the message “Quick Coupler Locking” will display on the monitor.

11. Hold the control lever for the bucket cylinder in the EXTEND position for 5 seconds to lock the hook. The monitor will display the message “Verify Tool Locking” and the alarm will stop.



Illustration 391

g06187115

WARNING

Inspect the quick coupler engagement before operating the machine.

Verify that the quick coupler is engaged per the procedure in the Operation and Maintenance Manual. Verify prior to operating the machine, after every engine start, and after an extended time of inactivity.

Serious injury or death may result from improperly engaged coupler.

12. Verify that the quick coupler and the work tool are locked together.

- a. Retract the bucket cylinder and place the work tool on the ground.
- b. Apply pressure to the work tool against the ground.

NOTICE

Back drag the work tool on the ground to ensure the quick coupler is properly locked.

Do Not strike the work tool on the ground to ensure the quick coupler is properly locked. Striking the work tool on the ground will result in damage to the coupler cylinder.

c. Drag the work tool backward.

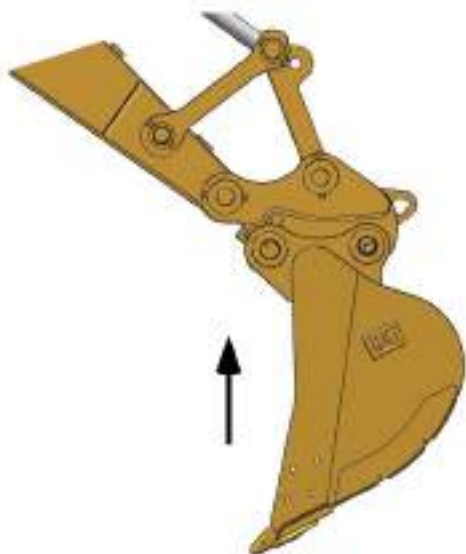


Illustration 392

g06458083

13. Raise the boom or raise the stick. Retract the bucket cylinder to confirm that the coupler is fully engaged. If the coupler is fully engaged, the work tool is locked in place. The work tool is ready to use.

Uncoupling the Work Tool

WARNING

Place the work tool or bucket in a safe position before disengaging the coupler. Disengaging the coupler will release the work tool or bucket from control of the operator.

Serious injury or death may result from disengaging the work tool or bucket when it is in an unstable position or carrying a load.

NOTICE

Auxiliary hoses for work tools must be disconnected before the Hydraulic Quick Coupler is disengaged.

Pulling the work tool with the auxiliary hoses could result in damage to the host machine or the work tool.



Illustration 393

g06187108

1. Extend the stick cylinder and fully extend the bucket cylinder until the work tool is curled past a vertical position. This action must be performed before pressing the switch.
2. Push the lock mechanism on the switch forward and then depress the rear of the switch to unlock the work tool. The alarm will sound continuously and the message "Quick Coupler Unlock" will display on the monitor.

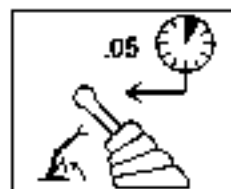


Illustration 394

g01231447

3. Hold the control lever for the bucket cylinder in the EXTEND position for 5 seconds to unlock the hook.

Operation Section
Hydraulic Pin Grabber Quick Coupler (If Equipped)



Illustration 395

g06187142

4. Move the boom and the stick until the tool or the bucket is in the storage position. Keep the tool close to the ground.



Illustration 396

g06187151

5. Rotate the quick coupler upward to release the bottom pin.



Illustration 397

g06187156

6. Continue to rotate the quick coupler upward to release the top pin and completely release the work tool from the quick coupler.

7. Move the stick to a position that is clear of the work tool.

Note: To lift objects with the lifting eye of the quick coupler, refer to "Coupler Lifting Eye Operation without Bucket" later in this chapter.

Coupling a Bucket that is Reversed



Illustration 398

g06187159

1. When you use a hydraulic pin grabber quick coupler, you can connect to a bucket that is in a reversed position. Refer to Illustration 398 for an example of connecting to a bucket that is in a reversed position.



Illustration 399

g06187057

2. Extend the stick cylinder and fully extend the bucket cylinder until the quick coupler is curled past a vertical position. This action must be performed before pressing the switch.
3. Follow the same steps for coupling the work tool to couple the host machine to a bucket that is reversed. Refer to "Coupling the Work Tool" for the proper procedure.

NOTICE

When some Caterpillar buckets are used in the reverse position, it can be more difficult to couple the bucket and uncouple the bucket than in the normal position.

Care must be taken to ensure that the position of the boom, stick, and bucket are aligned to ensure smooth coupling. The coupler must be in position between the bucket bosses.

If the bucket is not fully engaged in the jaw of the coupler, the quick coupler can become snagged on the bucket bosses. The full weight of the bucket is then carried by the quick coupler sideplates, which can cause damage to the quick coupler.

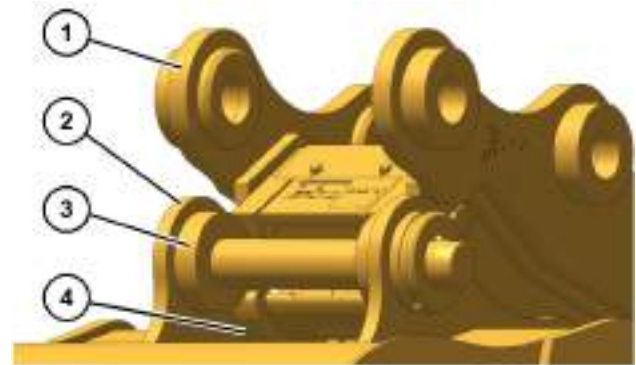


Illustration 400

g06187418

- (1) Quick coupler
- (2) Bucket
- (3) Boss
- (4) Hook

Coupler Lifting Eye Operation without Bucket

1. Remove the work tool. Refer to "Uncoupling the Work Tool" for the proper procedure.



Illustration 401

g06187057

2. The quick coupler must be curled past a vertical position before depressing the switch. Extend the stick cylinder and fully extend the bucket cylinder until the quick coupler is curled past a vertical position.

Operation Section
Hydraulic Pin Grabber Quick Coupler (If Equipped)



Illustration 402

g06300088

3. Push the lock mechanism on the switch forward and then depress the rear of the switch to lock the quick coupler. The alarm will sound continuously and the message "Quick Coupler Locking" will display on the monitor.



Illustration 403

g01231447

4. Hold the control lever for the bucket cylinder in the EXTEND position for 5 seconds to lock the hook. The monitor will display the message "Verify Tool Locking" and the alarm will stop.



Illustration 404

g06187164

5. Rotate the quick coupler downward and move the stick to a position that is clear of the work tool.



Illustration 405

g06223888

6. Use the lifting eye of the quick coupler, as needed.

7. To reinstall the bucket or the work tool, refer to "Coupling the Work Tool" for the proper procedure.

i07349163

Work Tool Operation (If Equipped)

SMCS Code: 6700; 7000

Hammer Operation (If Equipped)



Illustration 406

g06222793

NOTICE

Use only a hydraulic hammer that is recommended by Caterpillar.

The use of a hydraulic hammer that is not recommended by Caterpillar could result in structural damage to the host machine.

Consult your Cat dealer for information on recommended hydraulic hammers.

Only use the hydraulic hammer to break rocks, concrete, and other hard objects. Before you start hydraulic hammer operation, place the machine on a level, stable surface.

Before you start hydraulic hammer operation, close the front window. Caterpillar recommends the installation of a window guard on the front window for protection from flying debris.

NOTICE

In order to avoid structural damage to the host machine or the hydraulic hammer, comply with the following:

Do not attempt to break rocks or concrete by burying the hammer tool completely into the rocks or concrete.

Do not apply a prying force to the hammer tool in order to remove the hammer tool from the material.

Do not allow the hydraulic hammer to operate at one location and for more than 15 seconds. Change the location of the hydraulic hammer and repeat the procedure. Failure to change the location of the hydraulic hammer could cause the hydraulic oil to overheat. Overheated hydraulic oil could damage the accumulator.

Stop the hydraulic hammer immediately if the jumper lines are pulsating violently. This indicates that the accumulator nitrogen charge is lost. Consult your Cat dealer for the necessary repair.

NOTICE

Do not use the dropping force of the hydraulic hammer to break rocks or other hard objects. This could cause structural damage to the machine.

Do not use the sides or back of the hydraulic hammer to move rocks or other hard objects. Doing this could cause damage not only to the hammer but to stick or boom cylinder.

Do not operate the hydraulic hammer with any of the cylinders fully retracted or extended. Doing this could cause structural damage to the machine, resulting in reduced machine life.

Do not use the hydraulic hammer to lift an object.

Do not operate the hydraulic hammer while the stick is vertical to the ground. This could allow the stick cylinder to vibrate excessively.

Operate the attachment control levers carefully to keep the hydraulic hammer tool from hitting the boom.

Do not operate the hydraulic hammer under water unless the hydraulic hammer is properly equipped. Operating the hydraulic hammer under water could damage the machine hydraulic system. Consult your Cat dealer for information on underwater operation.

Do not operate the hydraulic hammer with the upper structure sideways to the undercarriage. Before you start hydraulic hammer operation, place the upper structure in the recommended positions that are shown in illustration 407. Any other operating positions could make the machine unstable. Any other operating positions could place excessive loads on the undercarriage.

Refer to the following for any additional questions about the operation and care of your Cat hydraulic hammer:

- Operation and Maintenance Manual, SEBU7346, "Hydraulic Hammers"
- The Operation and Maintenance Manual specific to your machine

Operation Section
If Equipped

An operation and maintenance decal, SMEU7397, is available for all hydraulic hammers. The decal provides procedures for operation and maintenance of the hydraulic hammers. The decal can be placed on the machine or the hammer. The decal can be obtained through the normal literature ordering channels.

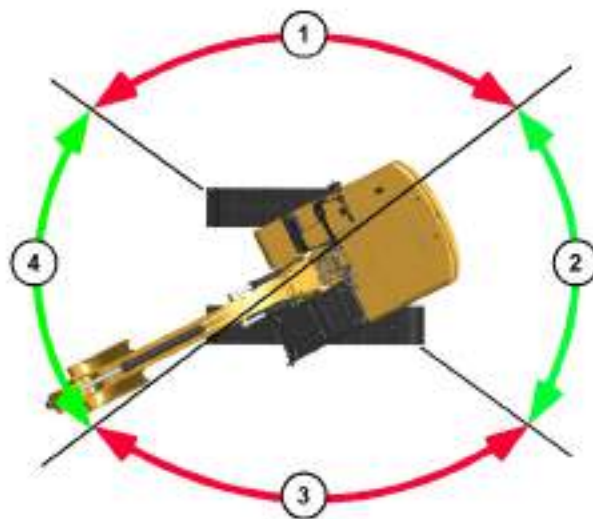


Illustration 407

g06192837

- (1) Incorrect working position
- (2) Correct working position
- (3) Incorrect working position
- (4) Correct working position

Shear Operation (If Equipped)



Illustration 408

g06222798

WARNING

Do not operate or work on this work tool unless you have read and understand the instructions and warnings in the Operation And Maintenance Manual for both the work tool and the host machine.

Failure to follow the instructions or heed the warnings could result in injury or death.

Contact your Caterpillar dealer for replacement manuals. Proper care is your responsibility.

NOTICE

Selection of a hydraulic shear must be done with extra care.

Use of a hydraulic shear not recommended by Caterpillar could result in structural damage to the host machine.

Consult your Cat dealer for hydraulic shear information.

WARNING

Serious injury or death could occur from the demolition of pipes, vessels, tanks or other containers that may contain gas, flammable materials or hazardous chemicals.

Do not perform any demolition work on these items until all of their contents have been removed.

Follow all regulations for the removal and disposal of these materials.

NOTICE

Using the demolition tool to level the work site or push over standing structures may damage the machine or the demolition tool. Use appropriate equipment to do site preparation or maintenance operations.

NOTICE

To avoid structural damage to the machine, do not break road surfaces by placing the cutting edge of the hydraulic shear on the ground and moving the machine.

Be sure that no one is near the work tool to prevent injury. Keep the work tool under control at all times to prevent injury. When a demolition tool is used, all personnel must maintain a minimum distance of 10 m (33 ft).

Close all windows. Make sure that all required guards are in place. Wear all required protective equipment. Follow the instructions in the Operation and Maintenance Manual for the work tool.

Crusher Operation (If Equipped)

WARNING

Improper operation and maintenance of the crusher could cause personal injury or death. Observe the following procedures for safe operation of the crusher.

Consult your Cat dealer for more information on the operation and maintenance of the crusher.

Do not operate the host machine with the work tool unless you have read and understood the instructions and warnings in the Operation and Maintenance Manual. Failure to follow the instructions or heed the warnings could result in machine or work tool damage, and/or serious injury or death. Contact your Cat dealer for a replacement manual, if needed.

When the crusher is installed on the host machine, always make sure that the protective guarding is in place.

Using the crusher in an incorrect manner can damage the machine and/or cause personal injury or death.

Always ensure that the work area is clear of ground personnel, due to the potential crush hazards with falling debris and machine movement.

Resting or placing your foot on the work tool pedal could result in unexpected movement of the machine / work tool which could result in personal injury or death. Always lock the crusher when not in use.

NOTICE

Selection of a hydraulic crusher must be done with extra care.

Use of a hydraulic crusher not recommended by Caterpillar could result in structural damage to the host machine.

Consult your Cat dealer for hydraulic crusher information.

Close all windows. Make sure that all required guards are in place. Wear all required protective equipment. Follow the instructions in the Operation and Maintenance Manual for the work tool.



Illustration 409

g06222800

Demolition work on the roof of a building could lead to serious personal injury if the building were to collapse and the excavator turned over or fell off the roof. The demolition work must be started ONLY AFTER surveying the building for its structural integrity.



Illustration 410

g06222803

Crushing work above your head must be avoided because objects can fall and damage the machine.

X



Illustration 411

g06222806

Do not perform demolition work at the base of the machine, because the ground could be unstable and cause the machine to fall.

X



Illustration 412

g06222809

Do not suddenly lower or stop the work tool, otherwise the excavator could turn over.

X

X



Illustration 413

g06222813

Crushing work using impact, swing, or dropping forces of the excavator could cause damages to the machine and also could lead to personal injury. As such, NEVER perform such an operation.

X



Illustration 414

g06222817

Crushing work with hydraulic cylinder at stroke end position could damage the excavator, resulting in shortening of lifespan. Also, as it could lead to unexpected personal injury due to breakage of the machine, do not perform any work at stroke end.



Illustration 415

g06222821

When performing work at elevated positions, always use care for the surroundings as well as for falling objects to avoid personal injury. Use guide personnel and signs as required.



Illustration 417

g06222831

Crushers could interfere with the boom and the cab depending on the type and method of usage. Know the working range of the crusher being used.



Illustration 416

g06222829

When working sideways, the track can lift. Avoid abrupt operation and operate slowly.

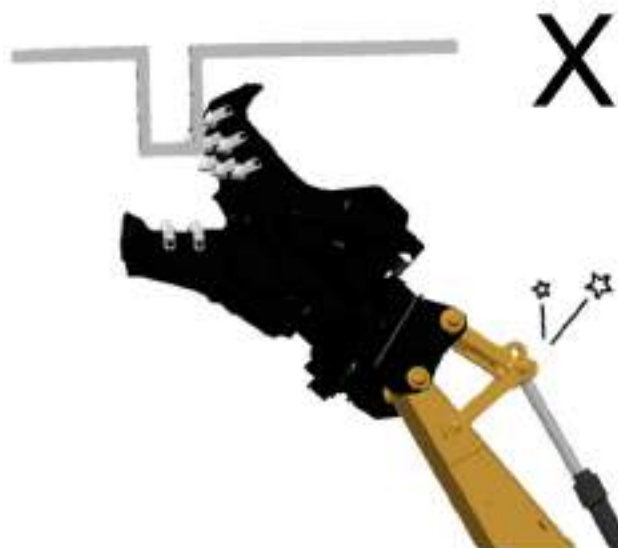


Illustration 418

g06222833

If the tooth of the crusher engages an object at a slant, excessive forces could be applied to the front regions. As such move the crusher to the front.

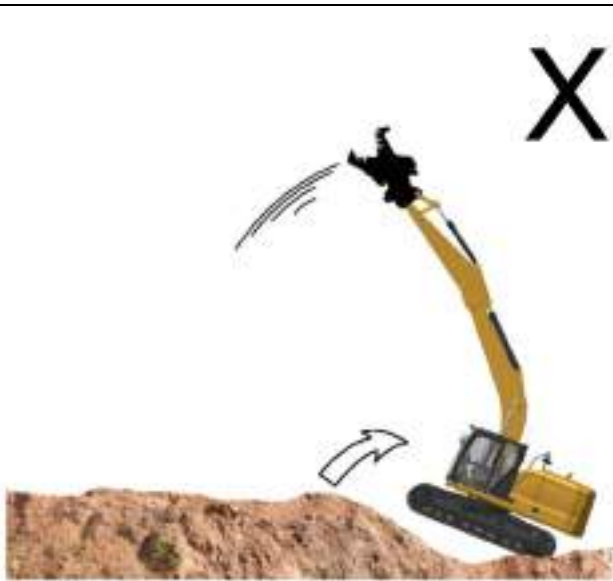


Illustration 419

g06222836

Never extend the boom cylinder suddenly. Sudden extension of the boom could cause tip backwards.



Illustration 420

g06222831

Sudden extension of the bucket cylinder, or sudden extension of the stick cylinder could cause damages at the stroke end position, resulting in personal injury. Operations that cause sudden extension of the cylinders is PROHIBITED!

Parking

i07868085

Stopping the Machine

SMCS Code: 7000

WARNING

Leaving the machine unattended when the engine is running may result in personal injury or death. Before leaving the machine operator station, neutralize the travel controls, lower the work tools to the ground and deactivate all work tools, and place the lever for the hydraulic lockout control in the LOCKED position.

Note: There may be regulations that define the requirements for the operator and/or support personnel to be present when the engine is running.

Park on a level surface. If the machine must be parked on a grade, chock the tracks securely.

Note: The swing parking brake is automatically applied when the machine is stopped. The swing parking brake is released when the engine is running and the joystick is activated.

1. Turn the engine speed dial counterclockwise to reduce engine speed.



Illustration 421

g06181402

2. Release the travel levers/pedals to stop the machine.

3. Lower the work tool to the ground. Apply a slight downward pressure.
4. Move the hydraulic lockout control to the LOCKED position.

i07088536

Freezing Conditions

SMCS Code: 7000

If freezing temperatures are expected, remove the mud and the dirt from each track roller frame. Park the machine on wood planks. Use the following procedure to clean each track roller frame.



Illustration 422

g06188791

1. Position the boom over one side of the machine.
2. Use boom down pressure to lift the track on one side off the ground. Operate the track in the forward direction. Then operate the track in reverse. Continue this procedure until the maximum amount of material is thrown off the track.
3. Lower the track onto the wood planks.
4. Repeat the procedure for the other track.
5. Clean the area around the carrier rollers and around the track rollers.
6. Lower the work tool onto a wood plank to prevent the work tool from touching the ground.

i07889731

Stopping the Engine

SMCS Code: 1000; 7000

NOTICE

Stopping the engine immediately after it has been working under load can result in overheating and accelerated wear of engine components.

Refer to the following procedure to allow the engine to cool and to prevent excessive temperatures in the turbocharger housing, which could cause oil coking problems.

NOTICE

Never turn the battery disconnect switch to the OFF position while the engine is running. Serious damage to the electrical system may result.

1. Park the machine on level ground. Refer to Operation and Maintenance Manual, "Stopping the Machine" for the recommended procedure.
2. While the machine is stopped, run the engine for 5 minutes at low idle. Idling the engine allows hot areas of the engine to cool gradually.
3. Turn the engine start switch to the OFF position.

Note: If the "Regen Active" indicator is illuminated, do not shut off the engine. Refer to Operation and Maintenance Manual, "Monitoring System" for more information on indicators.

Engine Shutdown Switch

NOTICE

Perform a walk around inspection after actuation of a shutdown device.

Take necessary corrective action to resolve the cause of the shutdown.

Ensure that no additional damage has been done or could occur before returning to operation.

Turn the engine start switch to the OFF position. If the engine does not stop, perform the following procedure.

Note: Always use the engine start switch to stop the engine. Use the engine shutdown switch as an alternate method to stop the engine if the start switch fails.

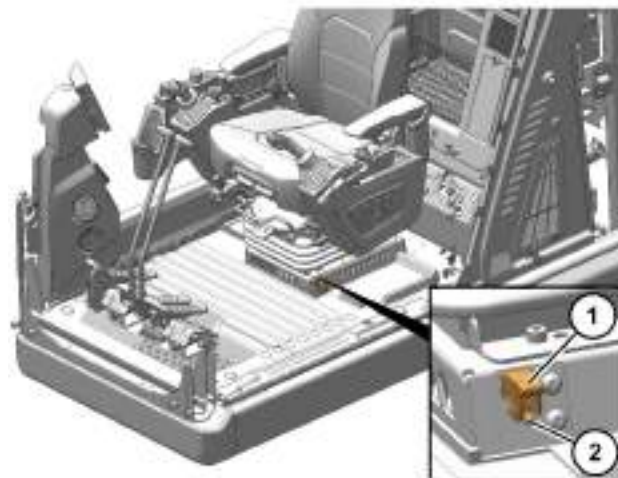


Illustration 423

g06181487

1. The engine shutdown switch is located below the left side of the operator seat.
2. Lift cover (1).
3. Push switch (2) upward. Pushing the switch upward should stop the engine and prevent the engine from being started again.
4. Return the switch to the original position. The engine will be enabled to start.

Note: Do not operate the machine again until the malfunction has been corrected.

5. Use the method that follows if the previous steps do not stop the engine.

Stop the Engine if an Electrical Malfunction Occurs

Turn the engine start switch to the OFF position. If the engine does not stop, perform the following procedure.

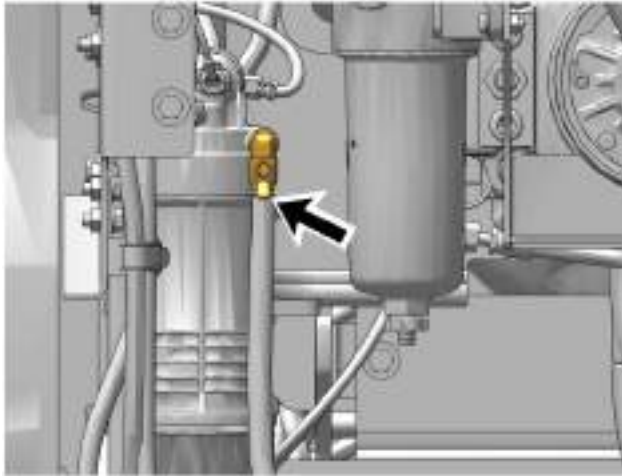


Illustration 424

g06426077

The fuel shutoff valve is located behind the right access door.

Shut off the fuel supply by turning the fuel shutoff valve clockwise. The engine will stop after consuming the fuel in the fuel line. The engine may continue to run for a few minutes.

Repair the engine before you restart the engine. The fuel system may need to be primed. See Operation and Maintenance Manual, "Fuel System - Prime" for instructions.

i07103299

Leaving the Machine

SMCS Code: 7000



Illustration 425

g06224270

1. Use the steps and the hand holds when you dismount. When you dismount, face the machine and use both hands.
2. Inspect the engine compartment for debris. Clean out any debris to avoid a fire hazard.
3. Remove all flammable debris from the front bottom guard through the access doors to reduce a fire hazard. Discard the debris properly.
4. Always turn the battery disconnect switch to the OFF position before leaving the machine.
5. If the machine will not be operated for a month or more, remove the battery disconnect switch key.
6. Lock all compartments and all vandalism covers (if equipped).

i07735116

Machine Storage and Specified Storage Period

SMCS Code: 7000

Machine Storage

The Safety Section of this Operation and Maintenance Manual contains storage information for fuels, lubricants, and ether (if equipped).

The Operation Section of this Operation and Maintenance Manual contains information for short-term storage of this machine, including engine shutdown, parking, and instructions for leaving the machine.

For detailed steps on long-term storage refer to Special Instruction, SEHS9031, "Storage Procedure for Caterpillar Products".

Specified Storage Period

The specified storage period of this machine is 1 year.

After the specified storage period has expired, consult your Cat dealer for inspect, repair, rebuild, install remanufactured, or install new components, and disposal options, and to establish a new specified storage period.

If a decision is made to remove the machine from service, refer to Decommissioning and Disposal for further information.

Transportation Information

i08163556

Shipping the Machine

SMCS Code: 7000; 7500

WARNING

Automatic Engine Speed Control (AEC) will increase engine speed automatically when you operate the control levers and/or travel pedals with AEC switch on.

When loading and unloading the machine from the truck or working in close quarters always turn AEC switch off to prevent any possibility of sudden movement of machine, which could result in serious injury or death.

Set the travel speed control switch to LOW before loading the machine. Never operate this switch when loading the machine on a trailer.

Investigate the travel route for overpass clearances. Make sure that there will be adequate clearance for the machine.

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

Note: Obey all laws that govern the characteristics of a load (height, weight, width, and length). Observe all regulations that govern wide loads. Certain regions may require the removal of door hooks and cab bumpers, if equipped. Consult all local and regional regulations

Choose the flattest ground when you load the machine or when you unload the machine.

1. Before you load the machine, chock the trailer wheels or the rail car wheels.
2. When you use loading ramps, make sure that the loading ramps have adequate length, adequate width, adequate strength, and an adequate slope.
3. Maintain the slope of the loading ramps within 15 degrees of the ground.
4. Position the machine so that the machine can drive straight up the loading ramps. The final drives should be toward the rear of the machine. Do not operate the control levers while the machine is on the loading ramps.
5. When you drive over the loading ramp joint areas, maintain the balance point of the machine.

6. Lower the work tool to the bed or to the floor of the transport machine.
7. To prevent rolling of the machine or sudden movement of the machine, perform the following items:
 - Chock both tracks.
 - Install sufficient tie-downs at several locations.
 - Fasten wire cables.
8. If equipped, remove door hooks, cab bumpers, and fuel tank step as necessary. Refer to local regulations.

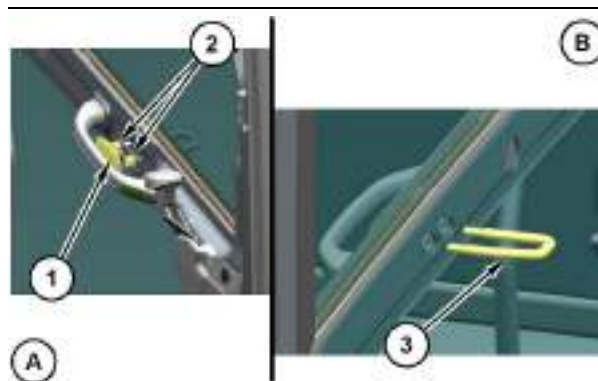


Illustration 426

g06516462

Typical example of door hook

- (A) Inside
(B) Outside
(1) Cover
(2) Nuts
(3) Door Hook

- a. Remove cover (1) and nuts (2) to remove door hook (3).



Illustration 427

g06516469

Typical example of cab bumper

- b. Remove any bumpers on your cab.

NOTICE

Do not allow the chrome surface of the bucket cylinder rod to touch any part of the trailer. Damage to the rod can occur from impact with the trailer during transport.

Note: Refer to Operation and Maintenance Manual, "Specifications".

Shipping a Machine that is not Completely Assembled

If the machine must be shipped when the boom, stick, or counterweight is not assembled on the machine, follow the instructions in Operation and Maintenance Manual, "Operation".

WARNING

The ROPS structural certification depends on the support of the boom, stick, and counterweight in the event of a machine tip over or a machine rollover incident.

When the machine needs to be moved without the boom, stick, or counterweight being installed, avoid any machine operations which could affect machine stability as a machine tip over or a machine rollover incident could result in serious injury or death.

The machine should be operated slowly on flat, stable ground or pavement by qualified operators.

i07539618

Securing the Machine

SMCS Code: 7000

WARNING

Do not transport the machine if there is a malfunction of the swing parking brake system.

The machine may swing during transportation if the swing parking brake system is not functioning properly which could result in injury or death.

Contact your Cat dealer for service.

Comply with any laws that govern the characteristics of a load (length, width, height, and weight).

1. Move the hydraulic lockout control to the LOCKED position.
2. Turn the engine start ring to the OFF position or press button to stop engine.

3. Turn the battery disconnect switch to OFF and remove the disconnect switch key.
4. Remove the ether starting aid cylinder. See Operation and Maintenance Manual, "Ether Starting Aid Cylinder - Replace" for the removal procedure.
5. Lock the door and the access covers. Attach any vandalism protection.

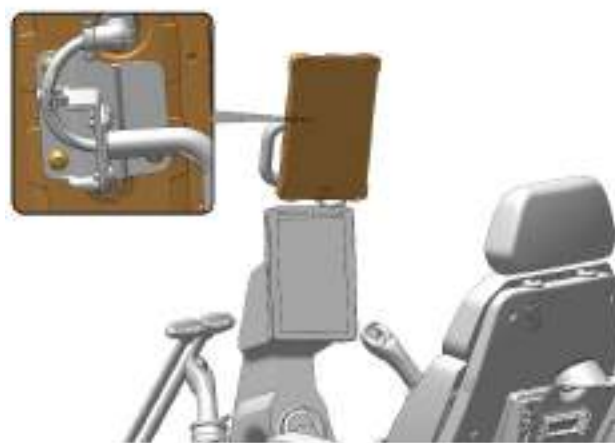


Illustration 428

g06181075

Note: Caterpillar strongly recommends removing the Cat Grade Control monitor (if equipped) before transporting the machine to protect the monitor from damage or theft.

6. Disconnect the wiring harness from the Cat Grade Control monitor. Remove the three screws that secure the monitor to the mounting bracket and remove the monitor. Remove the monitor from the cab and store in the monitor carrying case.
7. Cover the exhaust opening.

NOTICE

Do not allow the turbocharger to rotate while the engine is not operating. Damage to the turbocharger can result.

Note: Before you unload the excavator from the transport machine, remove the protective covering from the exhaust opening.

i07785977

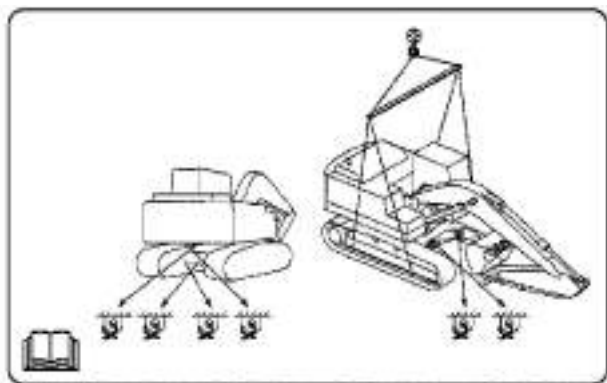


Illustration 429

g06289667

8. Chock the tracks and secure the machine with tie-downs. Make sure that you use the proper rated wire cable.

Use the front towing eyes on the lower frame, the rear towing eyes on the lower frame, and the rear towing eye that is on the upper frame.

Securely fasten all loose parts and all removed parts to the trailer or to the rail car.

When the engine is stopped, the swing parking brake is automatically applied. The swing brake prevents the upper structure from rotating.

NOTICE

In freezing weather, protect the cooling system with antifreeze, to the lowest outside expected temperature on the travel route. Or, drain the cooling system completely.

Lifting and Tying Down the Machine

SMCS Code: 7000; 7500

WARNING

Improper lifting and tie-down techniques can allow the load to shift or fail resulting in personal injury or property damage. Use only properly rated cables and slings with lift and tie down points provided on the machine. Keep the deck of the transport vehicle clean and use anti-slip mats on steel decks.

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 weight information.

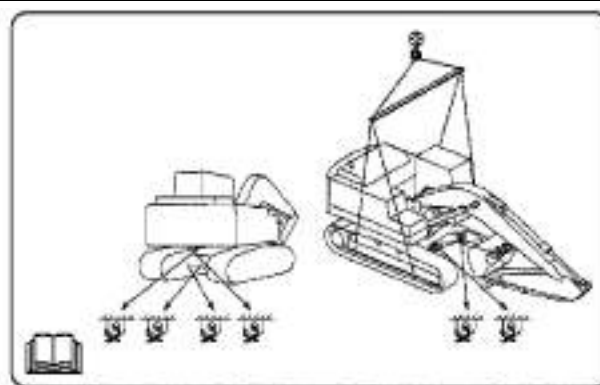


Illustration 430

g06289667

The lift and tie-down film is located near the base of the boom.

Lifting the machine



Illustration 431

g06184026

The machine center of gravity is located at the center of the swing gear.



Lifting Point – To lift the machine, attach the lifting devices to the lifting points.

The weight and the instructions that are given herein describe the machine as the machine is manufactured by Caterpillar.

Refer to the Operation and Maintenance, “Specifications” for specific weight information.

Note: Only lift objects from approved lifting points and with approved lifting devices

1. Use proper rated cables and slings for lifting. The crane should be positioned so that the machine is lifted parallel to the ground.
2. To prevent contact with the machine, lifting cables should have sufficient length.
3. Move the hydraulic lockout control to the LOCKED position.
4. Thread the cable between the first and second rollers at each end of the track.
5. Do not use the foot step as a lifting point.

6. If the full length roller guard is equipped, remove the guard.

7. Apply the proper protector to prevent machine/wire damage and slippage. Make sure that the rollers are not affected by the load.

Tying Down the Machine

There are two methods that can be used to tie down a machine. Local and/or regional regulations will determine which method to use.

Note: Obey all local and regional governmental regulations.

Frictional and Direct Lashing

When allowed, a combination of frictional lashing and direct lashing is the preferred method to tie down a machine.



Illustration 432

g06184145

(A) Front of the machine

(B) Rear of the machine

Diagonal Lashing

In areas where frictional lashing is not allowed, diagonal lashing can be used as shown below.

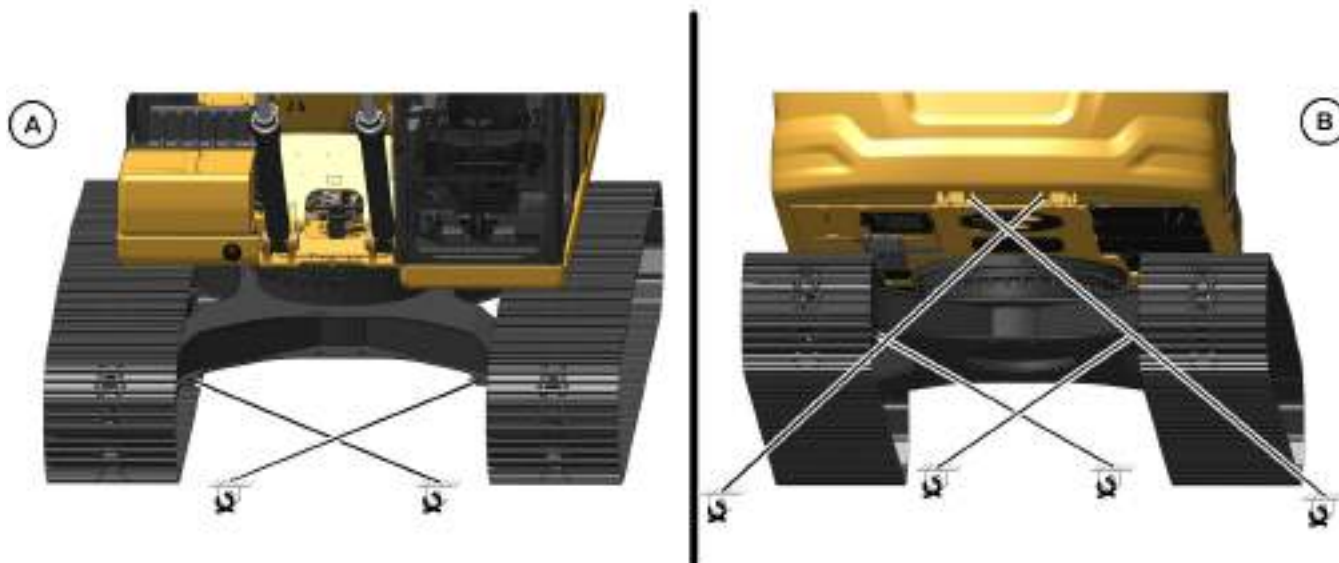


Illustration 433

g06435607

(A) Front of the machine

(B) Rear of the machine

Tying Down the Machine



Tie Down Point – To tie down the machine, attach the tie-downs to the tie-down points.

The weight and the instructions that are given herein describe the machine as the machine is manufactured by Caterpillar.

Refer to the Operation and Maintenance, "Specifications" for specific weight information.

1. Use proper rated cables and shackles for tying down the machine.
2. Use the rear eyes and the front eyes that are provided on the lower frame to fasten tie-downs. Use corner protectors for sharp corners.
3. Move the hydraulic lockout control to the LOCKED position.
4. If there is a requirement of diagonal lashing for tying down, use the proper tie-down point on the lower frame. Set the lashing angle which is on the longitudinal axis of the machine and the cable, at 30 to 50 degrees.
5. Keep the transport vehicle surface clean (for example, trailer deck).
6. For steel deck transport vehicles use skid-inhibiting or anti-slip mats (for example, rubber mats) with a friction coefficient of at least 0.3.

Lifting the Machine Segments

Bucket

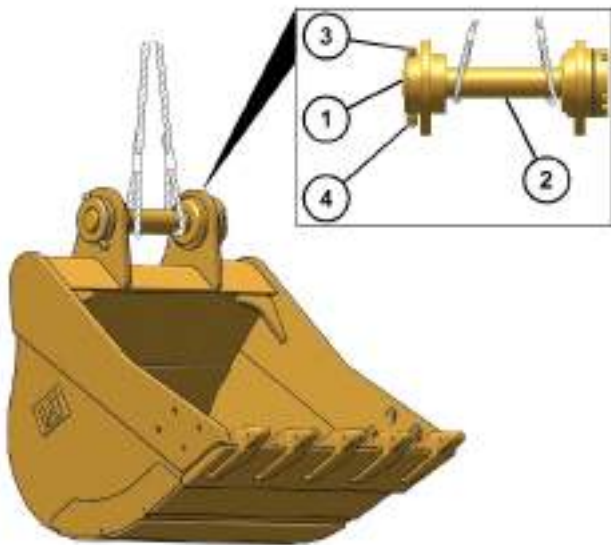


Illustration 434

g06184591

(1) Pin.(2) Sleeve.(3) Bolts.(4) Nuts.

Install pin (1) and install sleeve (2) in the brackets of the bucket. The previous illustration indicates the method to secure pin (1) with bolts (3) and nuts (4). Fasten two proper rated wire cables to pin (1).

Towing Information

i07348733

Towing the Machine

SMCS Code: 7000



Personal injury or death could result when towing a disabled machine incorrectly.

Block the machine to prevent movement before final drives are disengaged. The machine can roll free if it is not blocked. With final drives disengaged, the machine cannot be stopped or steered.

Follow the recommendations below, to properly perform the towing procedure.

Relieve the hydraulic tank and line pressure before any disassembly.

Even after the machine has been turned off, the hydraulic oil can still be hot enough to burn. Allow the hydraulic oil to cool before draining.

NOTICE

To tow the machine, both final drives must be disengaged.

Do not operate the travel motors with the final drives disengaged. Damage could result.

These towing instructions are for moving a disabled machine for a short distance at low speed. Move the machine at a speed of 2 km/h (1.2 mph) or less to a convenient location for repair. Always haul the machine if long distance moving is required.

Shields must be provided on both machines. This will protect the operator if the tow line or the tow bar breaks.

Do not allow an operator to be on the machine that is being towed.

Before you tow the machine, make sure that the tow line or the tow bar is in good condition. Do not use a wire rope that is kinked, twisted, or damaged. Make sure that the tow line or the tow bar has enough strength for the towing procedure that is involved. The strength of the tow line or of the tow bar should be at least 150 percent of the gross weight of the towed machine. This requirement is for a disabled machine that is stuck in the mud and for being towed on a grade.

Do not use a chain for pulling a disabled machine. A chain link can break. This may cause personal injury. Use a wire rope with ends that have loops or rings. Put an observer in a safe position to watch the pulling procedure. The observer can stop the procedure if the wire rope starts to break. Stop pulling whenever the towing machine moves without moving the towed machine.

During towing, do not allow anyone to step between the towing and the towed machines.

Do not allow the wire rope to be straddled while the machine is being towed.

Keep the tow line angle to a minimum. Do not exceed a 30 degree angle from the straight ahead position.

Avoid towing the machine on a slope.

Quick machine movement could overload the tow line or the tow bar. This could cause the tow line or the tow bar to break. Gradual, steady machine movement will be more effective.

Prior to releasing the brake of the final drive, firmly lock both tracks to prevent the machine from moving suddenly. When the machine is ready to be towed, release the brake of the final drive. Refer to Operation and Maintenance Manual, "Final Drive Sun Gear Removal".

Normally, the towing machine should be as large as the disabled machine. Make sure that the towing machine has enough brake capacity, enough weight, and enough power. The towing machine must be able to control both machines for the grade that is involved and for the distance that is involved.

You must provide sufficient control and sufficient braking when you are moving a disabled machine downhill. This may require a larger towing machine or additional machines that are connected to the rear of the disabled machine. This will prevent the machine from rolling away out of control.

All situation requirements cannot be listed. Minimal towing machine capacity is required on smooth, level surfaces. Maximum towing machine capacity is required on an incline or on a surface that is in poor condition.

Do not tow a loaded machine.

Consult your Cat dealer for the equipment that is necessary for towing a disabled machine.

Retrieval and Towing of Machine

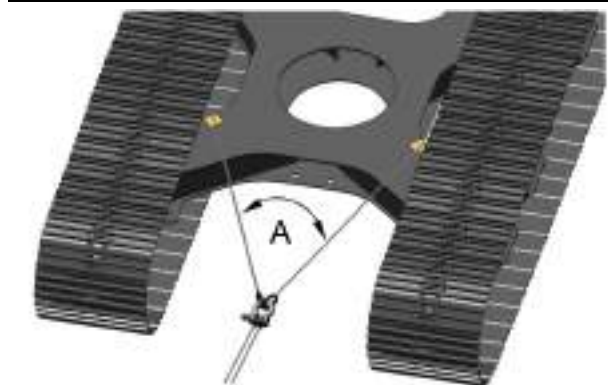


Illustration 435

g06289671

Note: Shackles must be used for towing the machine. The wire rope should be horizontal and straight to the track frame.

Install a properly rated wire rope to the lower frame of the towing machine and the lower frame of the towed machine. The permissible force for the lower frame is 100 percent of the gross weight of the towed machine.

Note: To prevent damage to the wire rope or the lower frame of the machines, use protective sleeves on the corners of the lower frame.

Retrieve the disabled machine carefully. The applied load for each wire rope should be equal. The angle (A) between each wire rope should be 60 degree maximum. Operate the machine at a low speed.

Lightweight Towing

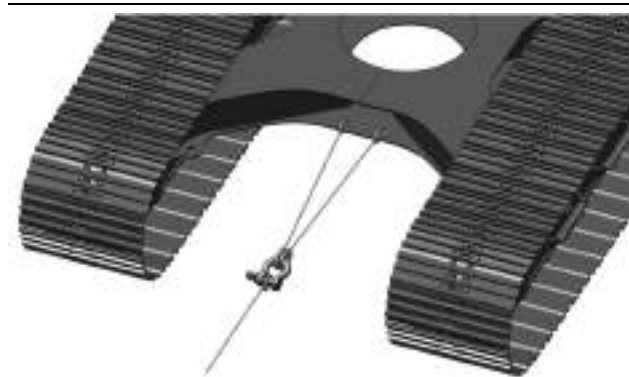


Illustration 436

g06186106

The maximum load for lightweight towing is 102900 N (75895 lb).

Shackles must be used for towing the machine. The wire rope should be horizontal and straight to the track frame.

Install a properly rated wire rope to the lower frame of the towing machine and the lower frame of the towed machine. Operate the machine at a low speed.

i06954175

Final Drive Sun Gear Removal

SMCS Code: 4050

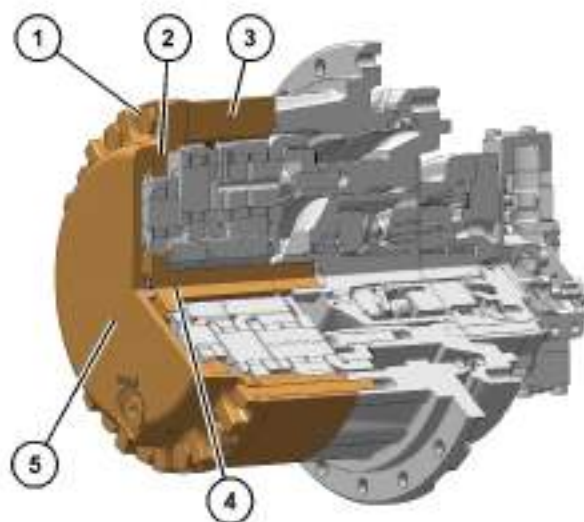


Illustration 437

g06188195

- (1) Bolt
- (2) Ring gear
- (3) Ring gear
- (4) Sun gear
- (5) Final drive cover

WARNING

Without the sun gear in place, the brakes are ineffective. Personal injury or death could result. Provide other means to hold or stop the machine.

1. Thoroughly clean the area around the final drive. Make sure that you also clean the track shoes that are positioned above the final drive.

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information on containing fluid spillage.

2. Drain the final drive oil into a suitable container. See Operation and Maintenance Manual, "Final Drive Oil - Change" for the procedure.

Operation Section
Final Drive Sun Gear Removal

3. Remove 14 of 16 cover bolts (1) from final drive cover (5). Do not leave a bolt in the top hole of the cover.
4. Insert an alignment dowel through the top hole of the cover and into the threads in the final drive housing. This is necessary to support ring gear (2) and ring gear (3) while you are removing the final drive cover.
5. Remove one track shoe to allow access to the face between final drive cover (5) and ring gear (2).
6. Loosen remaining two cover bolts (1).
7. Use a hammer and a wedge to separate final drive cover (5) and ring gear (2). Make sure that ring gear (2) and ring gear (3) stay in place.
8. Remove remaining two cover bolts (1) and final drive cover (5).
9. Remove sun gear (4) from final drive.
10. Install final drive cover (5) and 16 cover bolts (1).
11. Fill the final drive with new oil. See Operation and Maintenance Manual, "Final Drive Oil - Change" for the procedure.
12. Repeat Steps 1 through 11 for the other final drive.
13. Refer to the Service Manual for information on the installation of the final drive sun gear.

Engine Starting (Alternate Methods)

i06953771

Engine Starting with Jump Start Cables (If Equipped)

SMCS Code: 1000; 7000

 WARNING

Failure to properly service the batteries may cause personal injury.

Prevent sparks near the batteries. They could cause vapors to explode. Do not allow the jump start cable ends to contact each other or the machine.

Do not smoke when checking battery electrolyte levels.

Electrolyte is an acid and can cause personal injury if it contacts skin or eyes.

Always wear eye protection when starting a machine with jump start cables.

Improper jump start procedures can cause an explosion resulting in personal injury.

Always connect the battery positive (+) to battery positive (+) and the battery negative (-) to battery negative (-).

Jump start only with an energy source with the same voltage as the stalled machine.

Turn off all lights and accessories on the stalled machine. Otherwise, they will operate when the energy source is connected.

NOTICE

To prevent damage to engine bearings and to electrical circuits when you jump-start a machine, do not allow the stalled machine to touch the machine that is used as the electrical source.

Turn on (close) the battery disconnect switch prior to the boost connection to prevent damage to electrical components on the stalled machine.

Use only equal voltage for starting. Check the battery and starter voltage rating of your machine. Use only the same voltage for jump starting. Use of a welder or higher voltage will damage the electrical system.

Severely discharged maintenance free batteries do not fully recharge from the alternator after jump starting. The batteries must be charged to proper voltage with a battery charger. Many batteries thought to be unusable are still rechargeable.

Refer to Special Instruction, SEHS7633, "Battery Test Procedure" for complete testing and charging information. This publication is available from your Cat dealer.

When the auxiliary start receptacles are not available, use the following procedure.

1. Lower the equipment to the ground. Move all controls to the HOLD position. Move the hydraulic lockout control to the LOCKED position.
2. Turn the start switch on the stalled machine to the OFF position. Turn off all accessories.
3. Turn the battery disconnect switch on the stalled machine to the ON position.
4. Move the machine that is being used as an electrical source near the stalled machine so that the jump-start cables reach the stalled machine.
Do not allow the machines to contact each other.
5. Stop the engine of the machine that is being used as an electrical source. If you are using an auxiliary power source, turn off the charging system.



Illustration 438

g06181546

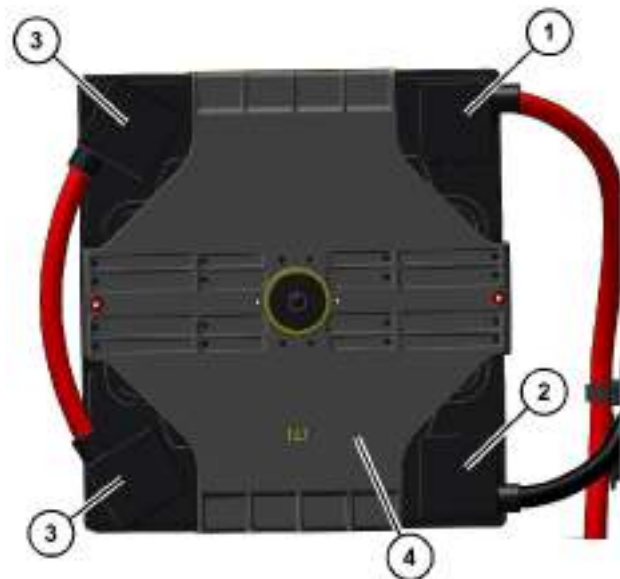


Illustration 439

g06181551

- (1) Red positive post to starter
- (2) The black negative post connects to the battery disconnect switch.
- (3) Do not use these two connections for jump starting. The red positive post is connected in series to the black negative post.
- (4) Cover

- 6. Ensure that battery caps on both machines are tight and correctly placed. Ensure that batteries in the stalled machine are not frozen. Make sure that the batteries have enough electrolyte.

Note: The positive terminal of the 24 V system of the source and the negative terminal of the 24 V system of the source must be identified correctly before the jumper cables are connected. The positive terminal of the 24 V system of the discharged battery must be identified correctly before the jumper cables are connected.

- 7. The positive ends of the jump-start cable are red. Connect one positive end of the jump-start cable to the positive cable terminal of the discharged battery. Some machines have battery sets.

Note: Batteries that are in series may be in separate compartments. Use the terminal that is connected to the starter solenoid. This battery or battery set is normally on the same side of the machine as the starter.

Do not allow the positive cable clamps to contact any metal except for the battery terminals.

- 8. Connect the other positive end of the jump-start cable to the positive cable terminal of the electrical source.
- 9. Connect one negative end of the jump-start cable to the negative cable terminal of the electrical source.
- 10. Finally, connect the other negative end of the jump-start cable to the frame of the stalled machine. Do not connect the jump-start cable to the battery post. Do not allow the jump-start cables to contact the battery cables, the fuel lines, the hydraulic lines, or any moving parts.
- 11. Start the engine of the machine that is being used as an electrical source or energize the charging system on the auxiliary power source.
- 12. Wait at least two minutes before you attempt to start the stalled machine. This will allow the batteries in the stalled machine to partially charge.
- 13. Attempt to start the stalled engine. See Operation and Maintenance Manual, "Engine Starting" for the correct starting procedure.
- 14. Immediately after you start the stalled engine, disconnect the jump-start cables in reverse order.

i07349165

Engine Starting with Auxiliary Start Receptacle (If Equipped)

SMCS Code: 1000; 7000



Illustration 440

g06179792

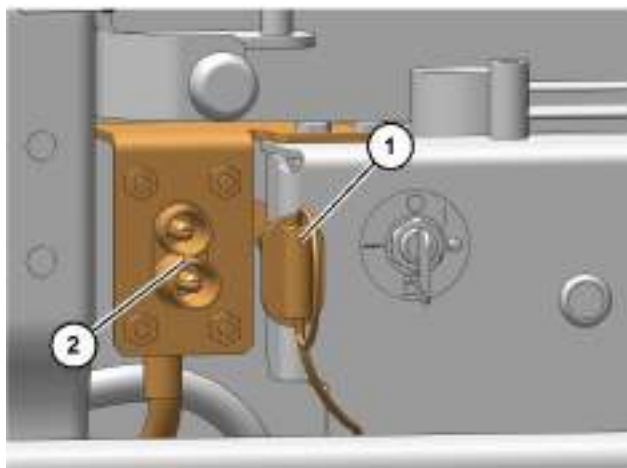


Illustration 441

g06181572

- (1) Cover
(2) Receptacle

Some Cat products may be equipped with an auxiliary start receptacle as a standard part. If your machine is not equipped with an auxiliary start receptacle, the machine can be equipped with an auxiliary start receptacle from parts service. This will ensure that a permanent receptacle is always available to jump-start the machine.

There are two cable assemblies that can be used to jump-start the stalled machine. You can jump-start the stalled machine from another machine that is equipped with an auxiliary start receptacle or with an auxiliary power pack. Your Cat dealer can provide the correct cable lengths for your application.

1. Determine the reason that the engine will not start.

Reference: Refer to Special Instruction, SEHS7633, "Battery Test Procedure" for more information.

2. Ensure that the travel control levers on the stalled machine are in the CENTER position. Engage the hydraulic lockout control. Engage the parking brake. Lower all work tools to the ground. Move all controls to HOLD.

3. Turn the engine start switch key on the stalled machine to the OFF position. Turn off all accessories.

4. Turn the battery disconnect switch on the stalled machine to ON.

5. Move the machine that is being used as a power source close to the stalled machine. The jump-start cables should reach the batteries on both machines. **DO NOT ALLOW THE MACHINES TO CONTACT EACH OTHER.**

6. Stop the engine on the machine that is being used as a power source. If you use an auxiliary power source, turn off the charging system.

7. Connect the appropriate jump-start cable to the auxiliary start receptacle on the stalled machine.

8. Connect the other end of the jump-start cable to the auxiliary start receptacle of the machine that is being used as a power source.

9. Start the engine on the machine that is being used as a power source or energize the charging system on the auxiliary power source.

10. Wait for a minimum of 2 minutes while the batteries in the stalled machine partially charge.

11. Attempt to start the stalled engine.

12. Immediately after the stalled engine starts, disconnect the jump-start cable from the power source.

13. Disconnect the other end of the jump-start cable from the stalled machine.

14. Conclude the failure analysis on the starting charging system of the stalled machine, as required. Check the machine while the engine is running and the charging system is in operation.

Maintenance Section

Maintenance Access

i07945068

Access Door and Cover Locations

SMCS Code: 726A-CH

Engine Hood

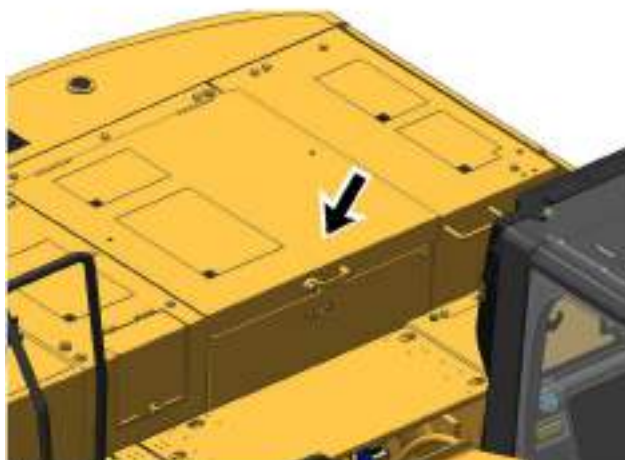


Illustration 442

g06225770

Allows access to engine and coolant tank.

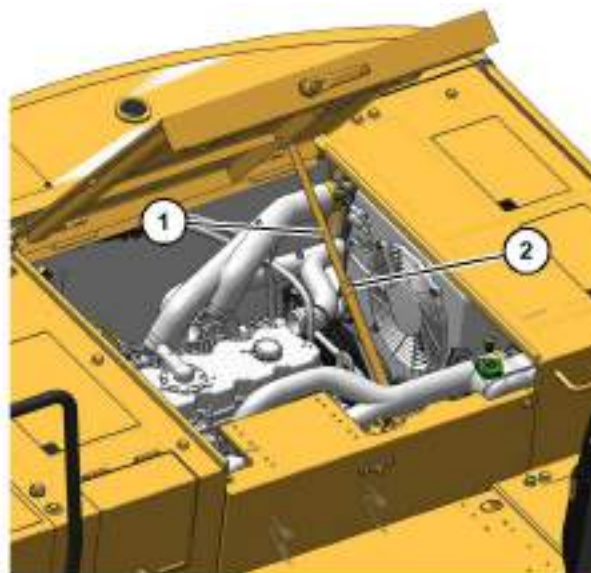


Illustration 443

g06225771

1. Open the engine hood.
2. Gas spring (1) will lock in place to hold the engine hood open.

WARNING

Operation of the Push Button Release for the Engine Hood

When closing the engine hood, only operate the push-button release by hand.

Failure to remove hands from the push-button release before closing the engine hood could result in personal injury.

Be sure to remove hands from the push-button release before completely closing the engine hood.

NOTICE

Do not add pressure to the engine hood when open.

WARNING

When closing the engine hood, Do Not operate the push-button release by foot.

Operation of the push-button release by foot could result in damage to the gas spring of the closing mechanism and/or personal injury.

Only operate the push-button release for closing the engine hood by hand.

3. To close the engine hood, support the engine hood with the door handle. Press the push-button release (2) to unlock the gas spring. Release the push button and slowly close the engine hood.

Engine Service Door

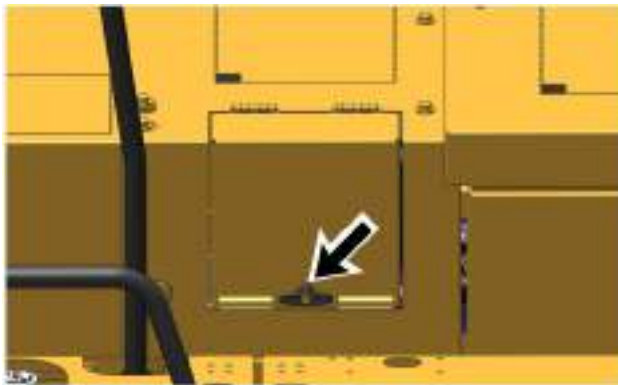


Illustration 444

g06183460

Allows access to the engine oil filler cap and the upper dipstick.

Left Rear Access Door



Illustration 445

g06179792

Allows access to the coolant sample port, coolant drain, cooling cores, power fuses, battery disconnect switch, and coolant reservoir.

Left Front Access Door



Illustration 446

g06181546

Allows access to engine air filter, batteries, and window washer reservoir.

Right Side Access Door



Illustration 447

g06182545

Allows access to the engine oil filter, engine oil sampling port, and ground level dipstick. Additionally, the compartment houses the hydraulic pump, fuel filters, refueling pump, fuel tank drain valve, and hydraulic tank sight gauge.

Right Front Access Door



Illustration 448

g06183098

Allows access to the Diesel Exhaust Fluid (DEF) tank.

Lubricant Viscosities and Refill Capacities

i07419350

Lubricant Viscosities (Fluids Recommendations)

SMCS Code: 7581

General Information for Lubricants

When you are operating the machine in temperatures below -20°C (-4°F), refer to Special Publication, SEBU5898, "Cold Weather Recommendations". This publication is available from your Cat dealer.

Refer to the "Lubricant Information" section in the latest revision of the Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations" for a list of Cat engine oils and for detailed information. This manual may be found on the web at Safety.Cat.com.

The footnotes are a key part of the tables. Read all footnotes that pertain to the machine compartment in question.

Selecting the Viscosity

To select the proper oil for each machine compartment, refer to the "Lubricant Viscosity for Ambient Temperature" table. Use the oil type AND oil viscosity for the specific compartment at the proper ambient temperature.

The proper oil viscosity grade is determined by the minimum ambient temperature (the air in the immediate vicinity of the machine). Measure the temperature when the machine is started and while the machine is operated. 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 for operating the machine at the highest temperature that is anticipated. Unless specified otherwise in the "Lubricant Viscosities for Ambient Temperatures" tables, use the highest oil viscosity that is allowed for the ambient temperature.

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. Refer to "General Information for Lubricants" article, "Lubricant Viscosities" tables, and any associated footnotes. Consult your Cat dealer if additional information is needed.

NOTICE

Not following the recommendations found in this manual can lead to reduced performance and compartment failure.

Engine Oil

Cat oils have been developed and tested to provide the full performance and life that has been designed and built into Cat engines.

Cat DEO-ULS or oils that meet the Cat ECF-3 specification, API CJ-4, and the newer API CK-4, are required for use in the applications listed below. Cat DEO-ULS and oils meeting Cat ECF-3 specification, API CJ-4, the newer API CK-4, and ACEA E9 oil categories have been developed with limited sulfated ash, phosphorus, and sulfur. These chemical limits are designed to maintain the expected aftertreatment devices life, performance, and service interval. If oils meeting the Cat ECF-3 specification, API CJ-4, the newer API CK-4 specifications are not available, oils meeting ACEA E9 may be used. ACEA E9 oils meet the chemical limits designed to maintain aftertreatment device life. ACEA E9 oils are validated using some but not all ECF-3 and API CJ-4 standard engine performance tests. Consult your oil supplier when considering use of an oil that is not Cat ECF-3, API CJ-4, or the newer API CK-4 qualified.

Failure to meet the listed requirements will damage aftertreatment-equipped engines and can negatively impact the performance of the aftertreatment devices. The Diesel Particulate Filter (DPF) if equipped, will plug sooner and require more frequent DPF ash service intervals.

Typical aftertreatment systems may include the following:

- Diesel Particulate Filters (DPF)
- Diesel Oxidation Catalysts (DOC)
- Selective Catalytic Reduction (SCR)
- Lean NOx Traps (LNT)

Other systems may apply.

Oils that are per API CI-4 or prior categories are not allowed. These oils have high ash and are not appropriate for use in engines with aftertreatment devices.

Table 21

Lubricant Viscosities for Ambient Temperatures						
Compartment or System	Oil Type and Performance Requirements	Oil Viscosities	°C		°F	
			Min	Max	Min	Max
Engine Crankcase for all Machines	Cat DEO-ULS Cold Weather	SAE 0W-40	-40	40	-40	104
	Cat DEO-ULS SYN	SAE 5W-40	-30	50	-22	122
	Cat DEO-ULS	SAE 10W-30	-18	40	0	104
		SAE 15W-40	-10	50	14	122
Pump Coupling (If Equipped)	Cat DEO-ULS	SAE 10W-30	-18	40	0	104

Hydraulic Systems

Refer to the “Lubricant Information” section in the latest revision of the Special Publication, SEBU6250, “Caterpillar Machine Fluids Recommendations” for detailed information. This manual may be found on the web at Safety.Cat.com.

The following are the preferred oils for use in most Cat machine hydraulic systems:

- Cat HYDO Advanced 10 SAE 10W
- Cat HYDO Advanced 20 SAE 20W
- Cat HYDO Advanced 30 SAE 30
- Cat BIO HYDO Advanced, Multigrade

Cat HYDO Advanced oils allow 6000 hours or higher oil drain intervals for most applications. S·O·S Services oil analysis is recommended when the oil drain interval is increased to 6000 hours or higher. In comparison, non-Cat commercial hydraulic oils (second choice oils) allow 2000 hours oil drain interval. It is recommended to follow the maintenance interval schedule for oil filter changes and for oil sampling that is stated in the Operation and Maintenance Manual for your particular machine. Consult your Cat dealer for details. When switching to Cat HYDO Advanced fluids, cross contamination with the previous oil should be kept to less than 10%.

Second choice oils are listed below.

- Cat MTO
- Cat DEO
- Cat DEO-ULS
- Cat TDTO
- Cat TDTO Cold Weather
- Cat TDTO-TMS
- Cat DEO-ULS Cold Weather

Note: Oil drain intervals of the oils listed above are less than those of Cat HYDO Advanced oils. The oil drain interval of these oils is typically 2000 hours and up to a maximum of 4000 hours. An exception is Cat TDTO Cold Weather oil which allows 6000 hours or higher oil drain interval. S·O·S Services oil analysis is required when the oils listed above are used in Cat hydraulic system components and hydrostatic transmissions.

Table 22

Lubricant Viscosities for Ambient Temperatures						
Compartment or System	Oil Type and Performance Requirements	Oil Viscosities	°C		°F	
			Min	Max	Min	Max
Hydraulic System	Cat HYDO Advanced 10 Cat TDTO	SAE 10W	-20	40	-4	104
	Cat HYDO Advanced 20 Cat TDTO	SAE 20W	-5	45	23	113
	Cat HYDO Advanced 30 Cat TDTO	SAE 30	10	50	50	122
	Cat BIO HYDO Advanced	"ISO 46" Multi-Grade	-30	50	-22	122
	Cat MTO Cat DEO-ULS Cat DEO	SAE10W-30	-20	40	-4	104
	Cat DEO-ULS Cat DEO	SAE15W-40	-15	50	5	122
	Cat TDTO-TMS	Multi-Grade	-15	50	5	122
	Cat DEO-ULS SYN	SAE 5W-40	-25	40	-13	104
	Cat DEO-ULS Cold Weather	SAE0W-40	-40	40	-40	104
	Cat TDTO Cold Weather	SAE 0W-20	-40	40	-40	104

For applications requiring the use of fire-resistant hydraulic fluids, Caterpillar recommends the use of EcoSafe FR-46. This product is a fully synthetic, non-aqueous hydraulic fluid. Water based and glycol-based hydraulic products are not recommended for use in Cat machine hydraulic systems. EcoSafe FR-46 is an ISO 46 multi-grade product. For more information refer to the product information provided by the manufacturer of EcoSafe hydraulic oil. Refer to your Cat dealer for availability.

Other Fluid Applications

Table 23

Excavators, Front Shovels, Mass Excavators, Demolition Excavators, and Track Material Handlers Lubricant Viscosities for Ambient Temperatures						
Compartment or System	Oil Type and Performance Requirements	Oil Viscosity Grade	°C		°F	
			Min	Max	Min	Max
Final Drives and Swing Drives	Cat TDTO Cold Weather	SAE 0W-20	-40	0	-40	32
	Cat TDTO	SAE 10W	-30	0	-22	32
		SAE 30 ⁽¹⁾	-30	35	-22	95
		SAE 50	-15	50	5	122
	Cat TDTO-TMS	Multi-Grade	-25	25	-13	77
Track Roller Frame Recoil Spring and Pivot Shaft Bearings	Cat TDTO Cold Weather	SAE 0W-20	-40	0	-40	32
	Cat TDTO	SAE 10W	-30	0	-22	32
		SAE 30 ⁽¹⁾	-20	25	-4	77

(continued)

(Table 23, contd)

Excavators, Front Shovels, Mass Excavators, Demolition Excavators, and Track Material Handlers Lubricant Viscosities for Ambient Temperatures						
Compartment or System	Oil Type and Performance Requirements	Oil Viscosity Grade	°C		°F	
			Min	Max	Min	Max
		SAE 50	0	50	32	122
	Cat TDTO-TMS	Multi-Grade	-25	25	-13	77
Track Idlers and Track Rollers	Cat DEO-ULS Cat DEO	SAE 15W-40 ⁽¹⁾	-10	50	14	122
	Cat DEO Cold Weather	SAE 0W-40	-40	40	-40	104
	Cat DEO-ULS SYN	SAE 5W-40	-35	40	-31	104
	Cat FDAO SYN	Multi-Grade	-30	50	-22	122

⁽¹⁾ Factory fill oil for standard configuration machines.

Special Lubricants

Grease

To use a non-Cat grease, the supplier must certify that the lubricant is compatible with Cat grease.

Each pin joint should be flushed with the new grease. Ensure that all old grease is removed. Failure to meet this requirement may lead to failure of a pin joint.

Table 24

Recommended Grease						
Compartment or System	Grease Type	NLGI Grade	°C		°F	
			Min	Max	Min	Max
External Lubrication Points	Cat Prime Application Grease	NLGI Grade 2	-20	140	-4	284
	Cat Extreme Application Grease	NLGI Grade 1	-20	140	-4	284
		NLGI Grade 2	-15	140	+5	284
	Cat Extreme Application Grease-Artic	NLGI Grade 0.5	-50	130	-58	266
	Cat Extreme Application Grease-Desert	NLGI Grade 2	-10	140	+14	284
	Cat Utility Grease	NLGI Grade 2	-20	140	-4	284
	Cat Ball Bearing Grease	NLGI Grade 2	-20	160	-4	320

Diesel Fuel Recommendations

Diesel fuel must meet Caterpillar Specification for Distillate Fuel and the latest revisions of "ASTM D975" and "EN 590" to ensure optimum engine performance. Refer to Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations" for the latest fuel information and for Cat fuel specification. This manual may be found on the Web at Safety.Cat.com.

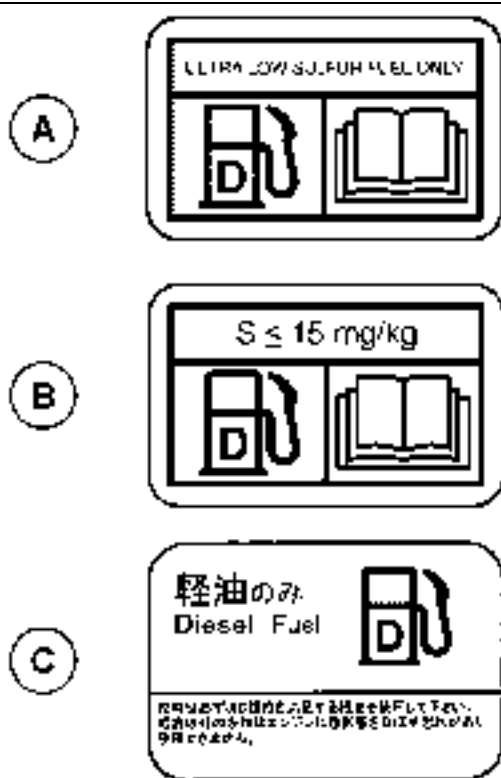


Illustration 449

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(A) North America film

(B) Europe, Africa, Middle East film

(C) Japan film

NOTICE

Ultra Low Sulfur Diesel (ULSD) fuel 0.0015 percent (≤ 15 ppm (mg/kg)) sulfur is required by regulation for use in engines certified to nonroad Tier 4 standards (U.S. EPA Tier 4 certified) and that are equipped with exhaust aftertreatment systems.

European ULSD 0.0010 percent (≤ 10 ppm (mg/kg)) sulfur fuel is required by regulation for use in engines certified to European Stage V type-approved nonroad engines. Additionally, the Cetane number should not be less than 45, and the bio-diesel content should not be greater than 20% volume/volume.

Misfueling with fuels of higher sulfur level can have the following negative effects:

- Reduce engine efficiency and durability.
- Increase the wear.
- Increase the corrosion.
- Increase the deposits.
- Lower fuel economy
- Shorten the time period between oil drain intervals (more frequent oil drain intervals).
- Increase overall operating costs.

Failures that result from the use of improper fuels are not Caterpillar factory defects. Therefore, the cost of repairs would not be covered by a Caterpillar warranty.

Caterpillar does not require the use of ULSD in non-road and machine applications that are not Tier 4/Stage V certified engines and are not equipped with aftertreatment devices. For Tier 4/Stage V certified engines, always follow operating instructions to ensure that the correct fuels are used.

Refer to Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations" for more details about fuels, lubricants, and Tier 4/Stage V requirements. This manual may be found on the web at Safety.Cat.com.

Diesel Exhaust Fluid

General Information

Diesel Exhaust Fluid (DEF) is a liquid that is injected into the exhaust system of engines equipped with Selective Catalytic Reduction (SCR) systems. SCR reduces emissions of nitrogen oxides (NOx) in diesel engine exhaust.

Diesel Exhaust Fluid (DEF) is also known under other names including Aqueous Urea Solution (AUS) 32, AdBlue, or generically referred to as urea.

In engines equipped with SCR emissions reduction system, DEF is injected in controlled amounts into the engine exhaust stream. At the elevated exhaust temperature, urea in DEF is converted to ammonia. The ammonia chemically reacts with NOx in diesel exhaust in the presence of the SCR catalyst. The reaction converts NOx into harmless nitrogen (N₂) and water (H₂O).

DEF Recommendations

For use in Cat engines, DEF must meet all the requirements defined by "ISO 22241-1" Requirements.

Caterpillar recommends the use of DEF available through the Cat parts ordering system for use in Cat engines equipped with SCR systems.

- Shorten the time interval between aftertreatment device service intervals (cause the need for more frequent service intervals)
- Adversely impact the performance and life of aftertreatment devices (cause loss of performance)
- Reduce regeneration intervals of aftertreatment devices

In North America, commercial DEF that is API approved and meets all the requirements defined in “ISO 22241-1” may be used in Cat engines that are equipped with SCR systems.

Outside of North America, commercial DEF that meets all requirements defined in “ISO 22241-1” may be used in Cat engines that are equipped with SCR systems.

The supplier should provide documentation to prove that the DEF is compliant with the requirements of “ISO 22241-1”.

NOTICE

Cat does not warrant the quality or performance of non-Cat fluids.

NOTICE

Do not use agriculture grade urea solutions. Do not use any fluids that do not meet “ISO 22241-1” Requirements in SCR emissions reduction systems. Use of these fluids can result in numerous problems including damage to SCR equipment and a reduction in NOx conversion efficiency.

DEF is a solution of solid urea that is dissolved in demineralized water to produce a final concentration of 32.5% urea. DEF concentration of 32.5% is optimal for use in SCR systems. DEF solution of 32.5% urea has the lowest attainable freeze point of -11.5° C (11.3° F). DEF concentrations that are higher or lower than 32.5% have higher freeze points. DEF dosing systems and “ISO 22241-1” specifications are designed for a solution that is approximately 32.5%.

Caterpillar offers a refractometer, Cat part number 360-0774, that can be used to measure DEF concentration. Follow the instructions provided with the instrument. Appropriate commercial portable refractometers can be used to determine urea concentration. Follow the instructions from the manufacturer.

DEF Guidelines

DEF solution is typically colorless and clear. Changes to color or clarity are indicators of quality issues. Quality of DEF can degrade when stored and handled inappropriately or if DEF is not protected from contamination. Details are provided below.

If quality issues are suspected, testing of DEF should focus on urea percentage, alkalinity as NH₃ and biuret content. DEF that does not pass all these tests or that is no longer clear should not be used.

Materials compatibility

DEF is corrosive. Due to the corrosion caused, DEF must be stored in tanks constructed of approved materials. Recommended storage materials:

Stainless Steels:

- 304 (S30400)
- 304L (S30403)
- 316 (S31600)
- 316L (S31603)

Alloys and metals:

- Chromium Nickel (CrNi)
- Chromium Nickel Molybdenum (CrNiMo)
- Titanium

Non-metallic materials:

- Polyethylene
- Polypropylene
- Polyisobutylene
- Teflon (PFA)
- Polyfluoroethylene (PFE)
- Polyvinylidene fluoride (PVDF)
- Polytetrafluoroethylene (PTFE)

Materials NOT compatible with DEF solutions include Aluminum, Magnesium, Zinc, Nickel coatings, Silver and Carbon steel, and Solders containing any of the above. Unexpected reactions may occur if DEF solutions come in contact with any non-compatible material or unknown materials.

Bulk storage

Follow all local regulations covering bulk storage tanks. Follow proper tank construction guidelines. Tank volume typically should be 110% of planned capacity. Appropriately vent indoor tanks. Plan for control of overflow of the tank. Heat tanks that dispense DEF in cold climates.

Bulk tank breathers should be fitted with filtration to keep airborne debris from entering the tank. Desiccant breathers should not be used because water will be absorbed, which potentially can alter DEF concentration.

Handling

Follow all local regulations covering transport and handling. DEF transport temperature is recommended to be -5° C (23° F) to 25° C (77° F). All transfer equipment and intermediate containers should be used exclusively for DEF. Containers should not be reused for any other fluids. Ensure that transfer equipment is made from DEF-compatible materials. Recommended material for hoses and other non-metallic transfer equipment includes:

- Nitrile Rubber (NBR)
- Fluoroelastomer (FKM)
- Ethylene Propylene Diene Monomer (EPDM)

The condition of hoses and other nonmetallics that are used with DEF should be monitored for signs of degradation. DEF leaks are easily recognizable by white urea crystals that accumulate at the site of the leak. Solid urea can be corrosive to galvanized or unalloyed steel, aluminum, copper, and brass. Leaks should be repaired immediately to avoid damage to surrounding hardware.

Cleanliness

Contaminants can degrade the quality and life of DEF. Filtering DEF is recommended when dispensed into the DEF tank. Filters should be compatible with DEF and should be used exclusively with DEF. Check with the filter supplier to confirm compatibility with DEF before using. Mesh-type filters using compatible metals, such as stainless steel, are recommended. Paper (cellulose) media and some synthetic filter media are not recommended because of degradation during use.

Care should be taken when dispensing DEF. Spills should be cleaned immediately. Machine or engine surfaces should be wiped clean and rinsed with water. Caution should be used when dispensing DEF near an engine that has recently been running. Spilling DEF onto hot components will cause harmful vapors.

Stability

NOTICE

Storing Diesel Exhaust Fluid in high heat areas is not recommended. Do not store DEF in high heat generating areas on the machine, such as the pump compartment or the engine compartment. The quality of the DEF can degrade when exposed to high temperatures.

DEF fluid is stable when stored and handled properly. The quality of DEF rapidly degrades when stored at high temperatures. The ideal storage temperature for DEF is between -9°C (15.8°F) and 25°C (77°F). DEF that is stored above 35°C (95°F) for longer than 1 month must be tested before use. Testing should evaluate Urea Percentage, Alkalinity as NH_3 and Biuret content.

The length of storage of DEF is listed in the following table:

Table 25

Storage Temperature	Expected DEF Life
Below 25°C (77°F)	18 months
25°C (77°F) to 30°C (86°F)	12 months
30°C (86°F) to 35°C (95°F)	6 months
Above 35°C (95°F)	test quality before use

Refer to "ISO 22241" document series for more information about DEF quality control.

Note: Dispose of all fluids according to applicable regulations and mandates.

Fuel Additives

Cat Diesel Fuel Conditioner and Cat Fuel System Cleaner are available for use when needed. These products are applicable to diesel and biodiesel fuels. Consult your Cat dealer for availability.

Biodiesel

Biodiesel is a fuel that can be made from various renewable resources that include vegetable oils, animal fat, and waste cooking oil. Soybean oil and rapeseed oil are the primary vegetable oil sources. To use any of these oils or fats as fuel, the oils, or fats are chemically processed (esterified). The water and contaminants are removed.

U.S. distillate diesel fuel specification "ASTM D7467" includes up to B20 (20 percent) biodiesel. Any diesel fuel in the U.S. may contain up to B20 biodiesel fuel.

European distillate diesel fuel specification "EN16709:2015" includes up to B20 (20 percent) biodiesel. Any diesel fuel in Europe may contain up to B20.

Note: The diesel portion used in the biodiesel blend must be Ultra Low Sulfur Diesel (15 ppm sulfur or less, per "ASTM D975"). In Europe the diesel fuel portion used in the biodiesel blend must be sulfur free diesel (10 ppm sulfur or less, per "EN 590"). The final blend must have 15 ppm sulfur or less.

When biodiesel fuel is used, certain guidelines must be followed. Biodiesel fuel can influence the engine oil, aftertreatment devices, non-metallic, fuel system components, and others. Biodiesel fuel has limited storage life and has limited oxidation stability. Follow the guidelines and requirements for engines that are seasonally operated.

To reduce the risks associated with the use of biodiesel, the final biodiesel blend and the biodiesel fuel used must meet specific blending requirements.

All the guidelines and requirements are provided in the latest revision of Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations". This manual may be found on the web at Safety.Cat.com.

Coolant Information

The information provided in this "Coolant Recommendation" section should be used with the "Lubricants Information" provided in the latest revision of Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations". This manual may be found on the web at Safety.Cat.com.

The following two types of coolants may be used in Cat diesel engines:

Preferred – Cat ELC (Extended Life Coolant)

Acceptable – Cat DEAC (Diesel Engine Antifreeze/Coolant)

NOTICE

Never use water alone as a coolant. Water alone is corrosive at engine operating temperatures. In addition, water alone does not provide adequate protection against boiling or freezing.

Table 26

Recommendations for Finished Coolants for use in Cat engines				
Coolant Type	Recommendations	Product	Service hours ⁽¹⁾⁽²⁾	Required Maintenance ⁽³⁾
Cat ELC, Cat ELI, or commercial coolant that meets Cat EC-1	Preferred	Cat ELC	12000 hours or 6 years	Add Cat ELC Extender at 6000 service hours or one half of service life
		Cat ELI (water based) ⁽⁴⁾	12000 hours or 6 years	Add Cat ELC Extender at 6000 service hours or one half of service life
	Min requirements	Cat EC-1 specification and "ASTM D6210" and Organic Additive Technology (OAT) based on a combination of a monocarboxylic acid and a dicarboxylic acid. Free of phosphate, borate, and silicate. Tolyltriazole: minimum typical concentration of 900 ppm Nitrite: minimum typical concentration of 500 ppm in new coolants	6000 hours or 6 years	Add Extender at 3000 service hours or one half of service life
Cat DEAC, Cat SCA, conventional coolants, and commercial extended life coolants that do not meet EC-1	Acceptable	Cat DEAC	3000 hours or 3 years	SCA at maintenance intervals
		Cat SCA (water based) ⁽⁴⁾	3000 hours or 2 years	SCA at maintenance intervals

(continued)

(Table 26, contd)

Recommendations for Finished Coolants for use in Cat engines				
	Min requirements for fully formulated Heavy-Duty Commercial coolants	"ASTM D6210" and Nitrite (as NO ₂) concentration: Minimum of 1200 ppm (70 grains/US gal) and maximum of 2400 ppm (140 grains/US gal) Silicon concentration: minimum of 100 ppm and maximum of 275 ppm	3000 hours or 2 years	SCA at maintenance intervals
	Min requirements for SCA and water ⁽⁴⁾ ⁽⁵⁾	Commercial supplemental coolant additive and water having Nitrite (as NO ₂) concentration: Minimum of 1200 ppm (70 grains/US gal) and maximum of 2400 ppm (140 grains/US gal) Silicon concentration: minimum of 100 ppm and maximum of 275 ppm	3000 hours or 1 year	Per manufacturer recommendations

- (1) New Coolants at 50 volume percent diluted. Coolants that are prediluted at the coolant manufacturer must be diluted with water that meets Reagent 4 "ASTM D1193" requirements.
- (2) Maintain the in-service coolant at the given limits.
- (3) For appropriate maintenance procedures, refer to the details given in this Chapter. For applications that allow the use of Cat ELI in water, a minimum of 7.5 percent of Cat ELI is recommended. For applications that allow the use of SCA and water, a minimum of 6 percent to a maximum of 8 percent concentration of Cat SCA are recommended.
- (4) Water-based coolants are not allowed for use in machines that has NO_x reduction aftertreatment devices, in engines that has AATAC and in Marine engines that have SWAC
- (5) There are currently no industry standards to define the quality of water-based conventional coolants. To control the quality of SCA and water coolants, the commercial SCA additive package should pass ASTM D6210 when this package is used in a glycol-based coolant. Do not use a commercial SCA additive package that only meets the ASTM D3306 or equivalent specification when used in a glycol-based coolant.

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Capacities (Refill)

SMCS Code: 1000; 7000

Table 27

Approximate Capacities (Refill)				
Component or System	Model	Liters	US gal	Recommended Type
Cooling System		25	(6.6)	Refer to Operation and Maintenance Manual, "Lubricant Viscosities".
Fuel Tank		474	125	
Engine Crankcase with Filter		25	6.6	
Hydraulic System ⁽¹⁾		147	38.8	
Swing Drive		10	2.6	
Each Final Drive		5.5	1.45	
DEF Tank		41	10.8	
		kg	lbs	
Swing Gear		16.5	36.4	Refer to Operation and Maintenance Manual, "Lubricant Viscosities".

(continued)

(Table 27, contd)

Approximate Capacities (Refill)			
Refrigerant ⁽²⁾	0.9	2.0	R-134a
	mL	oz	
Refrigerant Oil ⁽²⁾	240	8	Polyalkylene Glycol (PAG) Oil

⁽¹⁾ The amount of hydraulic fluid that is needed to refill the hydraulic system after performing Operation and Maintenance Manual, "Hydraulic System Oil - Change"

⁽²⁾ Refer to Service Manual, "Air Conditioning and Heating R-134a for All Caterpillar Machines" for additional information

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S·O·S Information

SMCS Code: 1000; 1348; 3080; 4050; 5050; 7000; 7542-008

S·O·S Services is a highly recommended process for Cat 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 Special Publication, SEBU6250, "Caterpillar Machine Fluid Recommendations" for detailed information concerning S·O·S Services.

The effectiveness of S·O·S Services is dependent on timely submission of the sample to the laboratory at recommended intervals.

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

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

Maintenance Support

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Prepare the Machine for Maintenance

SMCS Code: 1000; 7000

Refer to the following procedure before you perform any maintenance to the machine.

 WARNING

Personal injury can result from hydraulic oil pressure and hot oil.

Hydraulic oil pressure can remain in the hydraulic system after the engine has been stopped. Serious injury can be caused if this pressure is not released before any service is done on the hydraulic system.

Make sure all of the attachments have been lowered, oil is cool before removing any components or lines. Remove the oil filler cap only when the engine is stopped, and the filler cap is cool enough to touch with your bare hand.

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 any component containing fluids.

Refer to Special Publication, PERJ1017, "Dealer Service Tool Catalog" for tools and supplies suitable to collect and contain fluids on Cat® products.

Dispose of all fluids according to local regulations and mandates.

Note: Permit only one operator on the machine. Keep all other personnel away from the machine or in view of the operator.

1. Park the machine on a dry, level, solid surface that is free of any debris.

Note: The surface must be solid enough to support the weight of the machine and any tooling that is used to support the machine.

2. Engage the parking brake. Place wheel blocks in front and behind the wheels or tracks.
3. Lower all work tools to the ground.
4. Stop the engine.

5. Release the pressure in the hydraulic system. Refer to Operation and Maintenance Manual, "System Pressure Release" for more information.

Perform a visual inspection first. If the visual checks are completed but the problem has not been identified, perform operational checks. If the problem has not been identified, perform instrument tests. This procedure will help to identify system problems.

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Service Interval Chart

SMCS Code: 7000

The service interval chart is inside the battery compartment door on the left side of the machine.

Refer to the Operation and Maintenance Manual, "Maintenance Interval Schedule" for the correct maintenance intervals and procedures that are specific to your machine.

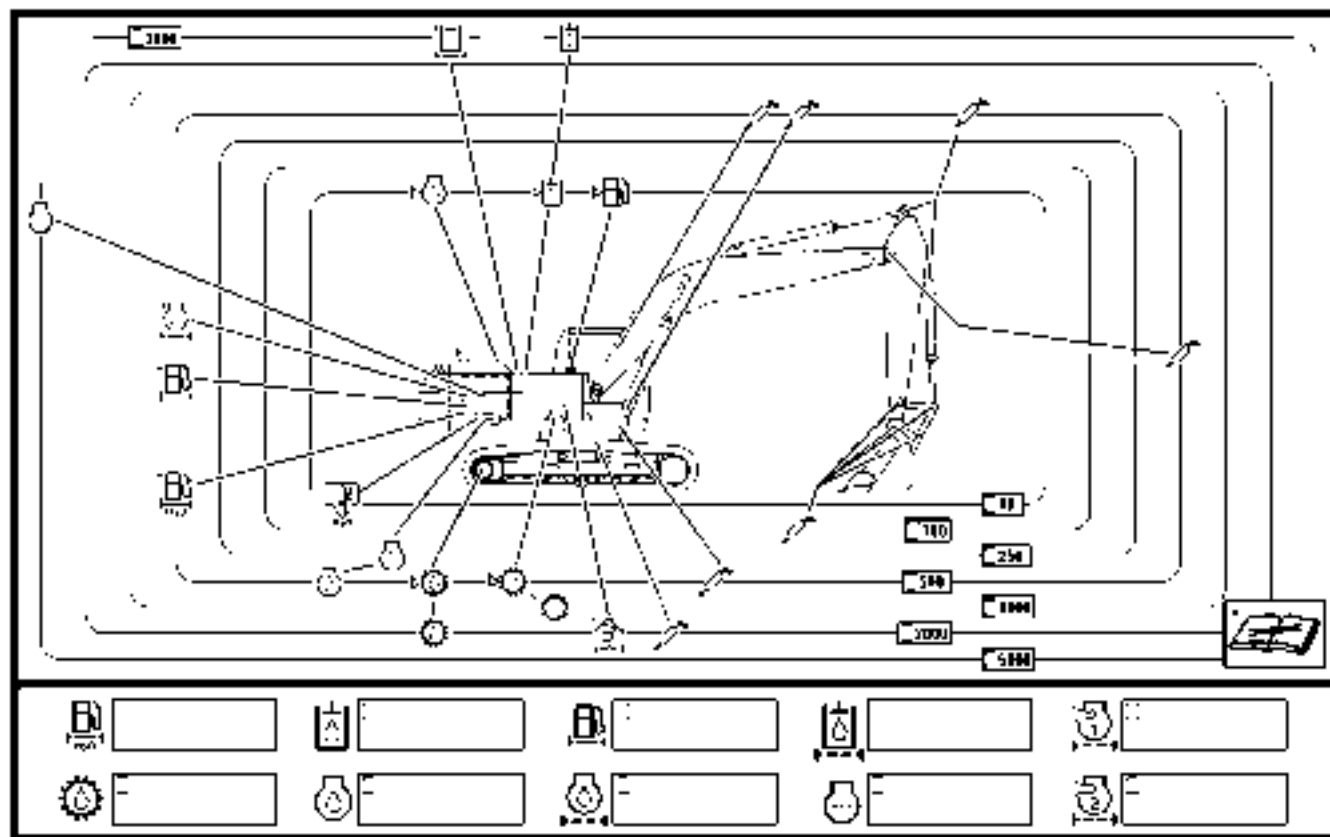


Illustration 450

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	Operation and Maintenance Manual – Refer to the OMM for maintenance instructions and guidelines.		Engine oil filter – Change the engine oil filter.
	Service hour interval – Hourly interval in which a maintenance procedure should be performed.		Final drive oil level – Check the final drive oil level.
	Cooling system coolant – Change the ELC (Extended Life Coolant) .		Final drive oil – Change the final drive oil.
	Engine air filter primary element – Clean or replace the primary air filter element.		Fuel cap filter – Replace the fuel cap filter.
	Engine air filter secondary element – Replace the secondary air filter element.		Fuel level – Check the fuel level.
	Engine oil level – Check the engine oil level.		Fuel system filter – Replace the fuel system filters.
	Engine oil – Change the engine oil.		Fuel system water separator – Drain the water separator.



Fuel system water separator element – Replace the fuel system water separator element.



Fumes Disposal Filter Element – Replace the fumes disposal filter element.



Grease zerk – Lubricate the designated locations.



Hydraulic oil level – Check the hydraulic oil level.



Hydraulic oil – Change the hydraulic oil.



Hydraulic oil filter – Change the hydraulic oil filter.



Swing drive oil level – Check the swing drive oil level.



Swing drive oil – Change the swing drive oil.

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System Pressure Release

SMCS Code: 1250-553-PX; 1300-553-PX; 1350-553-PX; 5050-553-PX; 6700-553-PX; 7540-553-PX

WARNING

Personal injury or death can result from sudden machine movement.

Sudden movement of the machine can cause injury to persons on or near the machine.

To prevent injury or death, make sure that the area around the machine is clear of personnel and obstructions before operating the machine.

Coolant System

WARNING

Pressurized system: Hot coolant can cause serious burn. To open cap, stop engine, wait until radiator is cool. Then loosen cap slowly to relieve the pressure.

To relieve the pressure from the coolant system, turn off the machine. Allow the cooling system pressure cap to cool. Remove the cooling system pressure cap slowly to relieve pressure.

Hydraulic System

The release of hydraulic pressure in a hydraulic circuit is required before service is performed to that hydraulic circuit. Release the pressure in the following hydraulic circuits before any hydraulic lines are disconnected or removed from that hydraulic circuit.

- Boom hydraulic circuit
- Stick hydraulic circuit
- Bucket hydraulic circuit
- Swing hydraulic circuit
- Travel hydraulic circuit
- Attachment hydraulic circuits (if equipped)
- Pilot hydraulic circuit
- Return hydraulic circuit

Note: Refer to the Disassembly and Assembly Manual for additional information concerning service of the components of specific hydraulic circuits.

Release of Hydraulic Pressure from the Main Hydraulic System

WARNING

Personal injury can result from hydraulic oil pressure and hot oil.

Hydraulic oil pressure can remain in the hydraulic system after the engine has been stopped. Serious injury can be caused if this pressure is not released before any service is done on the hydraulic system.

Make sure all of the work tools have been lowered to the ground, and the oil is cool before removing any components or lines. Remove the oil filler cap only when the engine is stopped, and the filler cap is cool enough to touch with your bare hand.

Maintenance Section
System Pressure Release

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 any component containing fluids.

Refer to Special Publication, PERJ1017, "Dealer Service Tool Catalog" for tools and supplies suitable to collect and contain fluids on Cat® products.

Dispose of all fluids according to local regulations and mandates.

Perform the following steps to release the hydraulic system pressure from the main hydraulic system.

Note: For additional safety, wrap hydraulic joint with material that could absorb/reduce any residual pressure of oil when released. Loosen the joint slowly, pause, and carefully check hydraulic joint for tensions indicating presence of pressure or spring force in lines or components.

1. Position the machine on level ground.



Illustration 451

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2. Fully retract the stick cylinder rod. Adjust the position of the bucket so that the bucket is parallel to the ground. Lower the boom until the work tool is flat on the ground. Refer to Illustration 451.

3. Release the system pressure from the implement and swing hydraulic circuits.

Note: Perform Step 3b through Step 3d immediately after the engine is shut off to insure adequate pilot system pressure is available to release the pressure in the hydraulic circuits.

- a. Shut off the engine.
- b. Turn the engine start switch to the ON position without starting the engine.

- c. Place the hydraulic activation control lever in the UNLOCKED position.

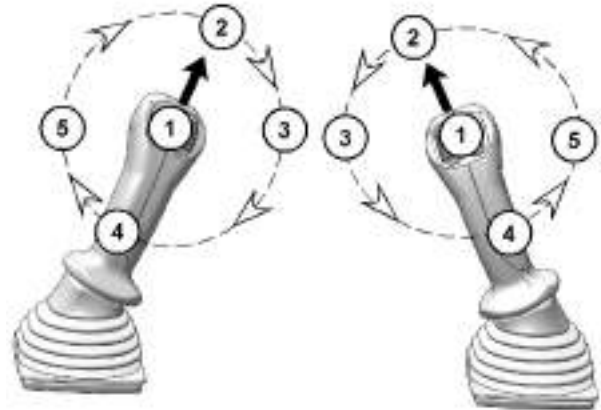


Illustration 452

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- d. Move both joysticks in a circular motion to the FULL STROKE positions multiple times until the pilot accumulator has been exhausted.

Note: Pilot pressure is required to relieve hydraulic system pressure.

- e. Place the hydraulic activation control lever in the LOCKED position.
- f. Start the engine to recharge the pilot accumulator.

Note: Do not activate any controls when recharging the pilot accumulator.

- g. Shut off the engine.
- h. Repeat Step 3b through Step 3g until the high-pressure lines have been released.

Note: Each time the accumulator is recharged, start the joysticks at different positions or rotate in the reverse direction. Doing so will ensure that the same circuit is not being relieved each time.

Note: You can also move only the joysticks or pedals of the hydraulic circuit that requires service to the full stroke positions after moving joysticks in a circular motion multiple times. This action will release the high pressure only in that single hydraulic circuit. This action will also release any pressure that might be present in the pilot hydraulic circuit.

4. Release hydraulic system pressure in the attachment circuits.

- a. Start the engine to charge pilot accumulator.
- b. Shut off the engine.

Note: Perform Step 4c through Step 4e immediately after the engine is shut off to insure adequate pilot system pressure is available to release the pressure in the hydraulic circuits.

- c. Turn the engine start switch to the ON position without starting the engine.
- d. Place the hydraulic activation control lever in the UNLOCKED position.
- e. Activate the switch or pedal for the attachment circuit.
- f. Place the hydraulic activation control lever in the LOCKED position.
- g. Start the engine to recharge pilot accumulator.

Note: Do not activate any controls when recharging pilot accumulator.

- h. Shut off the engine.
 - i. Repeat Step 4c through Step 4f for each attachment circuit.
5. After releasing the hydraulic pressure in each of the desired hydraulic circuits, place the hydraulic activation control lever in the LOCKED position.
6. Turn the engine start switch to the OFF position.

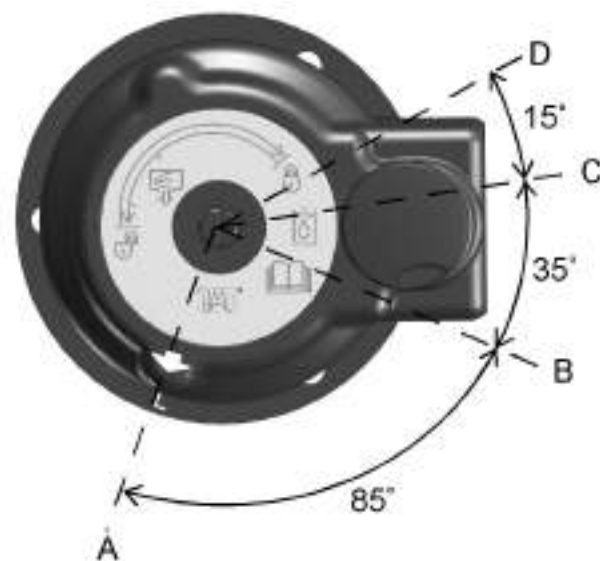


Illustration 453

g06184990

Hydraulic oil tank filler cap

- (A) LOCK position
(B) PRESSURE RELEASE - START position
(C) PRESSURE RELEASE - END position
(D) OPEN position

7. Release the pressure that may be present in the return hydraulic circuit with the following procedure. Refer to Illustration 453 for filler cap positions.

- a. Turn the filler cap counterclockwise and move the arrow from position (A) to position (B).
- b. Release the pressure for a minimum of 45 seconds by moving the arrow from position (B) to position (C).
- c. Push down the filler cap and move the arrow from position (C) to position (D).

Note: The travel hydraulic circuit is open to the hydraulic tank. Pressure from the travel circuit is released by releasing pressure from the return circuit.

8. Release the pressure that may be present in the boom circuit to remove the risk of residual pressure in the line. Make sure that the engine start switch is in the OFF position and the pressure in the hydraulic tank has been released.

- a. Remove the hydraulic oil tank filler cap.
- b. Remove any covers to access the main control valve.

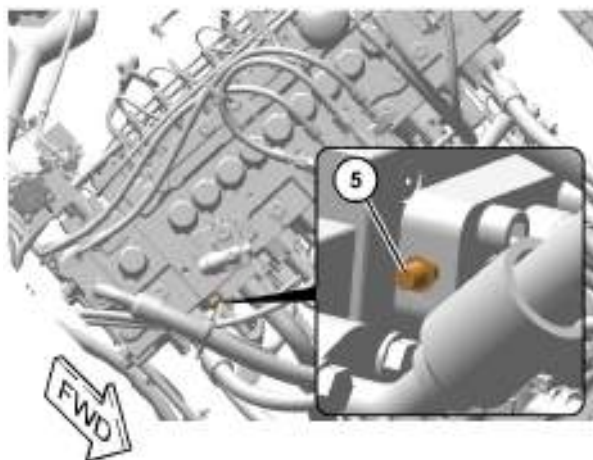


Illustration 454

g06205184

Main control valve

(5) Screw

- c. Use a clean hose of adequate length and size and connect to screw (5). Put the other end of the hose in the filler cap opening.
- d. Slowly loosen screw (5) by a maximum of 1/2 turn. Loosening the screw allows the hydraulic oil in the boom circuit to drain into the hydraulic tank.
- e. Tighten screw (5) to 13 ± 2 N·m (9 ± 1 lb ft).

Note: Refer to the Operation and Maintenance Manual, Equipment Lowering with Engine Stopped for information on lowering the work tool with the engine off.

- f. Disconnect the hose from screw (5). Do not allow the oil that is contained in the hose to spill. Drain the oil into a suitable container.

9. The pressure in the multiple hydraulic circuits that require service is now released and lines and components can be disconnected or removed from those hydraulic circuits.

i07746333

Welding on Machines and Engines with Electronic Controls

SMCS Code: 1000; 7000

Do not weld on any protective structure. If it is necessary to repair a protective structure, contact your Cat dealer.

Proper welding procedures are necessary to avoid damage to the electronic controls and to the bearings. When possible, remove the component that must be welded from the machine or the engine and then weld the component. If you must weld near an electronic control on the machine or the engine, temporarily remove the electronic control to prevent heat related damage. The following steps should be followed to weld on a machine or an engine with electronic controls.

1. Turn off the engine. Place the engine start switch in the OFF position.
2. If equipped, turn the battery disconnect switch to the OFF position. If there is no battery disconnect switch, remove the negative battery cable at the battery.

NOTICE

Do NOT use electrical components (ECM or sensors) or electronic component grounding points for grounding the welder.

3. Clamp the ground cable from the welder to the component that will be welded. Place the clamp as close as possible to the weld. Make sure that the electrical path from the ground cable to the component does not go through any bearing. Use this procedure to reduce the possibility of damage to the following components:
 - Bearings of the drive train
 - Hydraulic components
 - Electrical components
 - Other components of the machine
4. Protect any wiring harnesses and components from the debris and the spatter which is created from welding.

5. Use standard welding procedures to weld the materials together.

i04807435

Severe Service Application

SMCS Code: 1000

An engine which operates outside of normal conditions is operating in a severe service application.

An engine that operates in a severe service application may need more frequent maintenance intervals in order to maximize the following conditions:

- Reliability
- Service life

The number of individual applications cause the impossibility of identifying all of the factors which may contribute to severe service operation. Consult your Caterpillar dealer for the unique maintenance that may be necessary for your engine.

An application is a severe service application if any of the following conditions apply:

Severe Environmental Factors

- Frequent operation in dirty air
- Frequent operation at an altitude which is above 1525 m (5000 ft)
- Frequent operation in ambient temperatures which are above 32° C (90° F)
- Frequent operation in ambient temperatures which are below 0° C (32° F)

Severe Operating Conditions

- Frequent operation with inlet air which has a corrosive content
- Operation with inlet air which has a combustible content
- Operation which is outside of the intended application
- Operation with a plugged fuel filter
- Extended operation at low idle (more than 20% of hours)
- Frequent cold starts at temperatures below 0° C (32° F)

- Frequent dry starts (starting after more than 72 hours of shutdown)
- Frequent hot shutdowns (shutting down the engine without the minimum of 2 minutes to 5 minutes of cool down time)
- Operation above the engine rated speed
- Operation below the peak torque speed
- Operating with fuel which does not meet the standards for distillate diesel fuel as stated in Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations" "Distillate Diesel Fuel"
- Operating with a blend of distillate fuel which contains more than 20 percent biodiesel

Improper Maintenance Procedures (Maintenance Procedures Which May Contribute to a Severe Service Application)

- Inadequate maintenance of fuel storage tanks from causes such as excessive water, sediment, and microorganism growth.
- Extending maintenance intervals beyond the recommended intervals
- Using fluids which are not recommended in Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations"
- Extending maintenance intervals for changing the engine oil and engine coolant without S·O·S validation
- Extending maintenance intervals for changing air filters, oil filters, and fuel filters
- Failure to use a water separator
- Using filters which are not recommended by Special Publication, PEWJ0074, "2008 Cat Filter and Fluid Application Guide"
- Storing the engine for more than 3 months but less than 1 yr (For information about engine storage, refer to Special Publication, SEHS9031, "Storage Procedure for Caterpillar Products")

i08291961

Maintenance Interval Schedule

SMCS Code: 7000

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. All adjustments, the use of proper lubricants, fluids, filters, and the replacement of components due to normal wear and aging are included. 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**, to determine the maintenance intervals. Products that operate in severe operating conditions may require more frequent maintenance. Refer to the maintenance procedure for any other exceptions that may change the maintenance intervals.

Note: The aftertreatment system can be expected to function properly for the useful life of the engine (emissions durability period), as defined by regulation. All prescribed maintenance requirements must be followed.

Note: Before each consecutive interval is performed, all maintenance from the previous interval must be performed.

The following guidelines should be followed if the service hours are not met:

Items listed between 10 and 100 service hours should be performed at least every 3 months.

Items listed between 250 and 500 service hours should be performed at least every 6 months.

Items listed between 1000 service hours and 2500 service hours should be performed at least every year.

When Required

" Air Conditioner/Cab Heater Filter (Recirculation) - Inspect/Replace"	276
" Battery Electrolyte Level - Check"	276
" Battery or Battery Cable - Inspect/Replace"	277
" Bucket Linkage - Inspect/Adjust"	281
" Bucket Tips - Inspect/Replace"	282
" Cab Air Filter (Fresh Air) - Clean/Replace"	288
" Camera - Clean"	289

" Condenser (Refrigerant) - Clean"	290
" DEF Filler Screen - Clean"	296
" Diesel Exhaust Fluid - Drain"	298
" Diesel Exhaust Fluid - Fill"	298
" Engine Air Filter Primary and/or Secondary Element - Replace"	302
" Ether Starting Aid Cylinder - Replace"	313
" Film (Product Identification) - Clean"	314
" Fuel System - Prime"	317
" Fuel Tank Strainer - Clean"	321
" Fuses - Replace"	323
" High Intensity Discharge Lamp (HID) - Replace"	327
" Oil Filter - Inspect"	340
" Radiator, Aftercooler and Oil Cooler Cores - Clean"	341
" Rollover Protective Structure (ROPS) - Inspect"	342
" Track Adjustment - Adjust"	348
" Undercarriage - Check"	351
" Window Washer Reservoir - Fill"	351
" Window Wiper - Inspect/Replace"	352
" Windows - Clean"	352

Every 10 Service Hours or Daily

" Travel Alarm - Test"	350
" Cooling System Coolant Level - Check"	294
" Engine Oil Level - Check"	306
" Fuel System Water Separator - Drain"	320
" Fuel Tank Water and Sediment - Drain"	321
" Hydraulic System Oil Level - Check"	336
" Indicators and Gauges - Test"	338
" Seat Belt - Inspect"	343
" Track Adjustment - Inspect"	350

Every 10 Service Hours or Daily for First 50 Hours

" Boom and Stick Linkage - Lubricate"	279
" Boom and Stick Linkage - Lubricate"	278

" Bucket Linkage - Lubricate" 282

Every 100 Service Hours

" Bucket Linkage - Lubricate" 282

" Oil Filter (Hydraulic Hammer) - Replace" 338

Every 250 Service Hours

" Cooling System Coolant Sample - Obtain" 295

" Engine Oil Sample - Obtain" 308

Initial 500 Service Hours

" Engine Oil and Filter - Change" 308

" Final Drive Oil - Change" 315

" Swing Drive Oil - Change" 344

Initial 500 Hours (for New Systems, Refilled Systems, and Converted Systems)

" Cooling System Coolant Sample - Obtain" 295

Every 500 Service Hours

" Boom and Stick Linkage - Lubricate" 279

" Boom and Stick Linkage - Lubricate" 278

" Engine Oil and Filter - Change" 308

" Final Drive Oil Level - Check" 315

" Final Drive Oil Sample - Obtain" 316

" Hydraulic System Oil Sample - Obtain" 338

" Swing Bearing - Lubricate" 343

" Swing Drive Oil Level - Check" 345

" Swing Drive Oil Sample - Obtain" 346

Every 1000 Service Hours

" Battery - Clean" 276

" Battery Hold-Down - Tighten" 277

" Belt - Inspect/Adjust/Replace" 277

" Engine Oil and Filter - Change" 308

" Fuel System Primary Filter (Water Separator) Element - Replace" 318

" Fuel System Secondary Filter - Replace" 319

" Swing Drive Oil - Change" 344

Every 2000 Service Hours

" Final Drive Oil - Change" 315

" Fuel Cap Filter - Replace" 317

" Fumes Disposal Filter Element - Replace" 322

" Swing Gear - Lubricate" 346

Every Year

" Cooling System Coolant Sample - Obtain" 295

Every 3000 Service Hours

" Hydraulic System Oil Filter (Return) - Replace" 333

Every 3 Years After Date of Installation or Every 5 Years After Date of Manufacture

" Seat Belt - Replace" 343

Every 5000 Service Hours

" Diesel Exhaust Fluid Filter - Replace" 299

" Diesel Exhaust Fluid Injector - Replace" 301

" Receiver Dryer (Refrigerant) - Replace" 342

Every 6000 Service Hours or 3 Years

" Cooling System Coolant Extender (ELC) - Add" 293

" Hydraulic System Oil - Change" 327

Every 10 000 Service Hours

" DEF Manifold Filters - Replace" 298

Every 12 000 Service Hours or 6 Years

" Cooling System Coolant (ELC) - Change" 290

i06954215

Air Conditioner/Cab Heater Filter (Recirculation) - Inspect/Replace

SMCS Code: 1054-040-A/C; 1054-510-A/C

NOTICE

An air recirculation filter element plugged with dust will result in decreased performance and service life to the air conditioner or cab heater.

To prevent decreased performance, clean the filter element, as required.

The air conditioner filter is on the lower left side of the cab behind the seat.

1. Slide the operator seat forward.

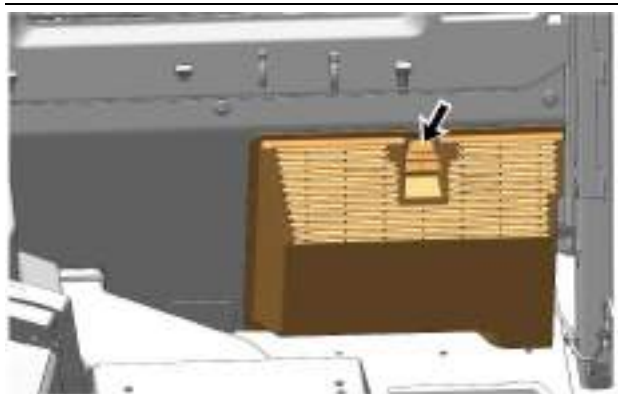


Illustration 455

g06181599

2. Release the cover latch.

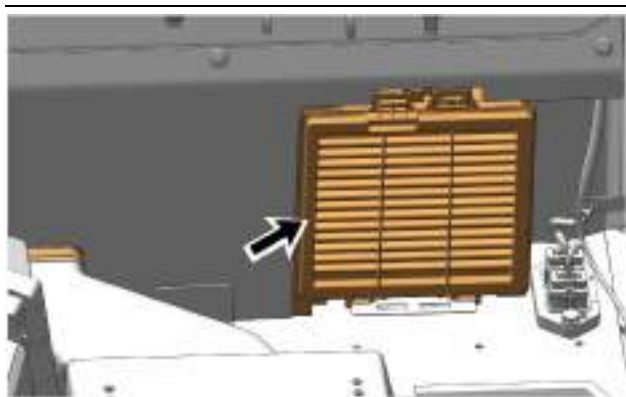


Illustration 456

g06181603

3. Slide the filter element upward.
4. Tap the air filter to remove the dirt. Do not use compressed air to clean the filter.

5. After you clean the filter element, inspect the filter element. If the filter element is damaged or badly contaminated, use a new filter element. Make sure that the filter element is dry.

6. Install the filter element.

7. Install the cover.

NOTICE

Failure to reinstall the filter element for the air conditioning system will contaminate and damage the system components.

i00934864

Battery - Clean

SMCS Code: 1401-070

Clean the battery surface with a clean cloth. Keep the terminals clean and keep the terminals coated with petroleum jelly. Install the post cover after you coat the terminal post with petroleum jelly.

i06019968

Battery Electrolyte Level - Check

SMCS Code: 1401-535-FLV; 1401; 1401-535

WARNING

All lead-acid batteries contain sulfuric acid which can burn the skin and clothing. Always wear a face shield and protective clothing when working on or near batteries.

Note: If the machine is operated in extreme temperatures, check the electrolyte level Every 500 Service Hours or 3 months.

When the engine is not run for long periods of time or when the engine is run for short periods, the batteries may not fully recharge. Ensure a full charge in order to help prevent the battery from freezing.

1. Clean the battery surface with a clean cloth. Clean the terminals and the cable clamps. Coat the clamps and the terminals with silicone lubricant or petroleum jelly. Install the post cover.
2. Inspect the electrolyte level in each battery cell. Maintain the electrolyte level to the bottom of the filler openings. Use distilled water. If distilled water is not available, use clean drinking water.

i00934872

Battery Hold-Down - Tighten

SMCS Code: 7257

Tighten the hold-downs for the battery in order to prevent the batteries from moving during machine operation.

i07592714

Battery or Battery Cable - Inspect/Replace

SMCS Code: 1401; 1401-561; 1401-040; 1401-510; 1402-040; 1402-510



WARNING

Personal injury can result from battery fumes or explosion.

Batteries give off flammable fumes that can explode. Electrolyte is an acid and can cause personal injury if it contacts the skin or eyes.

Prevent sparks near the batteries. Sparks could cause vapors to explode. Do not allow jumper cable ends to contact each other or the engine. Improper jumper cable connections can cause an explosion.

Always wear protective glasses when working with batteries.

1. Turn all the switches to the OFF position. Turn the engine start switch key to the OFF position.
2. Turn the battery disconnect switch to the OFF position. Remove the key.
3. Remove the battery hold-down.

Note: The machine may contain more than one set of batteries.

4. Disconnect the negative battery cable at the battery.
5. Disconnect the positive battery cable at the battery.
6. Disconnect the battery cable at the battery disconnect switch.
7. Inspect the battery terminals for corrosion. Clean the battery terminals and the surfaces of the batteries with a clean cloth.
8. Inspect the battery cables for wear or damage.

9. Make any necessary repairs. If necessary, replace the battery cables and/or the battery.

10. Connect the positive battery cable at the battery.

11. Connect the negative battery cable at the battery.

12. Coat the battery terminals with petroleum jelly to prevent corrosion and install the terminal covers.

13. Reinstall the battery hold-down. Tighten the hold-downs for the battery to prevent the batteries from moving during machine operation.

14. Connect the battery cable at the battery disconnect switch.

15. Install the key and turn the battery disconnect switch ON.

Recycle the Battery

Always recycle a battery. Never discard a battery.

Always return used batteries to one of the following locations:

- A battery supplier
- An authorized battery collection facility
- Recycling facility

i07041934

Belt - Inspect/Adjust/Replace

SMCS Code: 1357-040; 1357-510; 1357-025; 1397-025; 1397-040; 1397-510

Note: This engine is equipped with a belt tightener that automatically adjusts the belt to the correct tension.

1. Unlatch the engine hood and raise the engine hood.

i07531952

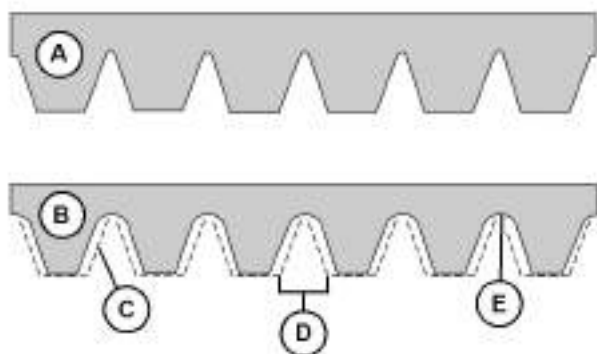


Illustration 457

g06206193

(A) New belt
 (B) Worn belt

2. Inspect the condition of the serpentine belt. Over time the belt ribs will lose material (C). The space between the ribs will increase (D). The loss of material will cause the pulley sheave to contact the belt valley. This will lead to belt slippage and accelerated wear (E). Replace the belt if the belt is worn or frayed.
3. If the belt requires replacement, perform Step 3a through Step 3f.
 - a. Remove the upper fan guard.



Illustration 458

g06206669

- b. Rotate the belt tensioner clockwise to remove the belt.
- c. Remove the belt.
- d. Install a new belt.
- e. Rotate the belt tensioner clockwise to install the belt.
- f. Install the upper fan guard.
- g. Lower the engine hood and latch the engine hood.

Boom and Stick Linkage - Lubricate (VA Boom (If Equipped))

SMCS Code: 6501-086; 6502-086

Note: Caterpillar recommends the use of 5% molybdenum grease for lubricating the boom, and stick linkage. Refer to Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations" for more information on molybdenum grease.

Apply lubricant through all fittings after operation under water.

Wipe all fittings before you apply lubricant.



Illustration 459

g06183509

1. Apply lubricant through the fitting at the base of each boom cylinder.

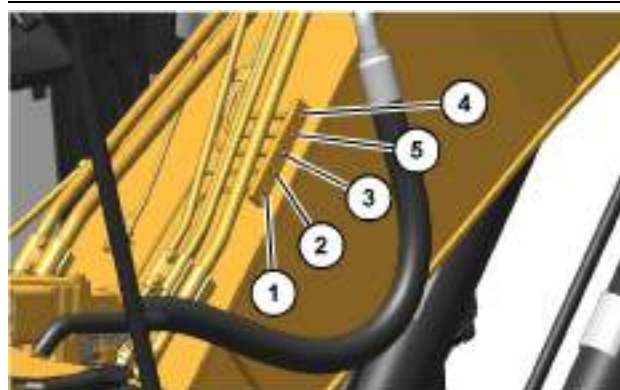


Illustration 460

g06183534

Note: Your machine may have the fittings mounted in a vertical position as shown in the illustration above, or your machine may have the fittings mounted in a horizontal position.

2. The fittings are at the base of the boom. The fittings can be serviced from the platform on the fuel tank. To lubricate the lower boom bearings, apply lubricant through fittings (1) and (2).
3. Apply lubricant through fitting (3) for the head end of the VA boom cylinder.
4. Apply lubricant through fittings (4) and (5) for the boom cylinder rod.

Note: To ensure proper lubrication of the lower boom bearings and of the boom cylinder rod end bearings, lubricant should be applied through fittings (1),(2),(4), and (5). Apply lubricant first when the boom is raised and any attachment is suspended. Then apply lubricant when the boom is lowered and the attachment is rested on the ground with a slight downward pressure.



Illustration 461

g06183854

Typical example

5. Apply lubricant through fitting (6). Fitting (6) is at the connection point of the boom and of the stick.

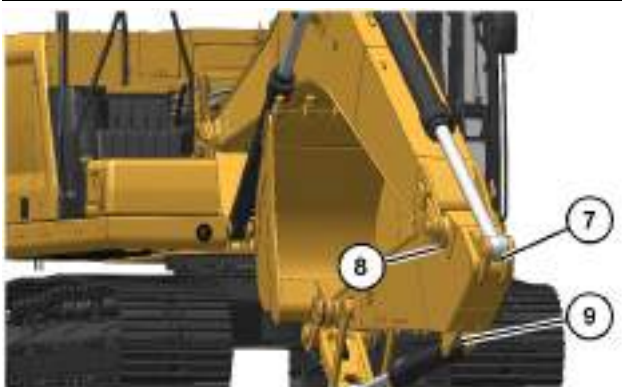


Illustration 462

g06183864

Typical example

6. Apply lubricant through fitting (7) on the stick cylinder rod. Apply lubricant through fitting (8) at the connection point of the boom and of the stick. Apply lubricant through fitting (9) at the bucket cylinder head end.

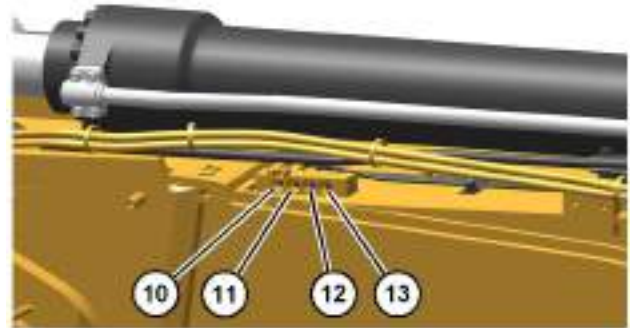


Illustration 463

g06192051

End of fore boom

7. Apply lubricant through fitting (10) and fitting (13) to lubricate the connection point between the stub boom and the fore boom.
8. Apply lubricant through fitting (11) to lubricate the stick cylinder head end.
9. Apply lubricant through fitting (12) to lubricate the rod end of the VA boom cylinder.

i07531958

Boom and Stick Linkage - Lubricate

SMCS Code: 6501-086; 6502-086

Note: Caterpillar recommends the use of 5% molybdenum grease for lubricating the boom, and stick linkage. Refer to Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations" for more information on molybdenum grease.

Apply lubricant through all fittings after operation under water.

Wipe all fittings before you apply lubricant.

Maintenance Section
Boom and Stick Linkage - Lubricate

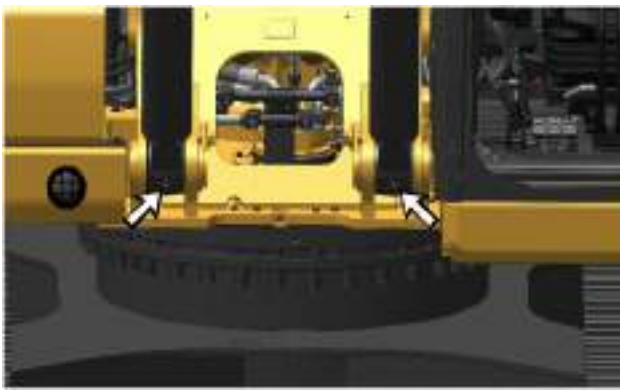


Illustration 464

g06183509

1. Apply lubricant through the fitting at the base of each boom cylinder.



Illustration 466

g06183854

5. Apply lubricant through fitting (6). Fitting (6) is at the connection point of the boom and of the stick.

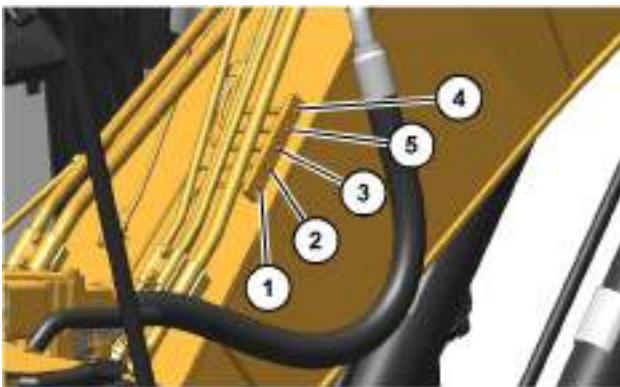


Illustration 465

g06183534

Note: Your machine may have the fittings mounted in a vertical position as shown in the illustration above, or your machine may have the fittings mounted in a horizontal position.

2. The fittings are at the base of the boom. The fittings can be serviced from the platform on the fuel tank. To lubricate the lower boom bearings, apply lubricant through fittings (1) and (2).
3. Apply lubricant through fittings (3) and (4) for the boom cylinder rod.
4. Apply lubricant through fitting (5) for the stick cylinder head.

Note: To ensure proper lubrication of the lower boom bearings and of the boom cylinder rod end bearings, lubricant should be applied through fittings (1), (2), (3), and (4). Apply lubricant first when the boom is raised and any attachment is suspended. Then apply lubricant when the boom is lowered and the attachment is rested on the ground with a slight downward pressure.

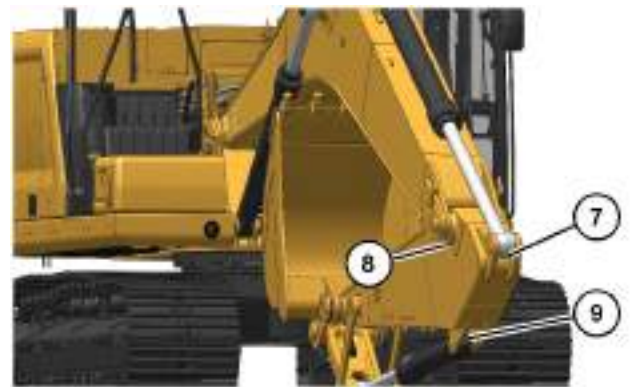


Illustration 467

g06183864

6. Apply lubricant through fitting (7) on the stick cylinder rod. Apply lubricant through fitting (8) at the connection point of the boom and of the stick. Apply lubricant through fitting (9) at the bucket cylinder head end.

i06980273

Bucket Linkage - Inspect/Adjust

SMCS Code: 6513-025; 6513-040

WARNING

Unexpected machine movement can cause injury or death.

To avoid possible machine movement, move the hydraulic lockout control to the LOCKED position and attach a Special Instruction, SEHS7332, "Do Not Operate" or similar warning tag to the hydraulic lockout control.

NOTICE

Improperly adjusted bucket clearance could cause galling on the contact surfaces of the bucket and stick, resulting in excessive noise and/or damaged O-ring seals.



Illustration 468

g06185692

Area for linkage adjustment

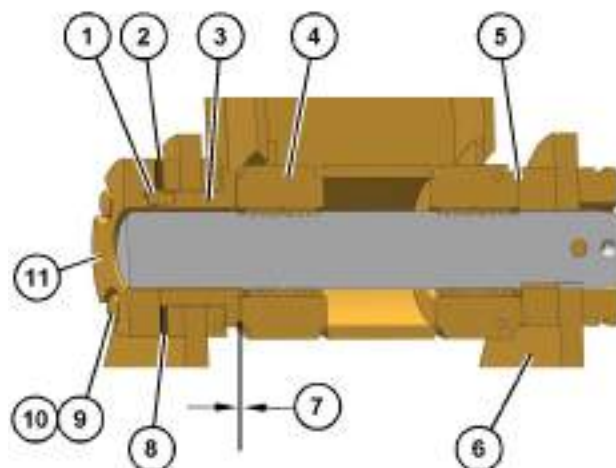


Illustration 469

g06185866

- (1) Pin
- (2) Shims
- (3) Flange
- (4) Stick boss
- (5) No gap
- (6) Bucket boss
- (7) Bucket clearance
- (8) Location
- (9) Bolts
- (10) Washers
- (11) Plate

The clearance of the bucket control linkage on this machine can be adjusted by shimming. If the gap between the bucket and the stick becomes excessive, adjust bucket clearance (7) to 0.5 to 1 mm (0.02 to 0.04 inch).

Two shims of different thickness are used at location (8). The thicknesses of the shims are 0.5 mm (0.02 inch) and 1.0 mm (0.04 inch).

1. Position the machine on a level surface and lower the bucket to the ground.
2. Slowly operate the swing control lever until stick boss (4) and the bucket boss (6) are in full face contact at no gap (5). This will help to determine the total clearance of the connection point of the stick and of the bucket.
3. Move the hydraulic lockout control to the LOCKED position. Stop the engine.
4. Measure bucket clearance (7), which is the existing total clearance.
5. Determine the number of shims that need to be removed from shims (2) by using the following calculation:

Maintenance Section

Bucket Linkage - Lubricate

Subtract 0.5 mm (0.02 inch) or 1.0 mm (0.04 inch) from bucket clearance (7).

6. Remove the appropriate number of shims at location (8) to meet the above thickness. Make sure that you use a minimum of three 0.5 mm (0.02 inch) shims. To remove the shims, remove bolts (9), washers (10), and plate (11).
7. After the correct number of shims has been removed and pin (1) is aligned with the pin hole, install plate (11), bolts (9), and washers (10). Tighten the bolts to 240 ± 40 N·m (175 ± 30 lb ft).
8. After installation, make sure that bucket clearance (7) is still correct.

i06970647

Bucket Linkage - Lubricate

SMCS Code: 6513-086

Note: Caterpillar recommends the use of 5% molybdenum grease for lubricating the bucket linkage. Refer to Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations" for more information on grease.

Wipe all fittings before you apply lubricant.

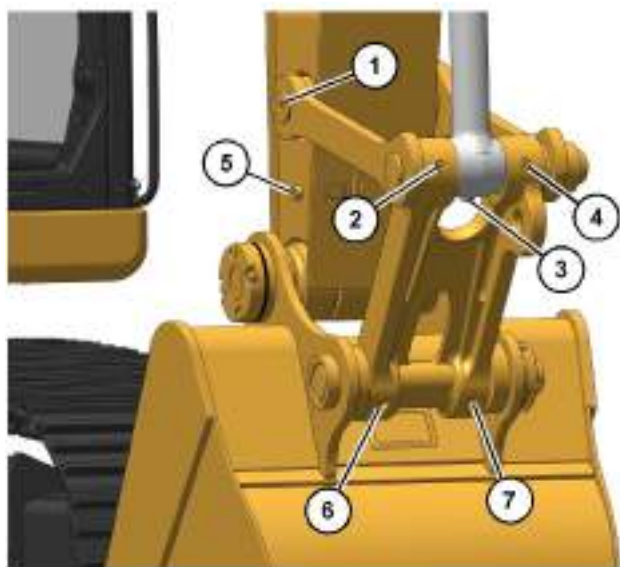


Illustration 470

g06183336

Note: Completely fill all cavities of the bucket control linkage with grease when you initially install a bucket.

1. Apply lubricant through fittings for the linkages (1), (2), (3), and (4).
2. Apply lubricant through fittings for the bucket (5), (6), and (7).

Note: Service the above fittings after you operate the bucket under water.

i08059817

Bucket Tips - Inspect/Replace

SMCS Code: 6805-510; 6805-040



Personal injury or death can result from bucket falling.

Block the bucket before changing bucket tips or side cutters.

K Series GET Drive-through System Bucket Tips

Note: To maximize the life of the bucket tip and the penetration of the bucket tip, the bucket tip can be rotated.



Illustration 471

g01055179

Acceptable wear



Illustration 472

g01055196

Replace this bucket tip.

Check the bucket tips for wear. If the bucket tip has a hole, replace the bucket tip.

Removal Procedure

WARNING

Retainer pin, when struck with force, can fly out and cause injury to nearby people.

Make sure the area is clear of people when driving retainer pins.

To avoid injury to your eyes, wear protective glasses when striking a retainer pin.



Illustration 473

g06528662

- (1) Bucket tip
- (2) Retainer
- (3) Adapter

Note: Retainers are often damaged during the removal process. Caterpillar recommends the installation of a new retainer when bucket tips are rotated or replaced.



Illustration 474

g01054386

Internal view

1. Use a hammer and a punch to drive out the retainer. The retainer can be removed from the top of the bucket tip or from the bottom of the bucket tip.
2. Remove the bucket tip from the adapter with a slight counterclockwise rotation.

Installation Procedure

1. Clean the adapter, if necessary.
2. Install the new bucket tip or the rotated bucket tip onto the adapter with a slight clockwise rotation.

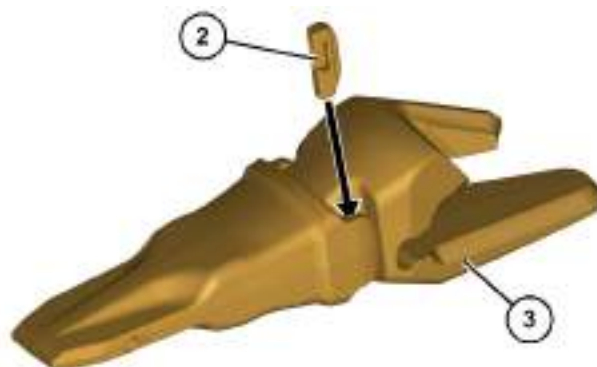


Illustration 475

g06528668

Proper location for installing the retainer

3. The retainer can be installed from the top of the bucket tip or from the bottom of the bucket tip. Use a hammer and a 1 inch X 1 inch X 8 inch steel bar stock to drive retainer (2) into adapter (3).

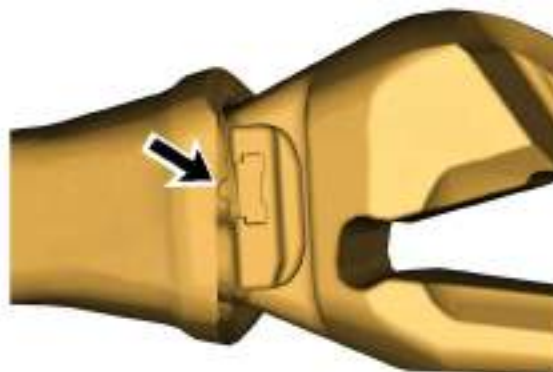


Illustration 476

g06528672

Internal View

The latch of the retainer is properly seated in the recess of the bucket tip.



Illustration 477

g06528674

A properly installed retainer does not extend beyond the ear of the bucket tip.

4. The retainer is properly seated if the retainer can be moved slightly by the technicians hand. If the retainer cannot be moved, adjust the retainer, as needed. The ends of the retainer should not extend beyond the ear of the bucket tip.

J Series GET Bucket Tips

WARNING

Block the bucket before changing the bucket teeth.

To prevent possible injury to the eyes, wear a protective face shield when striking the pin.

The pin, when struck, can fly out and cause injury to nearby personnel.

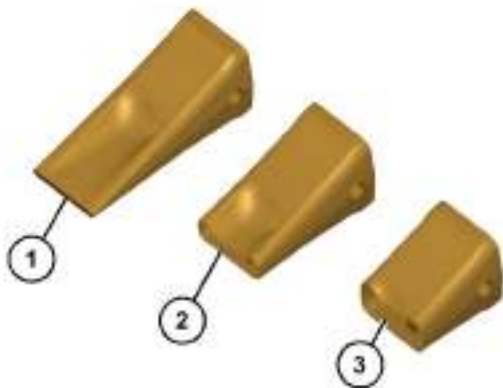


Illustration 478

g06528680

- (1) Usable tip
- (2) Replaceable bucket tip
- (3) Overworn tip

Check the bucket tips for wear. If the bucket tip has a hole, replace the bucket tip.

1. Remove the pin from the bucket tip. The pin can be removed by one of the following methods.

- Use a hammer and a punch from the retainer side of the bucket to drive out the pin.
- Use a Pin-Master. Follow Step 1a through Step 1c for the procedure.

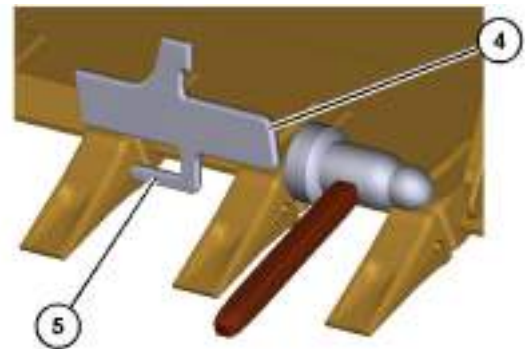


Illustration 479

g06214793

- (4) Back of Pin-Master
- (5) Extractor

- a. Place the Pin-Master on the bucket tip.
- b. Align extractor (5) with the pin.
- c. Strike the Pin-Master at the back of the tool (4) and remove the pin.

Note: Discard the old pin and the retainer assembly. When you change tips, use a new pin and a new retainer assembly. Refer to the appropriate parts manual for your machine.

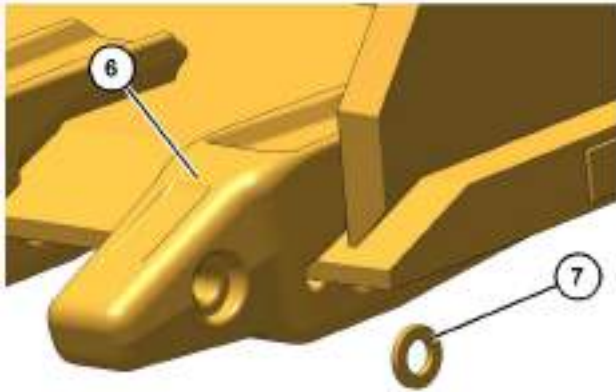


Illustration 480

g06214921

(6) Retainer assembly
(7) Adapter

2. Clean the adapter and the pin.

3. Fit retainer assembly (6) into the counterbore that is in the side of adapter (7). Make sure that the face of the retainer assembly with the marking "OUTSIDE" is visible.



Illustration 481

g06214795

4. Install the new bucket tip onto the adapter.

Note: The bucket tips can be rotated by 180 degrees to allow the tip to wear evenly. You may also move the tips from the outside teeth to the inside teeth. Check the tips often. If wear is present on the tips, rotate the tips. The outside teeth generate the most wear.

5. Drive the pin through the bucket tip. The pin can be installed by using one of the following methods:

- From the same side of the retainer, drive the pin through the bucket tip, the retainer assembly, and the adapter.
- Use a Pin-Master. Follow Step 5a through Step 5e for the procedure.

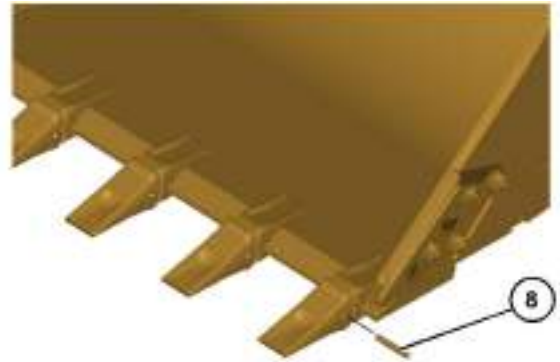


Illustration 482

g06214803

(8) Pin

a. Insert pin (8) through the bucket tip.

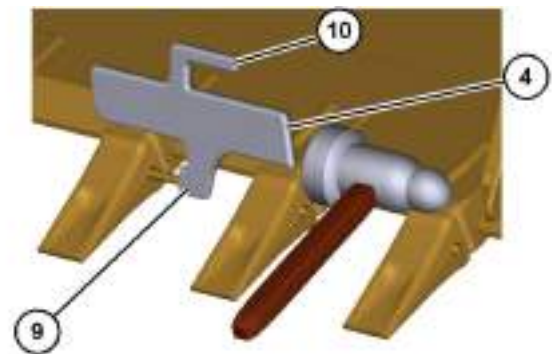


Illustration 483

g06214807

- Place the Pin-Master over the bucket tips so that the pin will fit into the counterbore of the pin holder (9).
- Strike the Pin-Master with a hammer at the back of the tool (4) to insert the pin.
- Slide pin holder (9) away from the pin and rotate the tool slightly to align pin setter (10) with the pin.



Illustration 484

g06214812

Final assembly of pin into bucket tip

- e. Strike the end of the tool until the pin is fully inserted.

Bucket Tips (Cat® Advansys) - If Equipped

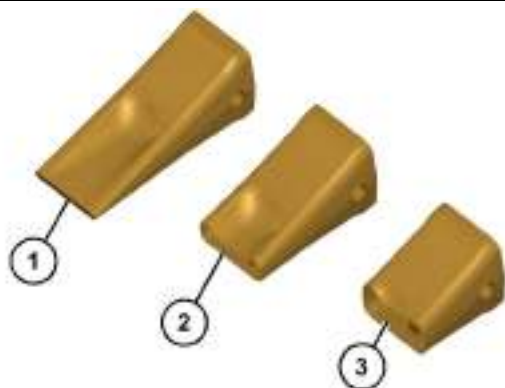


Illustration 485

g06528680

- (1) Usable tip
(2) Replaceable bucket tip
(3) Overworn tip

Check the bucket tips for wear. If the bucket tip has a hole, replace the bucket tip.

Removal

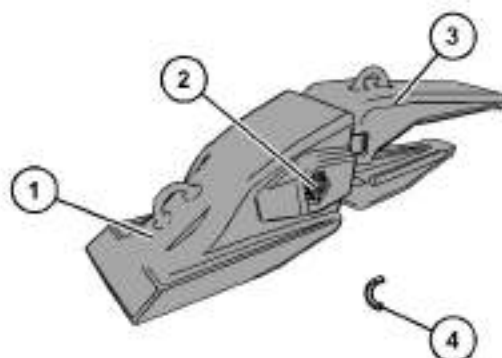


Illustration 486

g06528701

- (1) Bucket Tip
(2) Retainer
(3) Adapter
(4) Compression Sleeve

1. Use a 1/2" ratchet and rotate the retainer (2) 180 degrees to the unlocked position.
2. Remove the bucket tip (1) from adapter (3).
3. Clean adapter (3).

Installation

1. Clean the adapter and the area around the latch, if necessary.
2. Install the new bucket tip (1) onto the adapter (3).

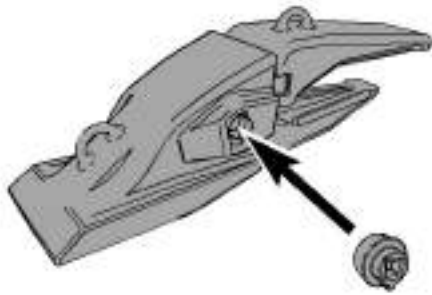


Illustration 487

g06528728

3. Use a 1/2" ratchet to rotate the retainer (2) 180 degrees to the locked position.

Side Cutters

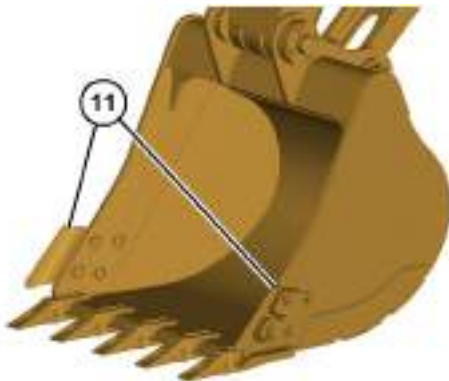


Illustration 488

g06214814

Bucket With Side Cutters

1. Remove the mounting bolts and the side cutters (11).
2. Clean the mounting surface of the side plate on the bucket and of the side cutter. Remove any burrs or protrusions on the mating surfaces.

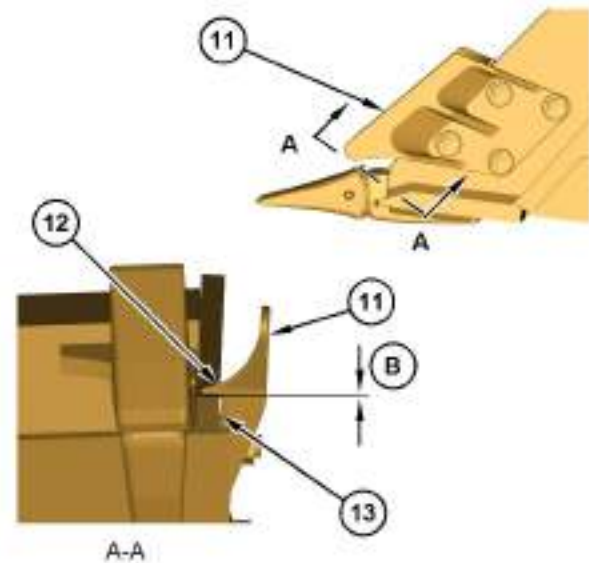


Illustration 489

g06214887

- (12) Shear ledge on a side cutter
(13) Side plate on a bucket
(B) 0.0 mm (0.0 inch)

Note: Some side cutters may be rotated for additional wear.

3. Install the side cutter.

Note: Certain bolts may require thread compound.

4. Hand tighten the bolts.
5. Make sure that there is not a gap between the side plate on the bucket and the shear ledge on the side cutter.
6. Torque the mounting bolts to the correct specification.

Side Protectors (If Equipped)

Inspect the wear of the side protector. When too much wear is present, replace the protector.

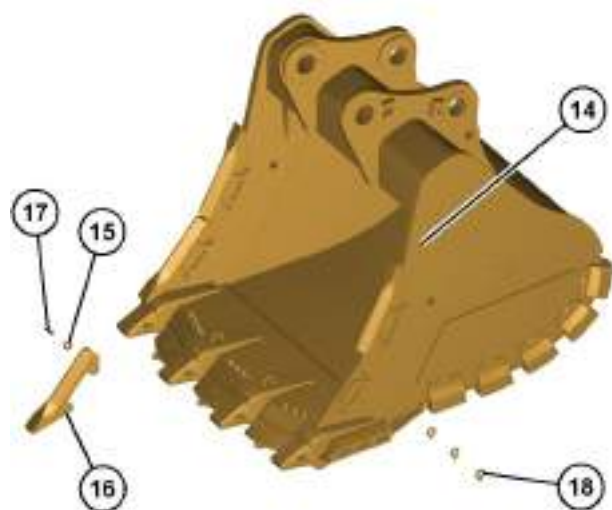


Illustration 490

g06219766

1. Hit pin (17) from the side of the bucket without the retainer to remove side protector (16) from side plate (14).
2. Clean side protector (16), pin (17), retainer (15), and side plate (14) before installation.

Note: Lateral clearance between the side plate and the side protector should not exceed 1 mm (0.04 inch). Shims (18) may be required to decrease the lateral clearance which will decrease movement. Install the shims between the side plate and the side protector on the opposite side of the retainer.

3. Put retainer (15) in side plate (14).
4. Align two pin holes of the new protector and the side plate. Hit the pin from the retainer side of the bucket.

Note: If the pin and/or the retainer are worn, replace the pin and/or the retainer.

i07092323

Cab Air Filter (Fresh Air) - Clean/Replace

SMCS Code: 7342-070; 7342-510

The cab air filter is on the left side of the cab.

1. Use the ignition key to open the access panel.

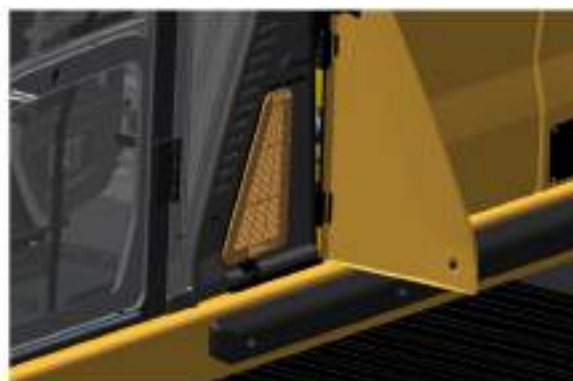


Illustration 492

g06182115

2. Remove air filter (1).
3. Tap the air filter to remove the dirt. Do not use compressed air to clean the filter.
4. After you clean the air filter, inspect the air filter. If the air filter is damaged or badly contaminated, use a new air filter.
5. Install the air filter.
6. Close and lock the access panel.

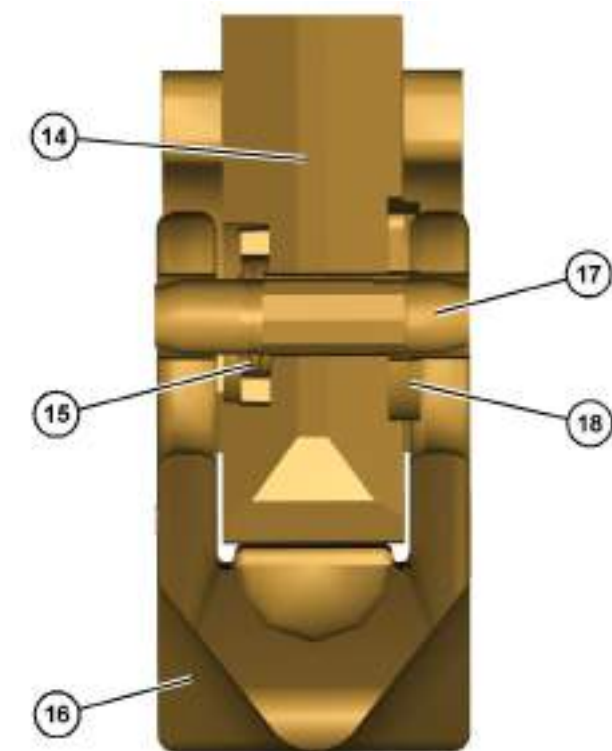


Illustration 491

g06219767

- (14) Side plate
- (15) Retainer
- (16) Side protector
- (17) Pin
- (18) Shim

i07243995

Camera - Clean

SMCS Code: 7348-070

WARNING

Failure to use an appropriate external ladder or an appropriate platform for direct access to the rear view camera could result in slipping and falling which could result in personal injury or death. Be sure to use an appropriate external ladder or an appropriate platform for direct access to the rear view camera.

The machine's counterweight and the engine hood are not approved as a maintenance platforms.

WARNING

Unexpected machine movement can cause injury or death.

In order to avoid possible machine movement, move the hydraulic lockout control to the LOCKED position and attach a Special Instruction, SEHS7332, "Do Not Operate" or similar warning tag to the hydraulic lockout control.

Note: When you access the camera for cleaning, be sure to observe safe procedures for access. Maintain a three-point contact and/or use a body harness.



Illustration 493

g06184579

The rear view camera is on top of the counterweight.

If necessary, use a damp cloth to clean the glass of the camera. The camera is sealed. The camera is not affected by a wash with high-pressure spray.

Note: Alternatively, cameras may be cleaned from ground level by using a wash with a high-pressure spray or a damp rag on a wand.



Illustration 494

g06214504

If equipped, clean the right side view camera.



Illustration 495

g06263435

If equipped, clean the left side view camera.



Illustration 496

g06263449

If equipped, clean the front view camera.

i06969907

Condenser (Refrigerant) - Clean

SMCS Code: 1805-070

NOTICE

If excessively dirty, clean condenser with a brush. To prevent damage or bending of the fins, do not use a stiff brush.

Repair the fins if found defective.



Illustration 497

g06179792

1. Open the access door on the left side of the machine. The condenser is located in front of the radiator.

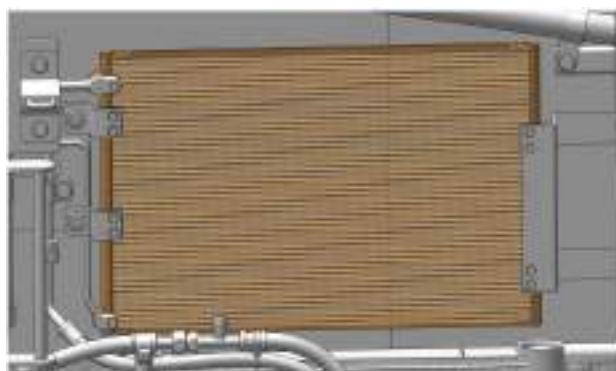


Illustration 498

g06183025

2. Inspect the condenser for debris. Clean the condenser, if necessary.
3. Use clean water to wash off all dust and dirt from the condenser.
4. Close the access door.

i06971000

Cooling System Coolant (ELC) - Change

SMCS Code: 1350-044

WARNING

Engine hood and engine hood parts can be hot while engine is running or immediately after engine shutdown. Hot parts or hot components can cause burns or personal injury. Do not allow these parts to contact your skin, when engine is running or immediately after engine shutdown. Use protective clothing or protective equipment to protect your skin.

WARNING

Personal injury can result from hot coolant, steam and alkali.

At operating temperature, engine coolant is hot and under pressure. The radiator and all lines to heaters or the engine contain hot coolant or steam. Any contact can cause severe burns.

Remove cooling system pressure cap slowly to relieve pressure only when engine is stopped and cooling system pressure cap is cool enough to touch with your bare hand.

Do not attempt to tighten hose connections when the coolant is hot, the hose can come off causing burns.

Cooling System Coolant Additive contains alkali. Avoid contact with skin and eyes.

NOTICE

Do not change the coolant until you read and understand the cooling system information in Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations".

Failure to do so could result in damage to the cooling system components.

NOTICE

Mixing ELC with other products will reduce the effectiveness of the coolant.

This could result in damage to cooling system components.

If Caterpillar products are not available and commercial products must be used, make sure they have passed the Caterpillar EC-1 specification for pre-mixed or concentrate coolants and Caterpillar Extender.

Note: This machine was filled at the factory with Cat Extended Life Coolant.

If the coolant in the machine is changed to Extended Life Coolant from another type of coolant, see Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations".

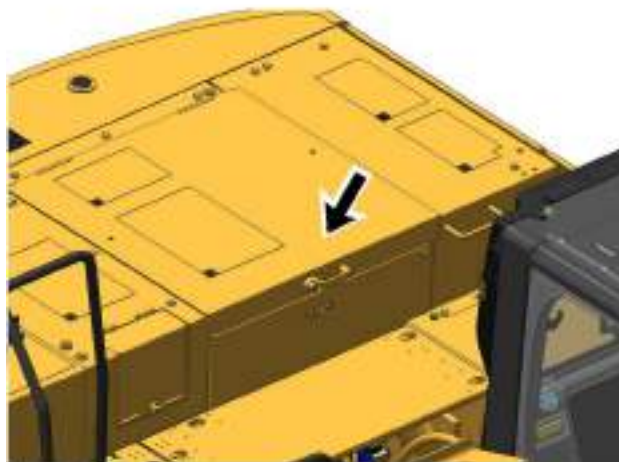


Illustration 499

g06225770

1. Unlatch the engine hood and raise the engine hood.

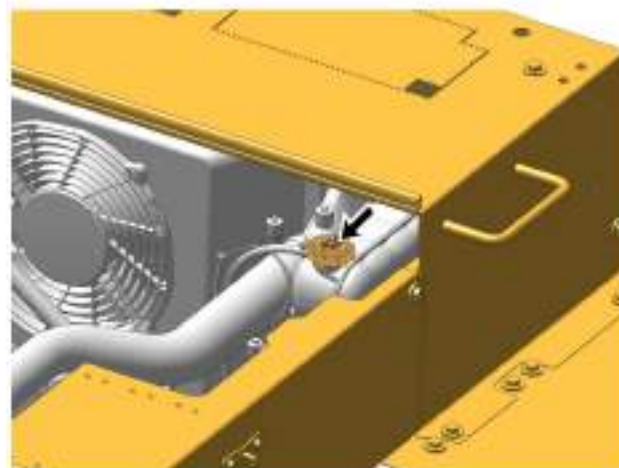


Illustration 500

g06183808

2. Slowly loosen the pressure cap that is on the coolant reservoir to release pressure from the cooling system.
3. Remove the pressure cap.
4. Inspect the gasket on the pressure cap. If the gasket is damaged, replace the pressure cap.

Maintenance Section
Cooling System Coolant (ELC) - Change



Illustration 501

g06179792

5. Open the rear access door on the left side of the machine.

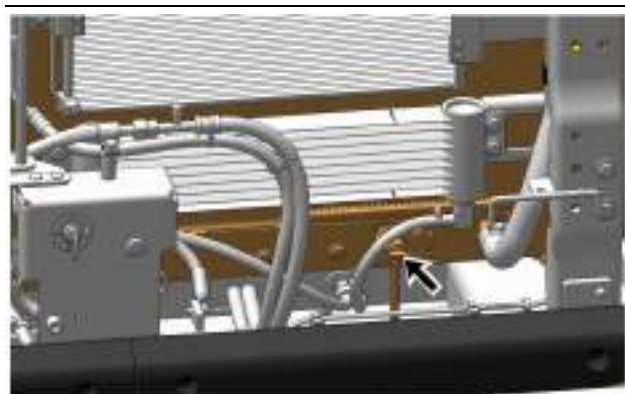


Illustration 502

g06183531

6. Open the drain valve and allow the coolant to drain into a suitable container. The drain valve is on the bottom of the radiator.

Note: Refer to Operation and Maintenance Manual, “General Hazard Information” for information that pertains to containing fluid spillage.

7. Flush the cooling system. Follow Step 7a through Step 7h to flush the cooling system.
- Close the drain valve.
 - Fill the cooling system with clean water.
 - Install the pressure cap.
 - Start the engine and run the engine until the engine reaches operating temperature.
 - Stop the engine and allow the engine to cool.
 - Loosen the pressure cap slowly to relieve any pressure in the cooling system.

- Open the drain valve that is on the bottom of the radiator and allow the coolant to drain into a suitable container.

- Flush the radiator with clean water until the draining water is transparent.

8. Close the drain valve.

9. Add the Extended Life Coolant. Refer to the following topics:

- Special Publication, SEBU6250, “Caterpillar Machine Fluids Recommendations”
- Operation and Maintenance Manual, “Capacities (Refill)”

10. After the cooling system has been filled, perform the following procedures during initial start-up:

- Start the engine without the filler cap.
- Run the engine at low idle for 10 minutes.
- Then, increase the engine speed to a high idle until the water temperature regulator is open and the coolant level is stabilized.
- Maintain the coolant at the proper level as the water temperature regulator opens and air is purged from the system. Refer to Operation and Maintenance Manual, “Cooling System Coolant Level - Check”.

11. Install the cooling system pressure cap.

12. Stop the engine.

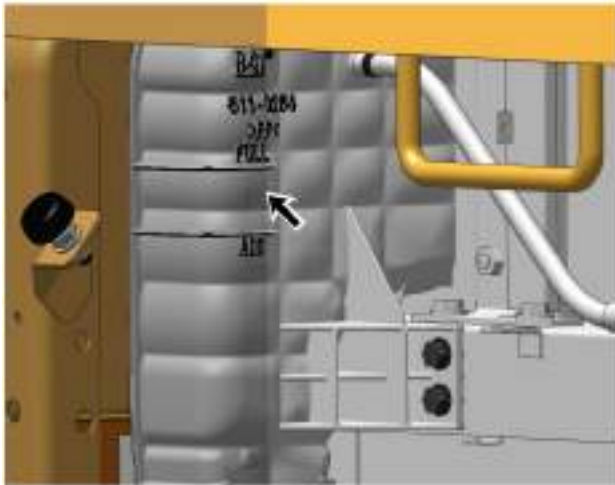


Illustration 503

g06205196

13. Check the coolant reservoir. Maintain the coolant level so that coolant is between the "ADD" and "FULL" lines. If more coolant is needed, see Operation and Maintenance Manual, "Cooling system Coolant Extender (ELC) - Add".
14. If more coolant is necessary, remove the pressure cap and add the appropriate coolant solution.
15. Install the pressure cap.
16. Close and latch the engine hood. Close the left access door.

i06972485

Cooling System Coolant Extender (ELC) - Add

SMCS Code: 1352; 1353; 1395

WARNING

Engine hood and engine hood parts can be hot while engine is running or immediately after engine shutdown. Hot parts or hot components can cause burns or personal injury. Do not allow these parts to contact your skin, when engine is running or immediately after engine shutdown. Use protective clothing or protective equipment to protect your skin.

WARNING

Personal injury can result from hot coolant, steam and alkali.

At operating temperature, engine coolant is hot and under pressure. The radiator and all lines to heaters or the engine contain hot coolant or steam. Any contact can cause severe burns.

Remove cooling system pressure cap slowly to relieve pressure only when engine is stopped and cooling system pressure cap is cool enough to touch with your bare hand.

Do not attempt to tighten hose connections when the coolant is hot, the hose can come off causing burns.

Cooling System Coolant Additive contains alkali. Avoid contact with skin and eyes.

Use Cat Extended Life Coolant (ELC) when you add coolant to the cooling system. See Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations" for all cooling system requirements.

Use a Coolant Conditioner Test Kit to check the concentration of the coolant.

NOTICE

Mixing ELC with other products will reduce the effectiveness of the coolant.

This could result in damage to cooling system components.

If Caterpillar products are not available and commercial products must be used, make sure they have passed the Caterpillar EC-1 specification for pre-mixed or concentrate coolants and Caterpillar Extender.

Note: This machine was filled at the factory with Cat Extended Life Coolant.

1. Park the machine on level ground.
2. Stop the engine.

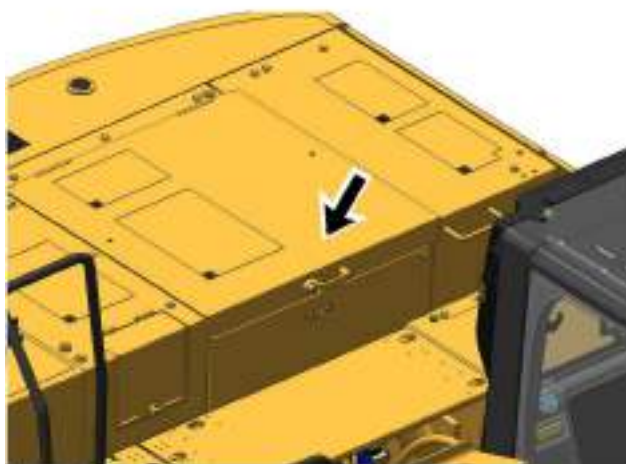


Illustration 504

g06225770

3. Unlatch the engine hood and raise the hood.

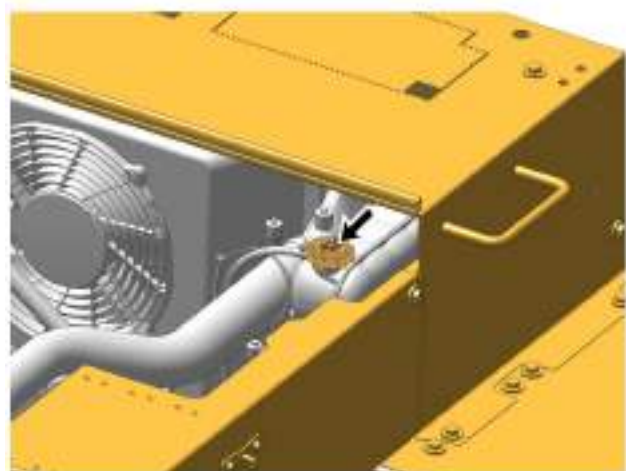


Illustration 505

g06183808

4. Make sure that the cooling system has cooled down. Loosen the cooling system pressure cap slowly to relieve system pressure. Remove the pressure cap.

Note: Refer to Operation and Maintenance Manual, “General Hazard Information” for information on containing fluid spillage.

5. You may need to drain some coolant from the radiator so that Cat Extender can be added to the cooling system.

Note: Always discard drained fluids according to local regulations.

6. Add Cat Extended Life Coolant (ELC) to the cooling system. Refer to the following topics for the proper amount of Cat Extender:

- Special Publication, SEBU6250, “Caterpillar Machine Fluids Recommendations”
- Operation and Maintenance Manual, “Capacities (Refill)”

7. Inspect the o-ring of the cooling system pressure cap. If the o-ring is damaged, replace the pressure cap.

8. Install the cooling system pressure cap.

9. Close and latch the engine hood.

i07038988

Cooling System Coolant Level - Check

SMCS Code: 1350-040; 1350-535-FLV; 1395-535-FLV

WARNING

Engine hood and engine hood parts can be hot while engine is running or immediately after engine shutdown. Hot parts or hot components can cause burns or personal injury. Do not allow these parts to contact your skin, when engine is running or immediately after engine shutdown. Use protective clothing or protective equipment to protect your skin.

⚠ WARNING

Personal injury can result from hot coolant, steam and alkali.

At operating temperature, engine coolant is hot and under pressure. The radiator and all lines to heaters or the engine contain hot coolant or steam. Any contact can cause severe burns.

Remove cooling system pressure cap slowly to relieve pressure only when engine is stopped and cooling system pressure cap is cool enough to touch with your bare hand.

Do not attempt to tighten hose connections when the coolant is hot, the hose can come off causing burns.

Cooling System Coolant Additive contains alkali. Avoid contact with skin and eyes.

1. Park the machine on level ground.
2. Stop the engine.
3. Open the rear access door on the left side of the machine.

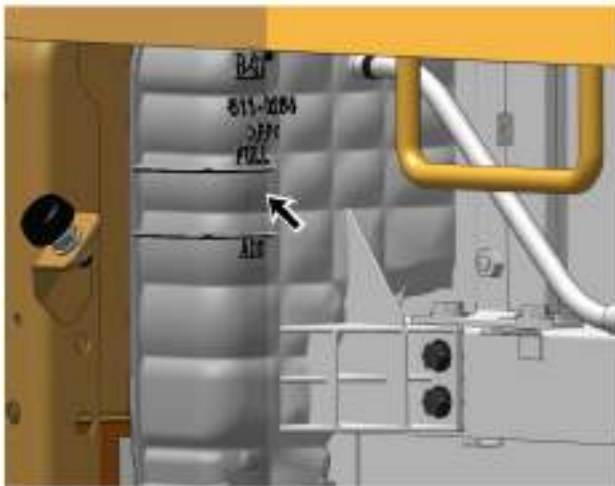


Illustration 506

g06205196

4. Maintain the coolant level so that coolant is between the “ADD” and “FULL” marks. If more coolant is needed, see Operation and Maintenance Manual, “Cooling system Coolant Extender (ELC) - Add”.
5. Close the access door.

Cooling System Coolant Sample - Obtain

SMCS Code: 1395-008; 1395-554

The cooling system coolant should be sampled and monitored with regular frequency. The samples should be analyzed per the following guidelines:

- **Level 1 analysis: Every 250 hours**
- **Level 2 analysis: Every Year**

Note: It is not necessary to obtain a Coolant Sample (Level 1) if the cooling system is filled with Cat ELC (Extended Life Coolant). Cooling systems that are filled with Cat ELC only require Level 2 analysis.

Note: Obtain a Coolant Sample (Level 1) if the cooling system is filled with any other coolant instead of Cat ELC. This includes the following types of coolants.

- Commercial long life coolants that meet the Caterpillar Engine Coolant Specification -1 (Caterpillar EC-1)
- Cat Diesel Engine Antifreeze/Coolant (DEAC)
- Commercial heavy-duty coolant/antifreeze

Note: A level 1 analysis may indicate the need for a Level 2 analysis.

Note: A Level 2 analysis is required after 500 hours of operation for the following reasons:

- The cooling system is new
- The cooling system has been refilled
- The cooling system has been converted to a new coolant

NOTICE

Always use a designated pump for oil sampling, and use a separate designated pump for coolant sampling. Using the same pump for both types of samples may contaminate the samples that are being drawn. This contaminate may cause a false analysis and an incorrect interpretation that could lead to concerns by both dealers and customers.

Maintenance Section
DEF Filler Screen - Clean

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 any component containing fluids.

Refer to Special Publication, PERJ1017, "Dealer Service Tool Catalog" for tools and supplies suitable to collect and contain fluids on Cat® products.

Dispose of all fluids according to local regulations and mandates.



Illustration 507

g06179792

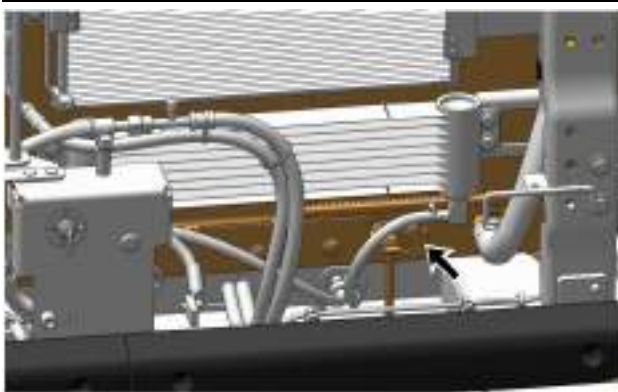


Illustration 508

g06183525

The coolant sampling port is on the radiator.

Obtain the sample of the coolant as close as possible to the recommended sampling interval. To receive the full effect of S·O·S analysis, a consistent trend of data must be established. To establish a pertinent history of data, perform consistent samplings that are evenly spaced. Supplies for collecting samples can be obtained from your Cat dealer.

Use the following guidelines for proper sampling of the coolant:

- Complete the information on the label for the sampling bottle before you begin to take the samples.
- Keep the unused sampling bottles stored in plastic bags.
- Obtain coolant samples directly from the coolant sample port. You should not obtain the samples from any other location.
- Keep the lids on empty sampling bottles until you are ready to collect the sample.
- Place the sample in the mailing tube immediately after obtaining the sample to avoid contamination.
- Never collect samples from expansion bottles.
- Never collect samples from the drain for a system.

Submit the sample for the appropriate analysis.

For additional information about coolant analysis, see Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations" or consult your Cat dealer.

i06970259

DEF Filler Screen - Clean

SMCS Code: 108K-070-Z3

NOTICE

Ensure that the engine is stopped before any servicing or repair is performed.

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 any component containing fluids.

Refer to Special Publication, NENG2500, "Cat Dealer Service Tool Catalog" or refer to Special Publication, PECJ0003, "Cat Shop Supplies and Tools Catalog" for tools and supplies suitable to collect and contain fluids on Cat products.

Dispose of all fluids according to local regulations and mandates.

The filler neck adapter filter screen in the diesel exhaust fluid tank will need to be cleaned or replaced if contaminated.



Illustration 509

g06183098

1. Open the Diesel Exhaust Fluid (DEF) compartment.

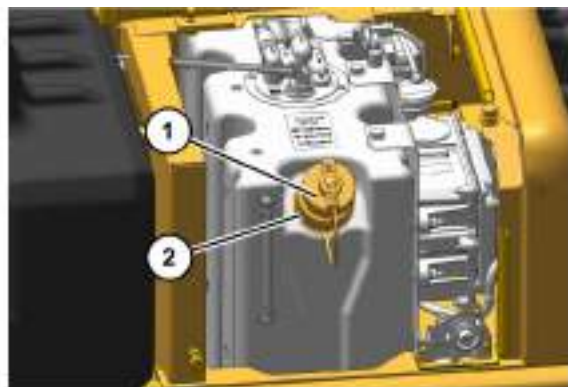


Illustration 510

g06183119

2. Remove fill cap (1).
3. Use a screwdriver or pick to press the tabs on the strainer. Pull the strainer upward from both sides of fill neck adapter (2).



Illustration 511

g06183125

4. Use water or compressed air to clean out the filter screen (3). If there is any debris inside, dry and remove the debris by turning the screen upside down and dumping debris out. If the debris cannot be removed or if the filter screen is damaged, replace the filter screen.

i06970250

DEF Manifold Filters - Replace

SMCS Code: 108K-510-FI



Illustration 512

g06183110

Replace the manifold filter (1). Refer to Disassembly and Assembly, "Manifold (DEF Heater) - Remove and Install" for more information.

i08258668

Diesel Exhaust Fluid - Drain

SMCS Code: 108K-543

NOTICE

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

Dispose of all fluids according to local regulations and mandates.

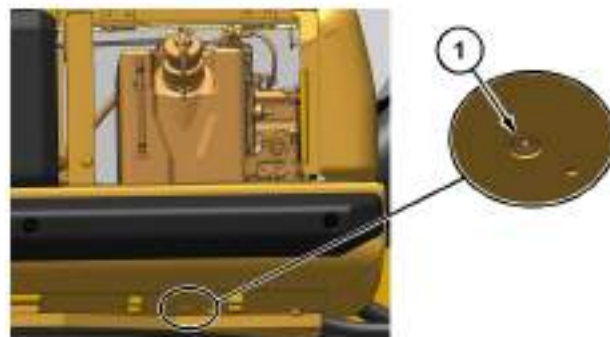


Illustration 513

g06604316

(1) Drain plug

1. Remove drain plug (1).
2. Drain the diesel exhaust fluid into a suitable container.
3. Install and tighten the drain plug to a torque of $20 \pm 3 \text{ N}\cdot\text{m}$ ($177 \pm 26 \text{ lb in}$).

i07391329

Diesel Exhaust Fluid - Fill

SMCS Code: 108K-544

Note: Stop the engine and turn the engine start switch to the OFF position before filling the DEF tank. Failure to stop the engine may cause fault codes.

Refer to Operation and Maintenance Manual, "Selective Catalytic Reduction Warning System" for more information.

NOTICE

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

Dispose of all fluids according to local regulations and mandates.

Reference: See Operation and Maintenance Manual, "Capacities (Refill)" for the capacity of the DEF tank for your machine.



Illustration 514

g06183098

The DEF tank is located inside the storage box on the right side of the machine.

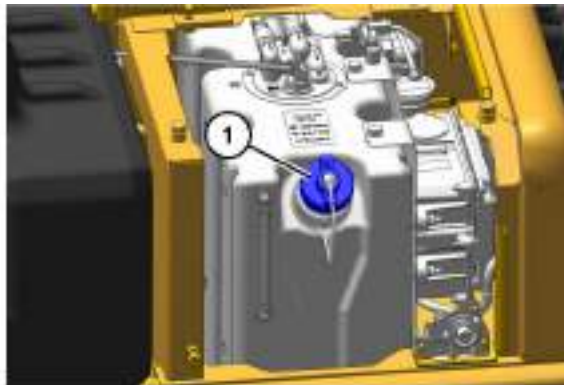


Illustration 515

g06306032



Illustration 516

g06306029

Blue DEF Tank Filler Cap

1. Clean the blue DEF tank filler cap and the surrounding area.
2. Remove the blue DEF tank filler cap.

3. Fill the tank with diesel exhaust fluid (DEF). DEF level gauge is located on the front side of DEF tank.

Note: Do not fill the DEF tank from a contaminated container or funnel.

Note: Do not over fill the tank. DEF can freeze and needs room for expansion.

4. Install the blue DEF tank filler cap.

Refer to Operation and Maintenance Manual, "Lubricant Viscosities" for more information on diesel exhaust fluid (DEF) guidelines.

i07942258

Diesel Exhaust Fluid Filter - Replace

SMCS Code: 108K-510-FI



Illustration 517

g06183098

1. Open the Diesel Exhaust Fluid (DEF) compartment.

Maintenance Section
Diesel Exhaust Fluid Filter - Replace



Illustration 518

g06210724

For clarity, the DEF assembly has been removed from the compartment.

2. Ensure that the area around the DEF filter is clean and free from dirt.

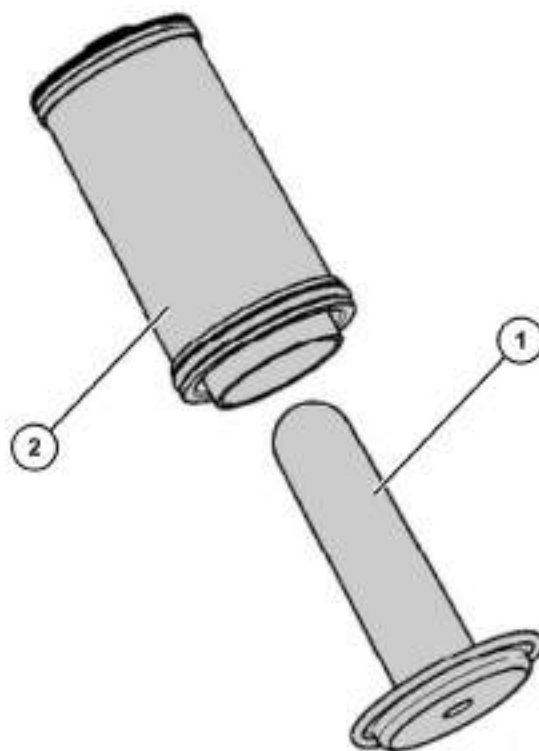


Illustration 519

g06216533

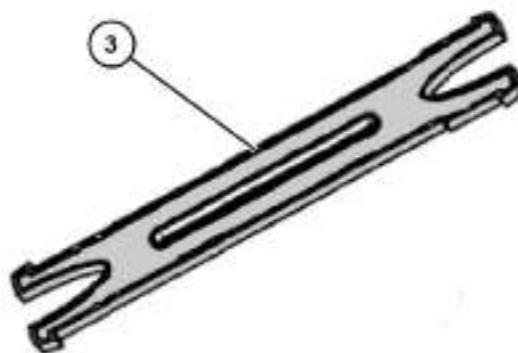


Illustration 520

g06216531

3. Unscrew the cap, remove expansion device (1) from DEF filter (2). Then, remove the DEF filter using special tool (3) that comes with the new filter. Discard the old filter and expansion device.
4. Install a new DEF filter assembly into the DEF pump housing.
5. Tighten the filter cap to $20 \pm 5 \text{ N}\cdot\text{m}$ ($15 \pm 4 \text{ lb ft}$).
6. Turning on the power will automatically prime the DEF system.

i07942263

Diesel Exhaust Fluid Injector - Replace

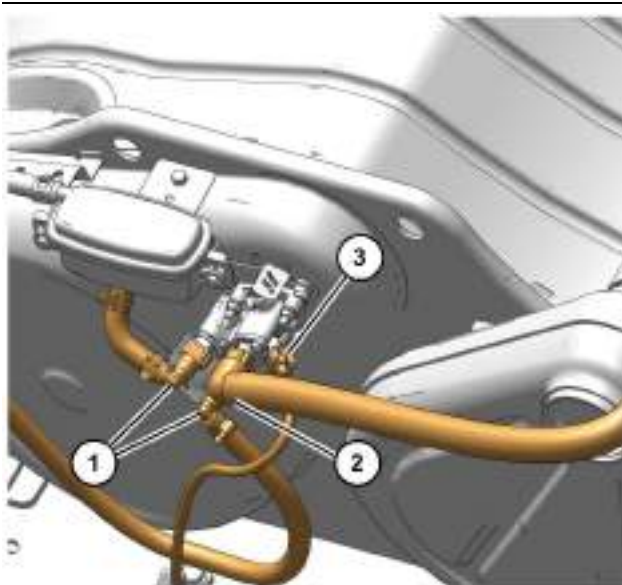
SMCS Code: 108I-510

Illustration 521

g06226112

Typical example

- (1) Coolant lines
- (2) DEF line
- (3) Electrical connector

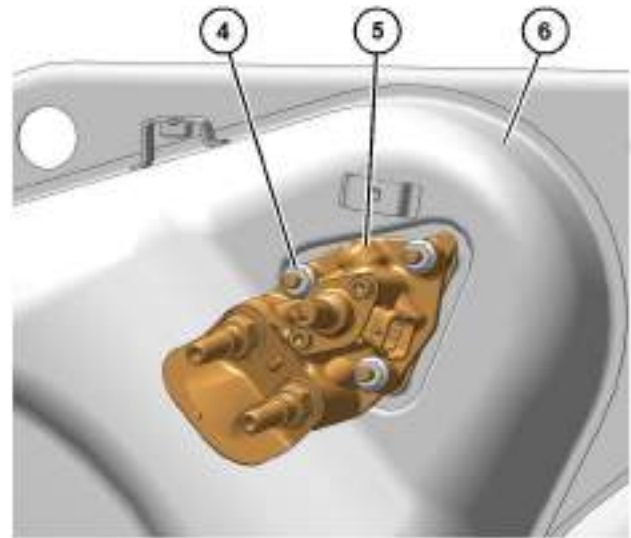


Illustration 522

g06226151

Typical example

- (4) Nuts
- (5) DEF injector
- (6) Clean Emission Module

1. Drain the coolant to remove coolant lines (1). Remove cooling lines (1) and remove Diesel Exhaust Fluid (DEF) line (2).
2. Remove electrical connector (3) from DEF injector (5) and install protection caps to DEF injector (5). Remove nuts (4) and washers (9) from DEF injector (5) and remove DEF injector from Clean Emission Module (CEM) (6).

i08165097

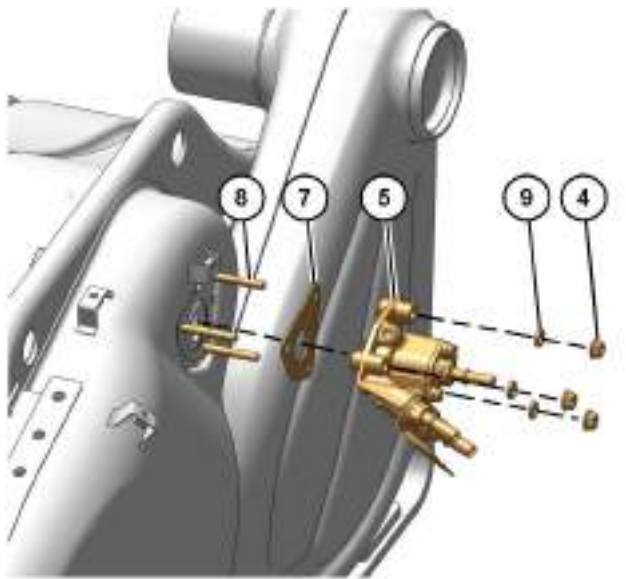


Illustration 523

g06226155

Typical example

- (4) Nuts
- (5) DEF injector
- (7) Gasket
- (8) Studs
- (9) Washers

3. Remove gasket (7) and remove studs (8). Discard the gasket and the studs.
4. Ensure that the sealing face of the CEM is clean and free from dirt.
5. Apply bostik pure nickel ant-seize compound to ends of the new studs (8). Install the coated ends of the new studs into the CEM, and tighten to a torque of 5 N·m (44 lb in).
6. Install new gasket (7), ensure that the metal side of the gasket is to the CEM. Install new DEF injector (5) to CEM (6).
7. Install washers (9) and apply bostik pure nickel ant-seize compound to the threads of studs (8).
8. Install nuts (4) and tighten the nuts to a torque of 5 N·m (44 lb in). Retighten the nuts to 5 N·m (44 lb in). Then, turn the nuts an additional 90 degrees.
9. Install electrical connector (3), DEF line (2), and coolant lines (1).
10. Fill cooling system to the correct level. Ensure that the correct specification of coolant is used.

If available, using the electronic service tool (ET) perform DEF Dosing System Verification test.

Engine Air Filter Primary and/or Secondary Element - Replace

SMCS Code: 1054-510-PY; 1054-510-SE

Primary Air Filter Element - Replace

NOTICE

Service the air cleaner only with the engine stopped. Engine damage could result.

NOTICE

Service the engine air filter elements only when a message or a warning is displayed on the monitor display. Do not open the filter compartment unless service is indicated. Opening the filter compartment when not necessary to do so increases the chance of dirt contamination in engine air intake system components.

NOTICE

Short air filter life can result if the pre-cleaner system malfunctions. If air filter life is drastically reduced from typical for the operating conditions, consult your Cat dealer.

NOTICE

Do not use the air filter elements longer than 1 year.

The engine air cleaner assembly is located behind the front access door on the left side of the machine.

1. Park the machine on a level surface. Stop the engine.



Illustration 524

g06181546

2. Open the front access door on the left side of the machine.

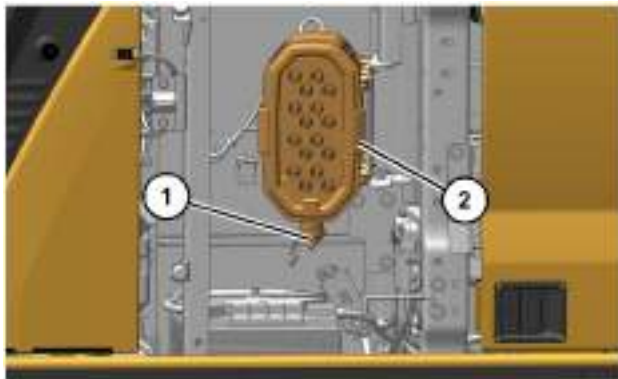


Illustration 525

g06183302

3. Squeeze outlet tube (1) to purge the dirt from the outlet tube.

Note: Purge the dirt from the outlet tube every 10 service hours or daily in a dirty environment.

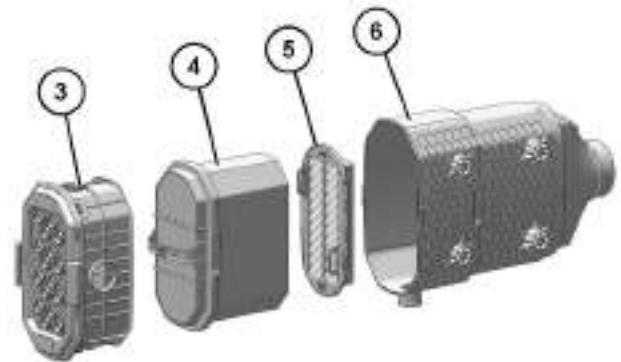


Illustration 526

g06222467

4. Release latches (2) that secure pre-cleaner (3) to engine air filter housing (6).
5. Remove pre-cleaner (3).
6. Clean inside the air filter housing where the pre-cleaner was removed.

NOTICE

Caterpillar does not recommend cleaning the primary air filter element. Caterpillar only recommends to replace the primary air filter element. Caterpillar does not cover costs for damage to engine components caused by cleaning the primary air filter element.

Observe the following guidelines if you attempt to clean the primary filter element:

Do not tap or strike the filter element in order to remove dust.

Do not wash the filter element.

Use low pressure compressed air in order to remove the dust from the filter element. Air pressure must not exceed 500 kPa (73 psi). Direct the air flow up the pleats and down the pleats from the inside of the filter element. Take extreme care in order to avoid damage to the pleats.

Do not clean the air filter element more than three times. The air filter element must be replaced if the filter has been in use for one year, regardless of the number of times the filter has been cleaned.

Do not use air filters with damaged pleats, gaskets, or seals. Dirt entering the engine will cause damage to engine components.

NOTICE

Do not clean the air filter elements by bumping or tapping. This could damage the seals. Do not use elements with damaged pleats, gaskets, or seals. Damaged elements will allow dirt to pass through. Engine damage could result.

Maintenance Section

Engine Air Filter Primary and/or Secondary Element - Replace

7. Remove primary air filter element (4). Replace the filter element as necessary.

Note: Replace the primary filter if the filter has been in use for 1 year.

8. Clean inside the air filter assembly housing.

Note: Do not allow any dirt or debris to contact the secondary air filter element (5).

9. Inspect the seal area ensure that no foreign debris has fallen into the seal area. Clean the air cleaner interior to remove remaining dust or debris

10. Without removing secondary air filter element (5), inspect the filter element for damage. Replace if necessary or dirty. Refer to Secondary Air Filter Element - Replace.

11. Install the secondary air filter element.

12. Install the primary filter.

Note: Filters must be fully installed before the pre-cleaner can be attached. If the pre-cleaner cannot be fully latched, verify that the filter elements are properly seated.

13. Install the pre-cleaner and secure the latches that hold the pre-cleaner to the air filter housing.

14. Close the access door.

Secondary Air Filter Element - Replace

NOTICE

Always replace the secondary element. Do not attempt to reuse it by cleaning. Engine damage could result.

NOTICE

Do not use the air filter elements longer than 1 year.

NOTICE

Replace the secondary filter element when you service the primary element for the third time. If a clean primary element has been installed and the filter element indicator is still flashing, replace the secondary filter element. Also if the exhaust smoke remains black and a clean primary filter element has been installed, replace the secondary filter element.

1. Open the front access door on the left side of the machine.

2. Refer to the section "Primary Air Filter Element - Replace". Remove the pre-cleaner from the engine air filter housing. Remove the primary air filter element from the air filter housing.

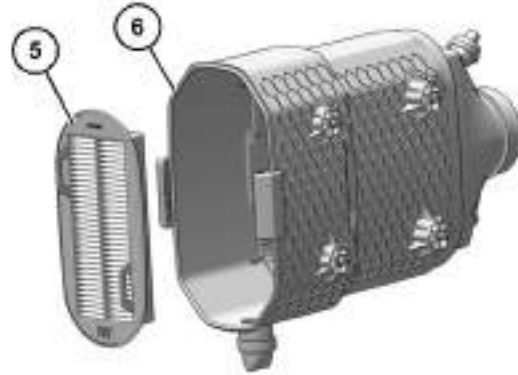


Illustration 527

g06183315

3. Secondary air filter element (5) is pressed into the rear portion of engine air filter housing (6). Pull forward on the secondary air filter element to remove the element from the engine air filter housing.
4. Cover the air inlet opening. Clean inside the air cleaner housing.
5. Clean all surfaces of the pre-cleaner cover and body.
6. Uncover the air inlet opening.
7. Carefully press the secondary air filter element into the rear portion of the engine air filter housing.

Note: Be certain that the new secondary air filter element is properly seated in the filter housing. Also, check to see that no damage to the filter element has occurred during installation.

8. Install the primary air filter element and the pre-cleaner.

9. Close the access door.

Engine Air Pre-Cleaner - Clean

Note: Do not attempt to clean the pre-cleaner by hitting the filter against another object. Damage to the filter is likely to occur.



Illustration 528

g06183310

After removing the pre-cleaner from the air filter housing, inspect the interior of the pre-cleaner through the ejection ports around the perimeter.

In general, dust and debris will clear automatically through normal pre-cleaner operation and no further service will be required.

If the ejection ports are blocked, or dust is packed between the pre-cleaner tubes, first try to clear any accumulation by vigorously shaking the pre-cleaner.

If the pre-cleaner is still blocked with dirt, the pre-cleaner may be separated by releasing the snap features holding the front cover to the pre-cleaner body.



Illustration 529

g06069263

1. Place the pre-cleaner assembly on a suitable work surface. The interior of the pre-cleaner may have accumulated debris. Protect your work surface to collect excess debris and to avoid scattering debris.



Illustration 530

g06069266

2. Lift the locking tabs on one end of the cover away from the retainers. Move the locking tabs only far enough to clear the retention posts.

Note: Do not bend the locking tabs farther than necessary to release the tabs. Damage to the air cleaner can result. Do not use tools to force the snap features off the retainers.

3. Pull one end of the top cover away from the bottom half.
4. Hold one end of the cover sections apart and separate one of the locking tabs on the other end of the pre-cleaner.



Illustration 531

g06069264

5. Pull the top cover up and away from the bottom.
6. Clear any blockage by shaking the pre-cleaner components and/or brushing away accumulated debris.

Note: Do not use picks or other stiff implements to clear debris, you may damage the pre-cleaner components

Note: Do not attempt to remove the pre-cleaner tubes from the top cover or you will damage the air cleaner.

7. If the blockage is still not cleared, you may attempt to clear the debris by use of an air nozzle limited to 500 kPa (73 psi).

Alternately, each part of the pre-cleaner may be submerged in water to loosen mud or other debris that may have dried on the interior surface of the air cleaner.

Note: Never attempt to use a pressure washer or other high-pressure water sources to clean the pre-cleaner. Use of high-pressure water may damage the pre-cleaner tubes and reduce the pre-cleaner effectiveness.

8. After cleaning, reassemble the pre-cleaner by lining up the tubes on the pre-cleaner top with the tubes in the pre-cleaner bottom.
9. Allow the pre-cleaner top to rest on the pre-cleaner bottom and ensure that the four snap features are aligned.



Illustration 532

g06069247

10. If all the tabs are aligned, gently push the pre-cleaner top down into place. Ensure that all the snap features have engaged.

11. Before installing the pre-cleaner to the air filter housing, inspect the pre-cleaner gasket for damage. Replace if damaged.

i06970869

Engine Oil Level - Check

SMCS Code: 1000-535

WARNING

Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact skin.

NOTICE

Do not overfill the crankcase. Engine damage can result.

This machine is equipped with both an automated function for checking fluid levels and dipsticks. Refer to Operation and Maintenance Manual, "Monitoring System" regarding the automated system. If the machine is on an incline or the engine has been stopped only for a short time, all engine oil may not be in the crankcase. The fluid level cannot be properly checked by either method during these instances. Park the machine on level ground. The engine oil level can be checked after the engine has been stopped for at least 30 minutes. Do not check the oil level while the engine is running.

The machine is equipped with a ground level dipstick and a dipstick on top of the engine.

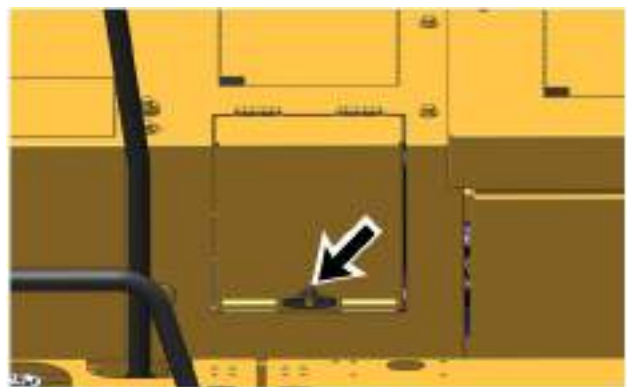


Illustration 533

g06183460

1. Open the access door on top of the machine.

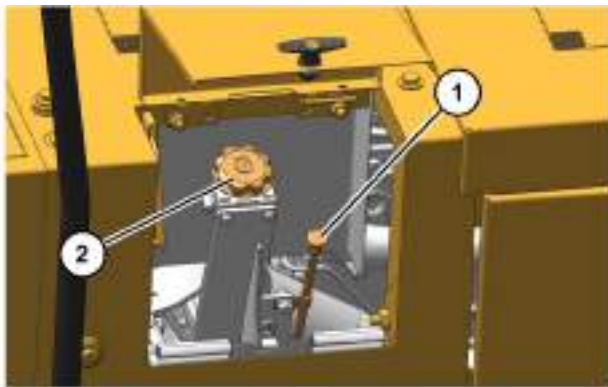


Illustration 534

g06183463

2. Remove dipstick (1). Wipe the oil off the dipstick and reinsert the dipstick.



Illustration 535

g06183475

3. Remove the dipstick and check the dipstick. The oil level should be between the "L" mark and the "H" mark.

NOTICE

Operating your engine when the oil level is above the "H" mark could cause the crankshaft to dip into the oil. This could lead to excessively high oil temperatures which can reduce the lubricating characteristics of the oil, lead to bearing damage, and could result in loss of engine power.

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information on Containing Fluid Spillage.

4. Remove oil filler plug (2) to add oil, if necessary.
See Operation and Maintenance Manual, "Lubricant Viscosities".

Note: If the oil is deteriorated or badly contaminated, change the oil regardless of the maintenance interval.

5. Clean the oil filler plug. Install the oil filler plug.
6. Close the access door.

Ground Level Dipstick



Illustration 536

g06182545

To access the ground level dipstick, open the right access door.

i08290580

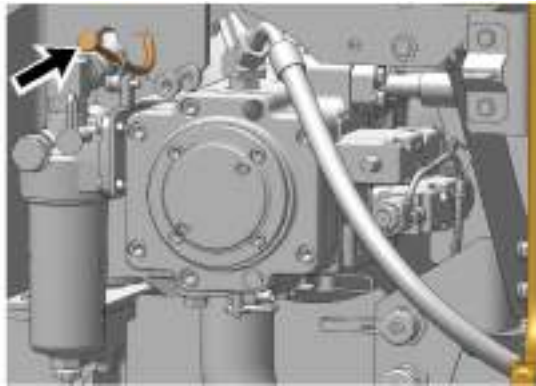


Illustration 537

g06211545

The ground level dipstick is located near the engine oil filter and main hydraulic pump.

i07088417

Engine Oil Sample - Obtain

SMCS Code: 1000-008; 1000; 1348-554-SM; 1348-008; 7542-008; 7542-554-OC; 7542-554-SM

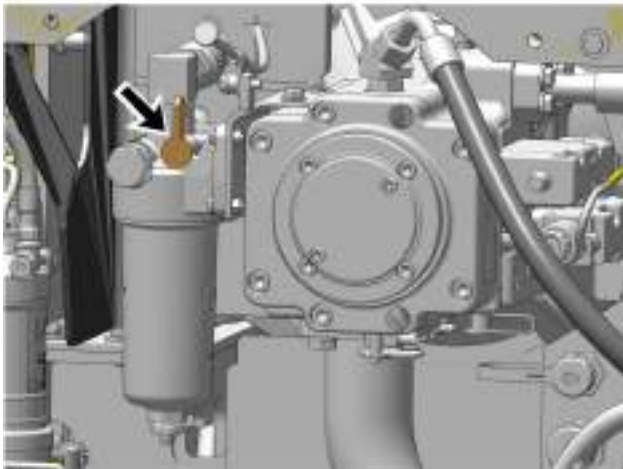


Illustration 538

g06220379

Obtain a sample of the engine oil from the engine oil sampling valve that is located on the engine oil filter housing. Refer to Special Publication, SEBU6250, "S·O·S Oil Analysis" for information that pertains to obtaining a sample of the engine oil. Refer to Special Publication, PEGJ0047, "How To Take A Good Oil Sample" for more information about obtaining a sample of the engine oil.

Engine Oil and Filter - Change

SMCS Code: 1318-510

NOTICE

The engine oil and filter change interval for standard service application is every 1000 hours when the following requirements are met:

- Utilize Cat Recommended Fluids
- Utilize Cat Filters
- Utilize S·O·S Services at recommended interval

When these requirements are not met, the oil and filter change interval should be every 500 hours, or use S·O·S Services oil sampling and analysis program to determine an acceptable oil change interval.

If you select an interval for oil and filter change that is too long, you may damage the engine.

NOTICE

When operating in any of the conditions or environments outlined in this Operation and Maintenance Manual, Severe Service Application, use S·O·S Services oil analysis to determine the best oil and filter change interval.

When S·O·S Services are not used in severe service applications, the oil and filter change interval should be every 250 hours..

If you select an interval for oil and filter change that is too long, you may damage the engine.

Reference: Operation and Maintenance Manual, "Lubricant Viscosities"

Reference: Operation and Maintenance Manual, "Maintenance Interval Schedule"

Reference: Operation and Maintenance Manual, "Severe Service Application"

Reference: Operation and Maintenance Manual, "S·O·S Information"

Use the table below to determine the appropriate oil and filter change interval.

Table 28

Selection of Oil and Filter Change Interval				
	Conditions			Interval
	Cat Recommended Fluids	Cat Filters	S·O·S Services	
Standard Service Application	YES	YES	YES	1000 hours
	YES	YES	NO	500 hours
	YES	NO	YES	500 hours
	NO	YES	YES	500 hours
	NO	NO	NO	250 hours
Severe Service Application	NO	NO	NO	250 hours
	YES	YES	NO	250 hours
	YES	YES	YES	Use S·O·S ⁽¹⁾
	YES	NO	YES	Use S·O·S ⁽¹⁾
	NO	YES	YES	Use S·O·S ⁽¹⁾

⁽¹⁾ If operating in any of the conditions or environments outlined in the Severe Service Application, use S·O·S Services oil analysis to determine the best oil change interval.

Note: Initial oil and filter change is required at initial 500 hours.

Procedure for Changing Engine Oil and Filter

WARNING

Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact skin.

Note: If the sulfur content in the fuel is greater than 1.5 percent by weight, use an oil that has a TBN of 30 and reduce the oil change interval by one-half.

Note: Drain the crankcase while the oil is warm. This allows waste particles that are suspended in the oil to drain. As the oil cools, the waste particles will settle to the bottom of the crankcase. The particles will not be removed by draining the oil and the particles will recirculate in the engine lubrication system with the new oil.

1. Prepare the machine for maintenance. Refer to "Prepare the Machine for Maintenance".

Note: Refer to "General Hazard Information" for information on Containing Fluid Spillage.



Illustration 539

g06183508

2. Open the crankcase drain valve. Allow the oil to drain into a suitable container.

Note: Discard any drained fluids according to local regulations.

3. Close the drain valve.



Illustration 540

g06182545

4. Open the access door at the right side of the machine.

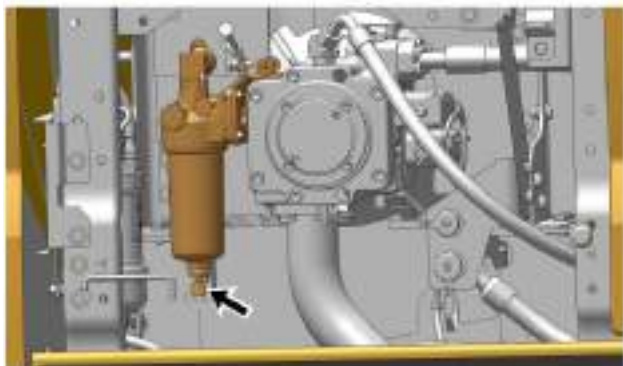


Illustration 541

g06183511

5. Loosen drain valve and allow the oil to drain out of the housing. The drain valve is on the bottom of the engine oil filter housing.

Note: If equipped with a fast fill system, the oil can be drained and filled using the fast fill coupler. Refer to "Fast Fill (If Equipped)" in this chapter.

6. Remove the oil filter housing. Refer to Operation and Maintenance Manual, "Oil Filter - Inspect". Dispose of the used filter according to local regulations.



Illustration 542

g06183515

7. Remove the filter from the housing.
8. Clean the filter housing and the base thread.
9. Install the new filter element into the housing.
10. After installing the new element, hand tighten the drain valve at the bottom of the housing.



Illustration 543

g06604084

11. Apply a thin coat of engine oil to the gasket of the filter. Refer to Illustration 543 for lubrication points on the gasket.

12. Install the filter housing with element to the filter base utilizing a socket wrench.

Note: Apply a tightening torque of 90 N·m (66 lb ft) and tighten until metal to metal contact is achieved.

13. Re-tighten the drain valve to a torque of 2.5 N·m (22.1 lb in).

14. Close the access door.

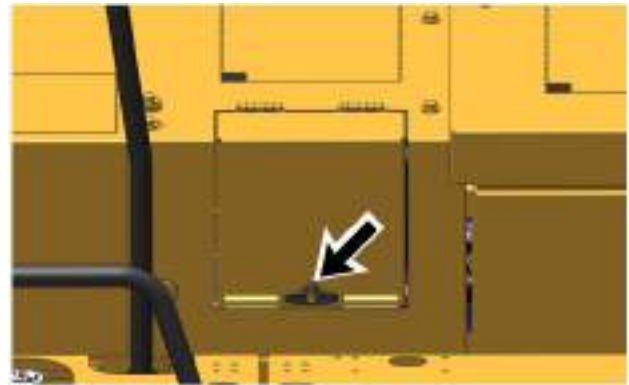


Illustration 544

g06183460

15. Open the access door on top of the machine. Refer to "Access Door and Cover Locations".

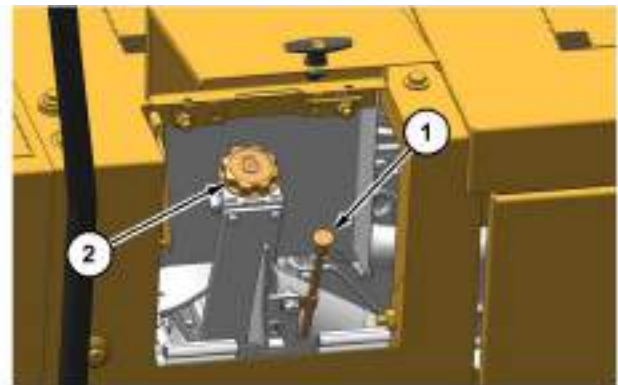


Illustration 545

g06614930

(1) Oil level gauge
(2) Oil filler cap

16. Remove oil filler cap (2). Fill the crankcase with new oil. Refer to Operation and Maintenance Manual, "Capacities (Refill)". Clean the oil filler cap and install the oil filler cap.

NOTICE

Do not under fill or overfill engine crankcase with oil. Either condition can cause engine damage.

17. Start the engine and allow the oil to warm. Refer to Operation and Maintenance Manual, "Engine Starting". Check the engine for leaks. Stop the engine.

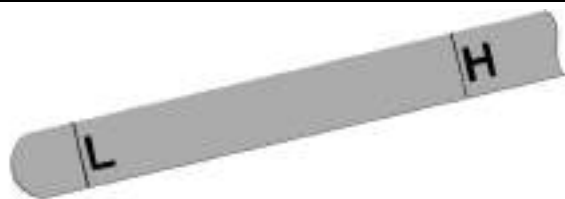


Illustration 546

g06183475

18. Wait for 30 minutes to allow the oil to drain back into the crankcase. Check the oil level with oil level gauge (1). Maintain the oil between the “L” and “H” marks on the oil level gauge. If necessary, add oil.

19. Close the access door.

Fast Fill (If Equipped)

If your machine is equipped with a deluxe service center, you may drain and add the engine oil through the fast fill port.



Illustration 547

g06182545

1. Open the access door on the right side of the machine.

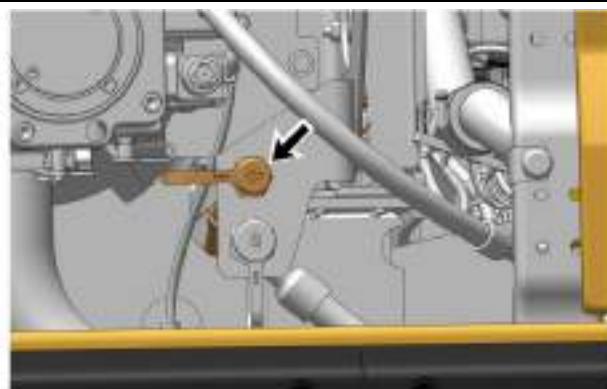


Illustration 548

g06183504

2. Remove the dust cover.

3. Attach a hose that is equipped with a nozzle.

Note: Make sure that the nozzle and the receiver are free from debris before attaching.

4. Drain the oil or add the oil, as needed.

5. Install the dust cover.

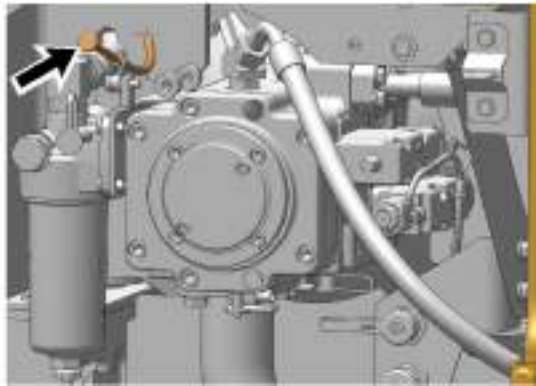


Illustration 549

g06211545

6. Verify that the correct amount of oil was added and add or remove oil as necessary. A ground level oil level gauge is located in the same compartment as the fast fill port.

i07051358

Ether Starting Aid Cylinder - Replace (If Equipped)

SMCS Code: 1456-510-CD

WARNING

Breathing ether vapors or repeated contact of ether with skin can cause personal injury. Personal injury may occur from failure to adhere to the following procedures.

Use ether only in well ventilated areas.

Do not smoke while changing ether cylinders.

Use ether with care to avoid fires.

Do not store replacement ether cylinders in living areas or in the operator's compartment.

Do not store ether cylinders in direct sunlight or at temperatures above 49 °C (120 °F).

Discard cylinders in a safe place. Do not puncture or burn cylinders.

Keep ether cylinders out of the reach of unauthorized personnel.

The ether cylinder is located inside the rear access door on the left side of the machine.

Refer to Operation and Maintenance, "Fire Prevention and Explosion Prevention" before you replace the ether cylinder.



Illustration 550

g06179792

1. Open the rear access door at the left side of the machine.

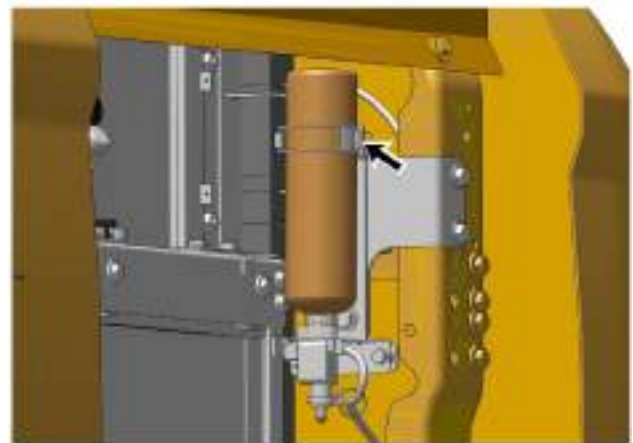


Illustration 551

g06211094

2. Loosen the cylinder retaining clamp.
3. Unscrew the empty ether starting aid cylinder and remove the empty ether starting aid cylinder.

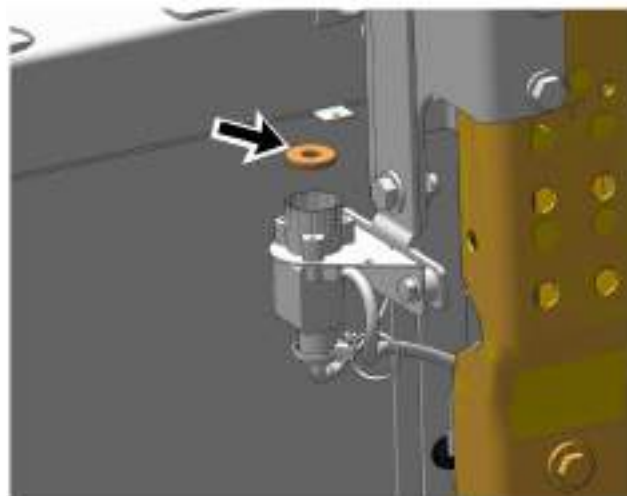


Illustration 552

g06211096

4. Remove the used gasket.

5. Install a new gasket.

Note: A new gasket and O-ring is provided with each new ether starting aid cylinder.

6. Install the new ether starting aid cylinder.

7. Tighten the ether starting aid cylinder hand tight.

8. Tighten the cylinder retaining clamp securely.

9. Close the access door.

i07786001

Film (Product Identification) - Clean

SMCS Code: 7405-070; 7557-070



Illustration 553

g06435629

Cleaning of the Films

Make sure that all the product identification films are legible. Make sure that the recommended procedures are used to clean the product identification films. Ensure that all the product identification films are not damaged or missing. Clean the product identification films or replace the films.

Hand Washing

Use a wet solution with no abrasive material that contains no solvents and no alcohol. Use a wet solution with a "pH" value between 3 and 11. Use a soft brush, a rag, or a sponge to clean the product identification films. Avoid wearing down the surface of the product identification films with unnecessary scrubbing. Ensure that the surface of the product identification films is flushed with clean water and allow the product identification films to air dry.

Power Washing

Power washing or washing with pressure may be used to clean product identification films. However, aggressive washing can damage the product identification films.

Excessive pressure during power washing can damage the product identification films by forcing water underneath the product identification films. Water lessens the adhesion of the product identification film to the product, allowing the product identification film to lift or curl. These problems are magnified by wind. These problems are critical for the perforated film on windows.

To avoid lifting of the edge or other damage to the product identification films, follow these important steps:

- Use a spray nozzle with a wide spray pattern.
- A maximum pressure of 83 bar (1200 psi)
- A maximum water temperature of 50° C (120° F)
- Hold the nozzle perpendicular to the product identification film at a minimum distance of 305 mm (12 inch).
- Do not direct a stream of water at a sharp angle to the edge of the product identification film.

i06969803

Final Drive Oil - Change

SMCS Code: 4050-044-FLV

WARNING

Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact skin.

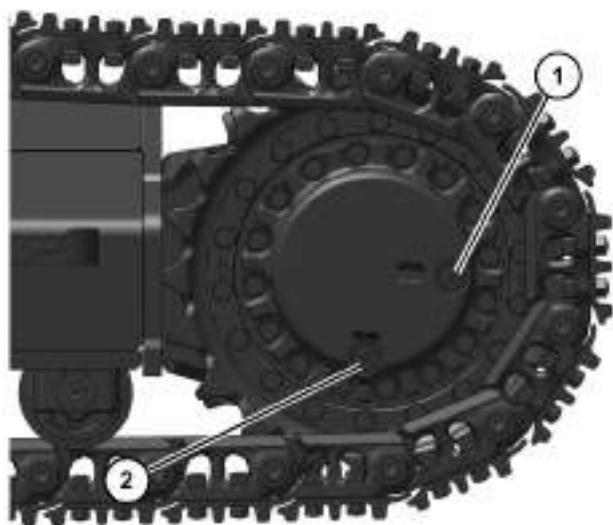


Illustration 554

g06182944

- (1) Oil level plug
(2) Oil drain plug

1. Position one final drive so that oil drain plug (2) is at the bottom.

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information on Containing Fluid Spillage.

2. Remove drain plug (2) and level plug (1). Allow the oil to drain into a suitable container.
3. Clean the plugs and inspect the O-ring seals. If wear or damage is evident, replace the drain plug, the level plug, and/or the O-ring seals.
4. Install drain plug (2).
5. Fill the final drive to the bottom of the opening on level plug (1). See Operation and Maintenance Manual, "Lubricant Viscosities" and Operation and Maintenance Manual, "Capacities (Refill)".

Note: If the oil fills slowly, the fill hole may be blocked by the planetary gear. Rotate the final drive to move the planetary gear away from the fill hole.

Note: Overfilling the final drive will cause the seals on the travel motor to allow hydraulic oil or water to enter the final drive. The final drive may become contaminated.

6. Install level plug (1).
7. Perform Step 1 to Step 6 on the other final drive. Use a different container for the oil so that the oil samples from the final drives will be separate.
8. Completely remove the oil that has spilled onto surfaces.
9. Start the machine and allow the final drives to run through several cycles.
10. Stop the machine. Check the oil level.
11. Check the drained oil for metal chips or for particles. If there are any chips or particles, consult your Cat dealer.
12. Properly dispose of the drained material. Obey local regulations for the disposal of the material.

i06969810

Final Drive Oil Level - Check

SMCS Code: 4050-535-FLV

WARNING

Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact skin.

i06969816

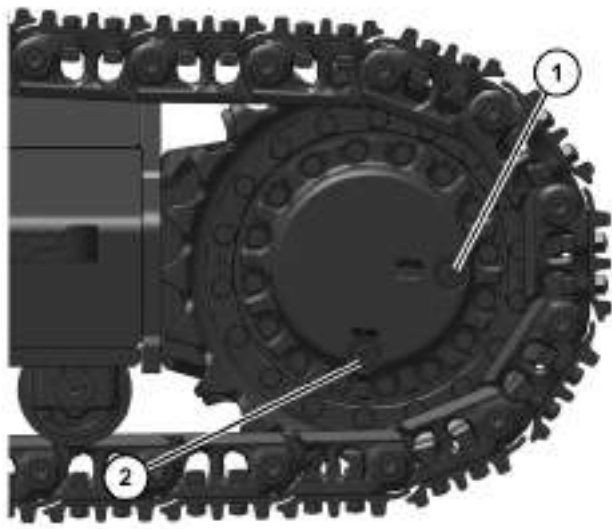


Illustration 555

g06182944

- (1) Oil level plug
(2) Oil drain plug

1. Position one final drive so that oil drain plug (2) is at the bottom.

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information on Containing Fluid Spillage.

2. Remove oil level plug (1).
3. Check the oil level. The oil should be near the bottom of the level plug opening.
4. Add oil through the level plug opening, if necessary. See Operation and Maintenance, "Lubricant Viscosities".

Note: If the oil fills slowly, the fill hole may be blocked by the planetary gear. Rotate the final drive to move the planetary gear away from the fill hole.

Note: Overfilling the final drive will cause the seals on the travel motor to allow hydraulic oil or water to enter the final drive. The final drive may become contaminated.

5. Clean oil level plug (1). Inspect the O-ring seal. Replace the O-ring seal if the O-ring seal is worn or damaged.
6. Install oil level plug (1).
7. Repeat the procedure for the other final drive.

Final Drive Oil Sample - Obtain

SMCS Code: 4011-008; 4050-SM; 4050-008; 7542-008

WARNING

Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact skin.

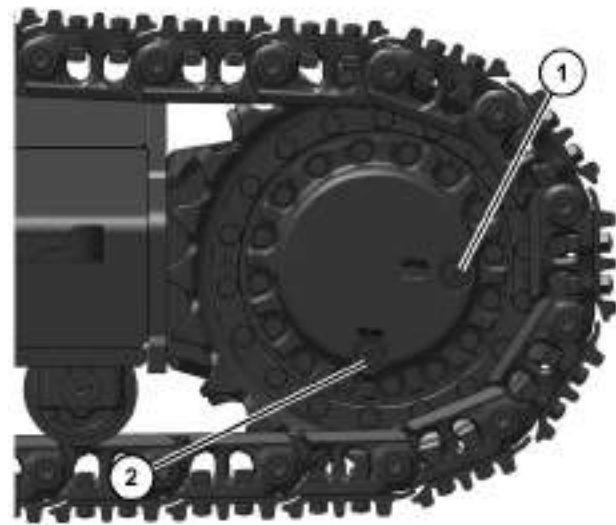


Illustration 556

g06182944

- (1) Oil level plug
(2) Oil drain plug

1. Position the final drive so that oil drain plug (2) is at the bottom.

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information on Containing Fluid Spillage.

2. Remove oil level plug (1).
3. Obtain a sample of the final drive oil through the hole for the oil level plug.
4. Install oil level plug (1).

Refer to Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations" "S·O·S Oil Analysis" for more information on obtaining a sample of the final drive oil. For additional information about taking an oil sample, refer to Special Publication, PEGJ0047, "How To Take A Good Oil Sample".

i07088575

Fuel Cap Filter - Replace

SMCS Code: 1261-510

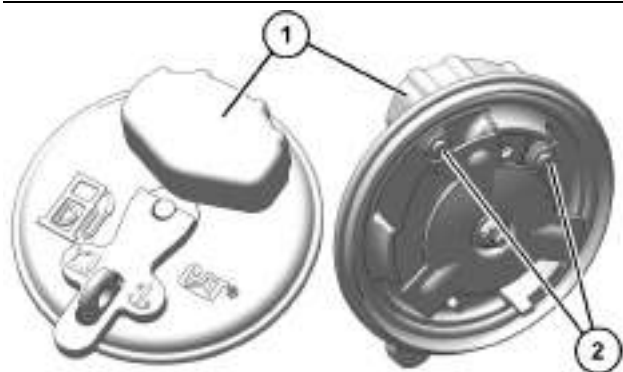


Illustration 557

g06220524

1. Remove the fuel cap.
2. Remove filter element screws (2) from the underside of the fuel cap and remove filter element (1).
3. Install a clean fuel cap filter element.
4. Install the screws to secure the filter element to the fuel cap.
5. Install the fuel tank cap.

i06674757

Fuel System - Prime

SMCS Code: 1250-548

WARNING

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire. To help prevent possible injury, turn the start switch off when changing fuel filters or water separator elements. Clean up fuel spills immediately.

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 any component containing fluids.

Refer to Special Publication, PERJ1017, "Dealer Service Tool Catalog" for tools and supplies suitable to collect and contain fluids on Cat® products.

Dispose of all fluids according to local regulations and mandates.

NOTICE

Do not loosen the fuel lines at the fuel manifold. The fittings may be damaged and/or a loss of priming pressure may occur when the fuel lines are loosened.

NOTICE

Do not allow dirt to enter the fuel system. Thoroughly clean the area around a fuel system component that will be disconnected. Fit a suitable cover over any disconnected fuel system components.

Prime the fuel system in order to fill the fuel filter, and prime the fuel system in order to purge trapped air. The fuel system should be primed under the following conditions:

- The fuel tank is running low.
- The machine has been stored.
- The fuel filter is being replaced.

1. Turn the engine start switch to the ON position. Leave the engine start switch in the ON position for 2 minutes.
2. Verify that the water separator is full of fuel.
3. If the water separator is not full of fuel, turn the engine start switch OFF and then turn the engine start switch ON. Turning the engine start switch off and on will cycle the fuel priming pump again.
4. When the water separator is full of fuel, attempt to start the engine. If the engine starts and the engine runs rough or the engine misfires, operate at low idle until the engine is running smoothly. If the engine cannot be started, or if the engine continues to misfire or smoke, repeat Step 1.

i07511456

Fuel System Primary Filter (Water Separator) Element - Replace

SMCS Code: 1263-510-FQ

WARNING

Personal injury or death may result from failure to adhere to the following procedures.

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire.

Clean up all leaked or spilled fuel. Do not smoke while working on the fuel system.

Turn the disconnect switch OFF or disconnect the battery when changing fuel filters.

NOTICE

Do not fill the fuel filters with fuel before installing the fuel filters. The fuel will not be filtered and could be contaminated. Contaminated fuel will cause accelerated wear to fuel system parts.

The primary filter/water separator is located behind the access door on the right side of the machine.



Illustration 558

g06182545

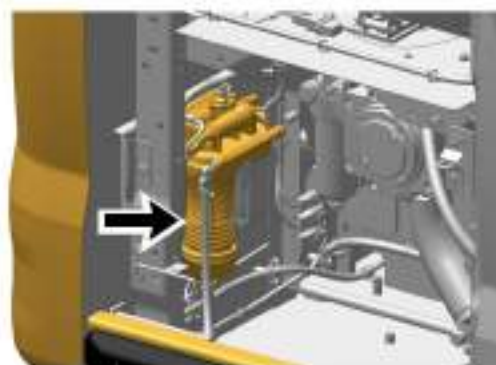


Illustration 559

g06342852

Typical Example

1. Open the rear access door on the right side of the machine.

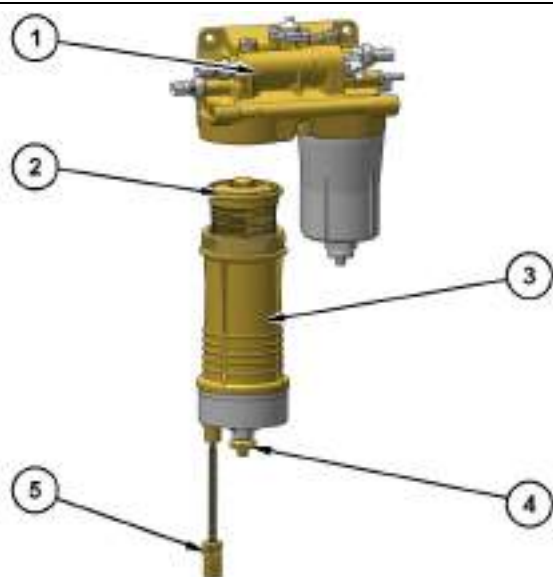


Illustration 560

g06344343

Typical example of primary filter water separator

- (1) Filter base
- (2) Filter
- (3) Filter housing
- (4) Drain valve
- (5) Sensor

2. Turn drain valve (4) counterclockwise to open. The drain valve is on the bottom of the water separator.

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information that pertains to containing fluid spillage.

3. Drain the water and the sediment into a suitable container.

Note: Dispose of used fluids according to local regulations.

4. Close the drain valve (4).
5. Disconnect the water sensor (5) from the harness.

Note: Do not attempt to remove the sediment bowl from the housing. The sediment bowl is permanently attached to the housing. Attempting to remove the sediment bowl may damage the bowl.

6. Unscrew filter housing (3) and remove primary filter (2). A filter wrench may be used to loosen the filter housing. Properly discard the used filter.
7. Clean the mounting base (1).
8. Lubricate the seal of the new filter (2) with clean diesel fuel.
9. Install the new filter (2) into the housing.

10. Tighten the filter housing approximately 1/6 of a turn. Do not use tools to tighten the filter housing to the filter base.
11. Ensure that sensor (5) is in the correct position and connect to the wiring harness. If the sensor was removed from the bowl, install the sensor and tighten to $2.5 \pm 0.5 \text{ N}\cdot\text{m}$ ($22 \pm 4 \text{ lb in}$).
12. Open the fuel shutoff valve.
13. Close the access door.

i07506478

Fuel System Secondary Filter - Replace

SMCS Code: 1261-510

WARNING

Personal injury or death can result from a fire.

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire.

Clean up all leaked or spilled fuel. Do not smoke while working on the fuel system.

Turn the disconnect switch OFF or disconnect the battery when changing fuel filters.

NOTICE

Do not fill fuel filters with fuel before installing them. Contaminated fuel will cause accelerated wear to fuel system parts.

NOTICE

Do not allow dirt to enter the fuel system. Thoroughly clean the area around a fuel system component that will be disconnected. Fit a suitable cover over any disconnected fuel system components.



Illustration 561

g06182545

1. Open access door on the right side of the machine.
2. Shut off the fuel supply. Refer to Fuel Tank Shutoff and Drain Control for additional information.

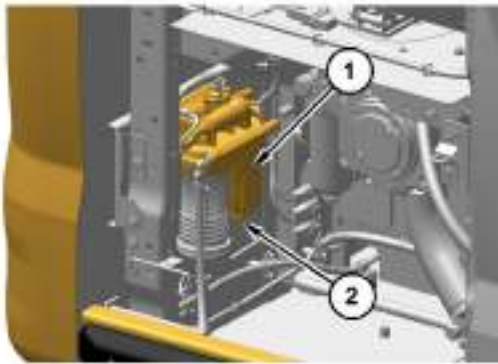


Illustration 562

g06342848

Typical Example

3. Loosen drain valve (2) and allow the fuel to drain out of the housing into a suitable container.

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information on containing fluid spillage.

4. After all the fuel has been removed, tighten the drain.
5. Remove the secondary fuel filter housing (1) from the base.
6. Remove the filter element from the housing.
7. Clean the filter housing and the base.
8. Install the new filter element into the housing.
9. Apply a thin coat of clean diesel fuel to the sealing surface of the new fuel filter.

10. Install the new filter and tighten to 50 +/- 5 N·m (36.9 +/- 4 ft lb).

11. Turn on the fuel supply.

12. Close the access door.

i06969852

Fuel System Water Separator - Drain

SMCS Code: 1263

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 any component containing fluids.

Refer to Special Publication, PERJ1017, "Dealer Service Tool Catalog" for tools and supplies suitable to collect and contain fluids on Cat® products.

Dispose of all fluids according to local regulations and mandates.



Illustration 563

g06182545

1. Open the access door on the right side of the machine.

i06969894

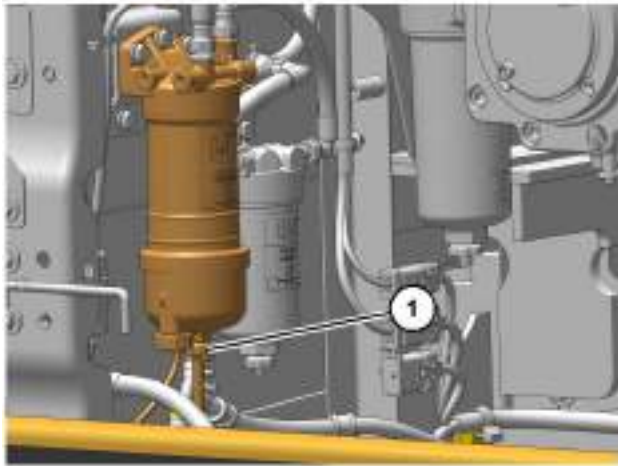


Illustration 564

g06182984

2. Open drain valve (1) on the bottom of the fuel/water separator element. Drain the water into a suitable container.
3. Close the drain valve when all the water has been drained.

Note: When water is not drained from the primary filter sufficiently, water will collect in the secondary fuel filter. Trapped water will eventually overflow. Draining water from the secondary fuel filter will prevent water damaging the fuel system. The procedure for the secondary filter is the same as the primary filter.

4. Close the access door.

Fuel Tank Strainer - Clean

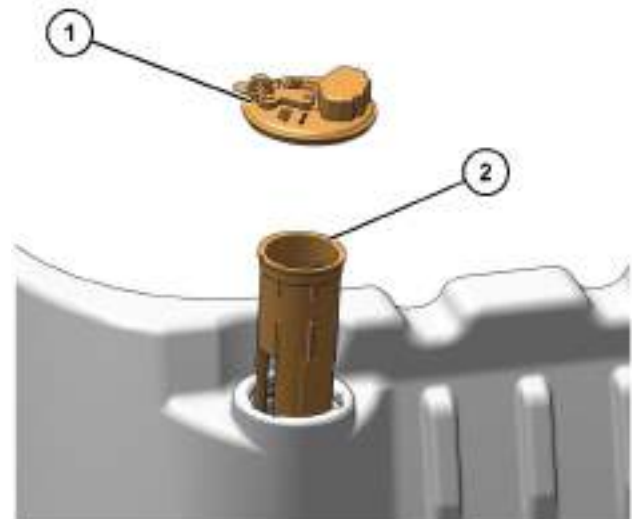
SMCS Code: 1273-070-STR

Illustration 565

g06183008

1. Remove fuel tank cap (1).
2. Remove strainer (2) from the filler opening.
3. Wash the strainer in a clean, nonflammable solvent.
4. Install the strainer into the filler opening.
5. Install the fuel tank cap.

i06954978

Fuel Tank Water and Sediment - Drain

SMCS Code: 1273-543

The drain valve for the fuel tank is located in the right compartment.

i07047559



Illustration 566

g06182545

1. Open the right compartment door.

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information on containing fluid spillage.

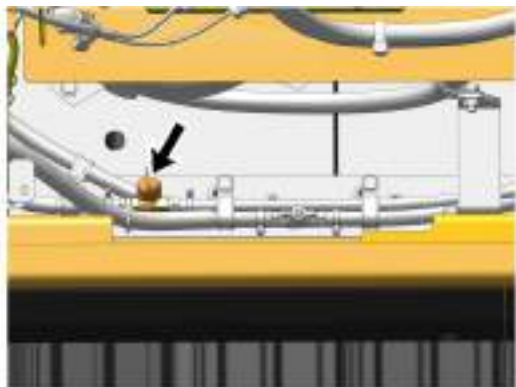


Illustration 567

g06182139

2. Open the drain valve by turning the valve counterclockwise. Allow the water and the sediment to drain into a suitable container.

Note: Dispose of drained fluids according to local regulations.

3. Close the drain valve by turning the valve clockwise.
4. Close the compartment door.

Fumes Disposal Filter Element - Replace

SMCS Code: 1074



Illustration 568

g06209196

Typical example

Note: Perform the maintenance with the engine shut off.

1. Open the engine hood.
2. Remove the lid that holds the canister to the filter base assembly.
3. Remove the filter element. Dispose of the used element properly.
4. Install the new filter.
5. Install the lid.
6. Close the engine hood.

i07956684

Fuses - Replace

SMCS Code: 1417-510

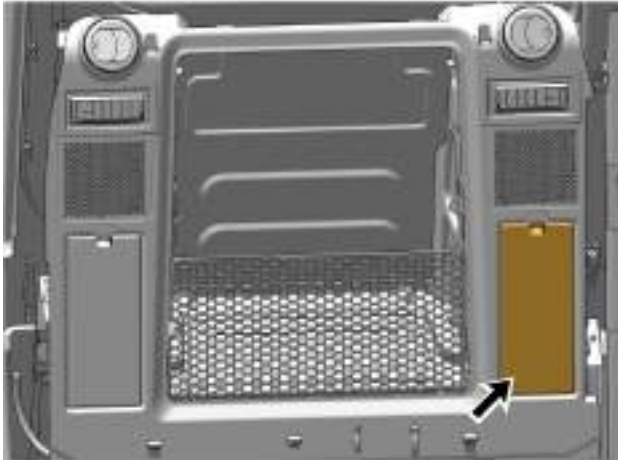


Illustration 569

g06181624

The fuse panel is on the left side of the interior storage box. Remove the cover to access the fuses.



Fuses – Fuses protect the electrical system from damage that is caused by overloaded circuits. Change a fuse if the element separates. If the element of a new fuse separates, check the circuit and/or repair the circuit.

NOTICE

Always replace fuses with the same type and capacity fuse that was removed. Otherwise, electrical damage could result.

NOTICE

If it is necessary to replace fuses frequently, an electrical problem may exist.

Contact your Cat dealer.

To replace a fuse, use the puller that is stored in the fuse panel.

The following list identifies the circuits that are protected by each fuse. The amperage for each fuse is included with each circuit.

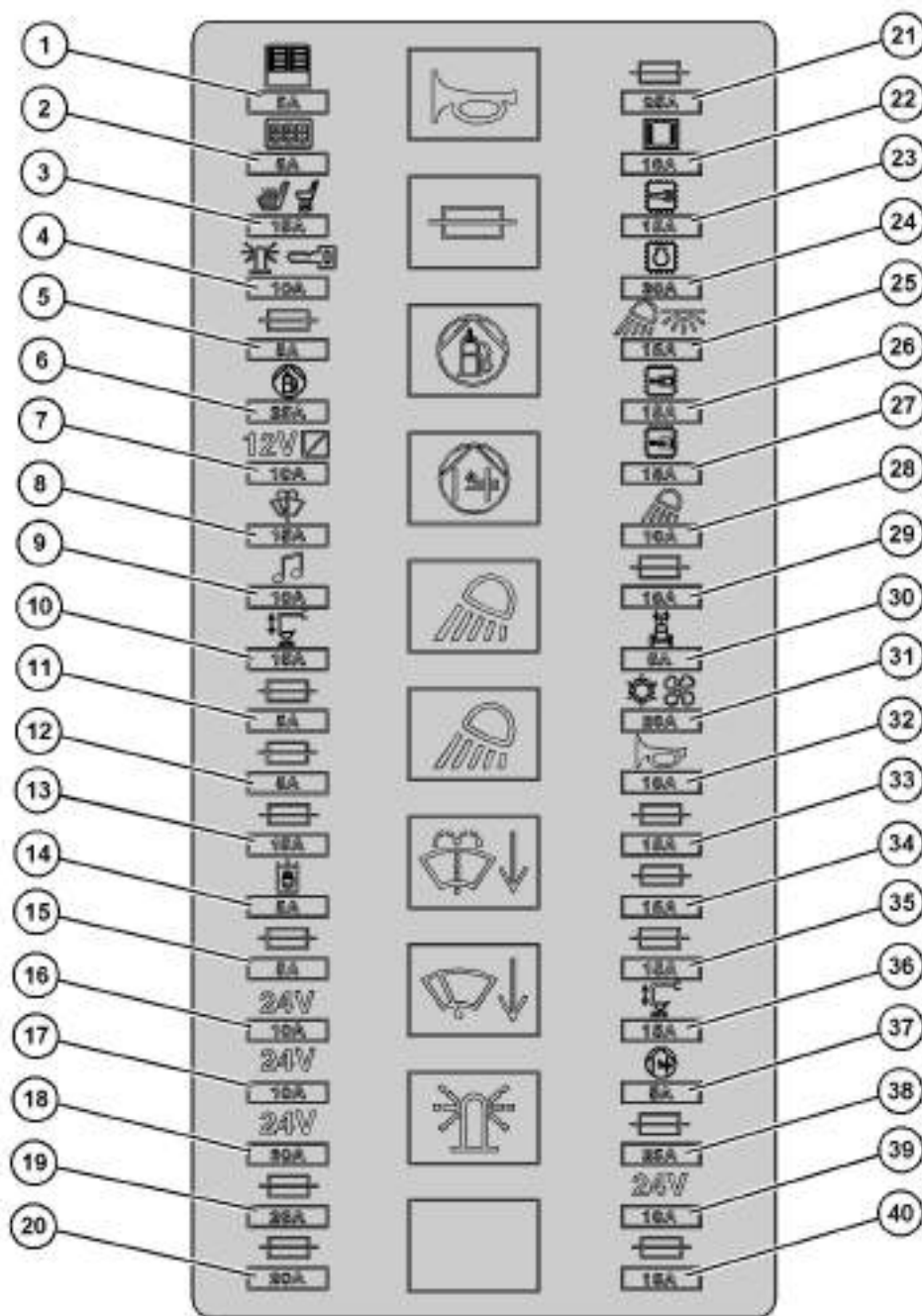


Illustration 570

g06223505

(1) Heater and Air Conditioner Control and Monitor – 5 Amp

(2) Electronic Switch Control Panel – 5 Amp

(3) Grip, Seat Heater, and Air Suspension Seat – 15 Amp

(4) Beacon/Caution Lamp – 10 Amp

(5) Spare – 5 Amp

(6) Electric Refueling Pump – 25 Amp

(7) 12V Converter – 10 Amp

(8) Window Wiper and Window Washer – 15 Amp

(9) Radio – 10 Amp

(10) Cat Grade Control – 15 Amp

(11) Spare – 5 Amp

(12) Spare – 5 Amp

- (13) Spare – 15 Amp
- (14) Hydraulic Lock – 5 Amp
- (15) Spare – 5 Amp
- (16) Spare – 10 Amp
- (17) 24V Auxiliary Circuit – 10 Amp
- (18) 24V Auxiliary Circuit – 30 Amp
- (19) Spare – 20 Amp
- (20) Spare – 10 Amp
- (21) Spare – 25 Amp
- (22) Display and ET Connector – 10 Amp
- (23) Body Control Module – 15 Amp
- (24) Engine Electronic Control Module – 30 Amp
- (25) Dome Light – 15 Amp
- (26) Primary Electronic Control Module – 15 Amp
- (27) Secondary Electronic Control Module – 15 Amp
- (28) Boom Lamp – 10 Amp
- (29) Spare – 10 Amp
- (30) Product Link Module – 5 Amp
- (31) Air Conditioner and Heater Blower – 20 Amp
- (32) Horn – 10 Amp
- (33) Spare – 15 Amp
- (34) Spare – 15 Amp
- (35) 12V Converter – 10 Amp
- (36) Cat Grade Control – 15 Amp
- (37) Fuel Lifting Pump – 5 Amp
- (38) Spare – 25 Amp
- (39) Auxiliary Circuit – 10 Amp
- (40) Spare – 15 Amp

Relays

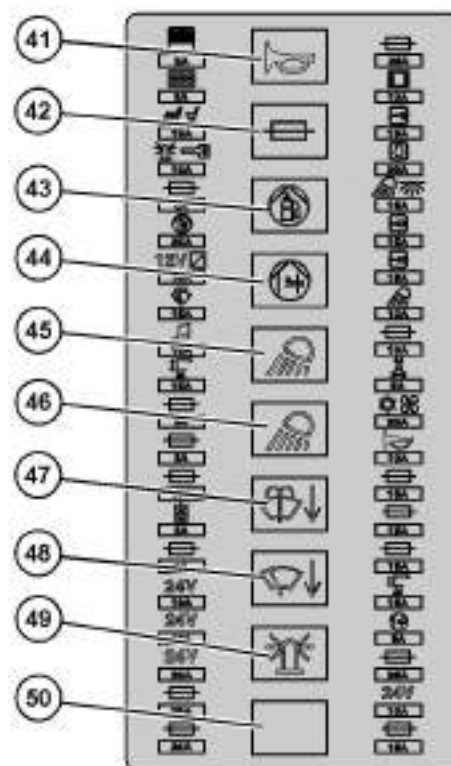


Illustration 571

g06223517

- (41) Horn – Relay
- (42) DEF Pump – Relay
- (43) Priming Pump – Relay
- (44) Lifting Pump – Relay
- (45) Boom Light – Relay
- (46) Chassis Light and Cab Light – Relay
- (47) Lower Washer – Relay
- (48) Lower Wiper – Relay
- (49) Caution – Relay
- (50) Spare – Relay

Power Fuse Module



Illustration 572

g06179792

The power fuse module is located behind the rear access door on the left side of the machine. Remove the cover to access the fuses.

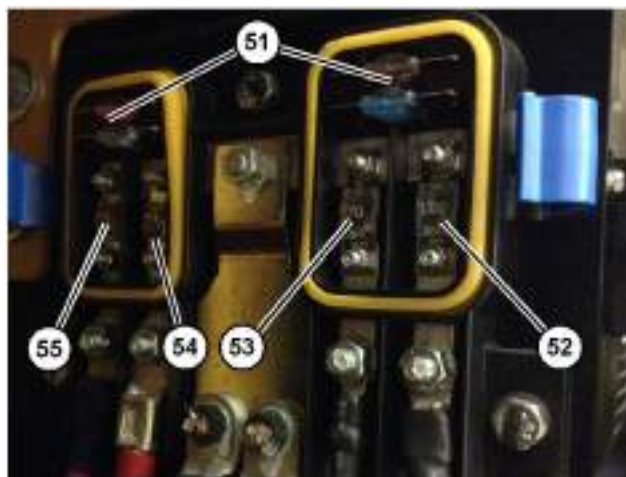


Illustration 573

g06225641

Typical Example



Spare (51) – The fuse module includes spare fuses which can be used if one of the installed fuses opens. One spare fuse is provided for each fuse in use.



Electric Cooling Fans 100 Amp (52)/(53) – This fuse is designed to protect the cooling fans.

Note: For machines with 11 electric fans, fuse (52) is 125 Amp.



Main Circuit 100 Amp (54) – This fuse is designed to protect the wires between the batteries and the fuses. If the wires are shorted to the machine body, this fuse would minimize the damage to the wires.



Alternator Circuit 150 Amp (55) – This fuse is designed to protect the alternator. If the batteries are installed with reversed polarity, the fuse would prevent the alternator from damaging the rectifier.

Secondary Power Fuse Module



Illustration 574

g06181546

The secondary power fuse module is located behind the front access door on the left side of the machine. Remove the cover to access the fuses.

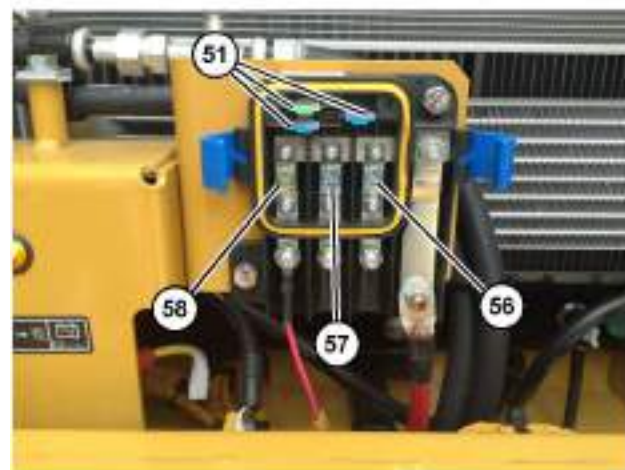


Illustration 575

g06308723

Typical Example



Spare (51) – The fuse module includes spare fuses which can be used if one of the installed fuses opens. One spare fuse is provided for each fuse in use.



Alternator Circuit 150 Amp (56) – This fuse is designed to protect the alternator. If the batteries are installed with reversed polarity, the fuse would prevent the alternator from damaging the rectifier.



Glow Plug Circuit 70 Amp (57) – This fuse is designed to protect the glow plugs.



Diesel Exhaust Fluid (DEF) Pump Circuit 40 Amp (58) – This fuse is designed to protect the DEF pump circuit.

i08067436

High Intensity Discharge Lamp (HID) - Replace (If Equipped)

SMCS Code: 1434-510

WARNING

HID lamps operate at very high voltages. To avoid electrical shock and personal injury, disconnect power before servicing HID lamps.

WARNING

HID bulbs become very hot during operation. Before servicing, remove power from lamp for at least five minutes to ensure lamp is cool.

NOTICE

Although HID bulb materials may change over time, HID bulbs produced at the time of the printing of this manual contain mercury. When disposing of this component, or any waste that contains mercury, please use caution and comply with any applicable laws.

1. Prepare the machine for maintenance. Refer to Operation and Maintenance Manual, "Prepare the Machine for Maintenance".
2. Remove the electrical power from the high intensity discharge lamp (HID). The electrical power must be removed from the HID lamp for at least 5 minutes, to ensure that the bulb is cool.
3. Disassemble the housing for the HID lamp to have access to the bulb.

Note: On some HID lamps, the bulb is a part of the lens assembly. The bulb is not removed separately from the lens assembly. Replace the entire lens assembly on these HID lamps.

4. Remove the bulb from the HID lamp.

5. Install the replacement bulb in the HID lamp.

If the bulb is a part of the lens assembly, install the replacement lens assembly in the HID lamp.

Note: To avoid failure to the bulb that is premature, avoid touching the bulb's surface with your bare hands. Clean any fingerprints from the bulb with alcohol prior to operation.

6. Reassemble the housing for the HID lamp. Ensure that any printing on the lens is oriented correctly for the HID lamp's mounting position on the machine.

7. Reattach the electrical power to the HID lamp.

8. Check the HID lamp for proper operation.

Note: Consult your Cat dealer for additional information on HID lamps.

i07833138

Hydraulic System Oil - Change

SMCS Code: 5056-044

Cat HYDO Advanced 10 Oil Change Interval

The standard Cat HYDO Advanced 10 oil change interval is every 6000 service hours or 3 years. But a 6000 service hour or 3-year maintenance interval for hydraulic oil (change) is strongly recommended with S·O·S monitoring of the hydraulic oil after 3000 service hours. The interval for S·O·S monitoring is every 500 hours. The hydraulic oil change is strongly recommended when the oil deterioration or contamination is detected. The maintenance interval for the hydraulic oil filter is not changed.

Hydraulic Hammer Use

The use of hydraulic hammers shortens the life of hydraulic oil. If a hydraulic hammer is used, the maintenance interval is shortened, refer to Table 29 for the intervals.

Table 29

Percentage of Hammer Use	Hydraulic System Oil - Change
50%	Every 1000 service hours
100%	Every 600 service hours

Procedure to Change the Hydraulic Oil

WARNING

Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact skin.

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 any component containing fluids.

Refer to Special Publication, PERJ1017, "Dealer Service Tool Catalog" for tools and supplies suitable to collect and contain fluids on Cat® products.

Dispose of all fluids according to local regulations and mandates.

1. Park the machine on level ground. Lower the bucket to the ground so that the stick is vertical.

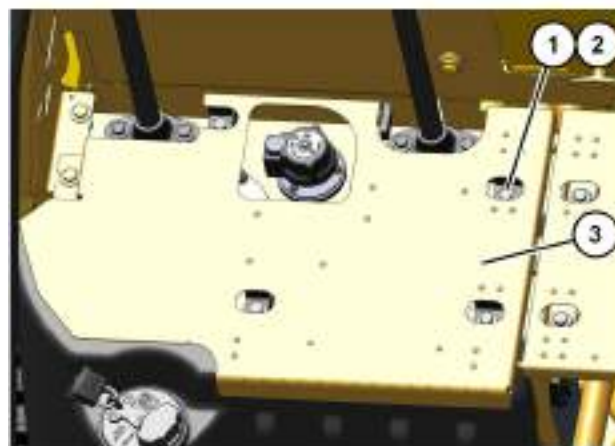


Illustration 576

g06182169

2. Remove five bolts (1) and washers (2). Remove cover (3) from the top of the hydraulic tank.



Illustration 577

g06182174

3. Clean the area thoroughly to keep dirt out of the screen cover and filler cap (4).

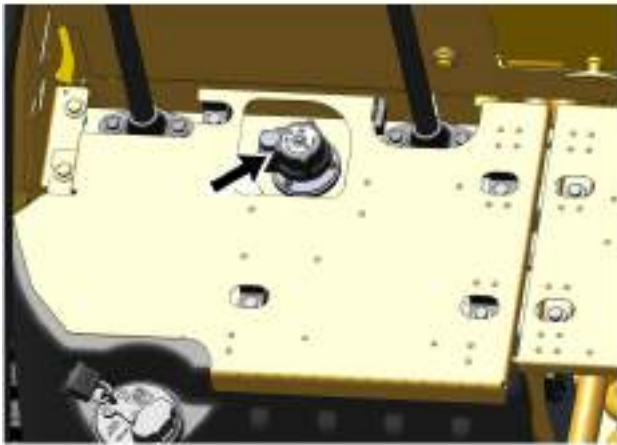


Illustration 578

g06184080

Hydraulic tank filler cap location

**Pressurized system!**

The hydraulic tank contains hot oil under pressure. To prevent burns from the sudden release of hot oil, relieve the tank pressure with the engine off. Relieve pressure by slowly turning the cap until the cap reaches the secondary stop.

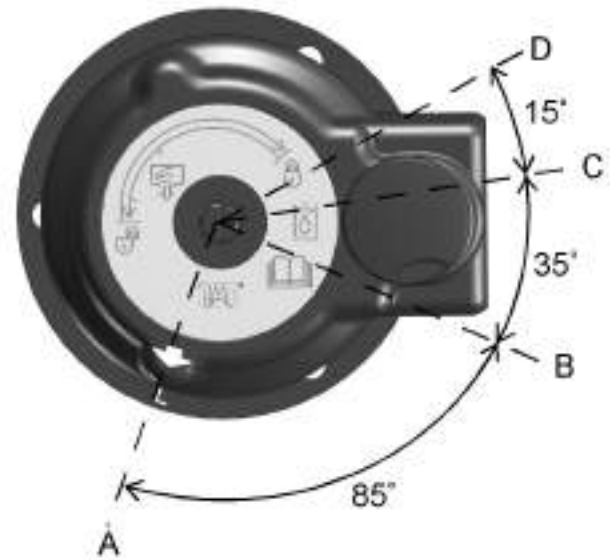


Illustration 579

g06184990

Filler cap

- (A) LOCK position
- (B) PRESSURE RELEASE - START position
- (C) PRESSURE RELEASE - END position
- (D) OPEN position

4. Release the pressure that may be present in the return hydraulic circuit with the following procedure. Refer to Illustration 579 for filler cap positions.
 - a. Turn the filler cap counterclockwise and move the arrow from position (A) to position (B).
 - b. Release the pressure for a minimum of 45 seconds by moving the arrow from position (B) to position (C).
 - c. Move the arrow from position (C) to position (D).
 - d. After the tank pressure is relieved, tighten the filler cap.

Maintenance Section
Hydraulic System Oil - Change



Illustration 580

g06182179

5. Remove the hydraulic tank access cover that is located under the upper structure. Removing the cover will allow access to the drain valve.

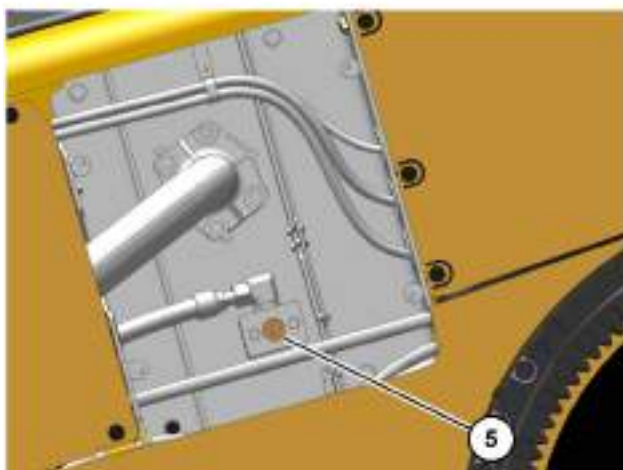


Illustration 581

g06182182

(5) Plug

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information that pertains to containing fluid spillage.

6. Remove plug (5).
7. Inspect the O-ring. Replace the O-ring if wear or damage is evident.

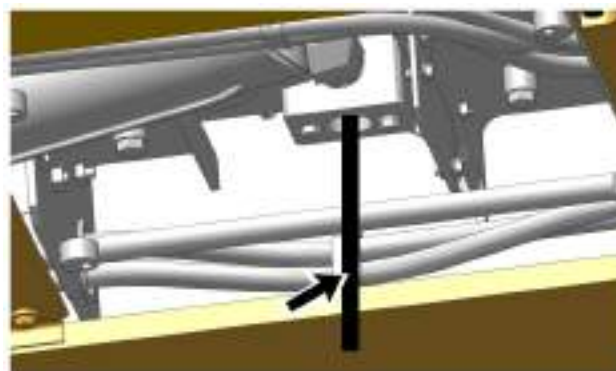


Illustration 582

g06182192

8. Use a bar to push the plunger up to allow the oil to drain.
9. Drain the oil into a suitable container.

Note: Dispose of used fluids according to local regulations.

10. After the oil has been drained, clean drain plug (5) and install. Tighten the plug to $68 \pm 7 \text{ N} \cdot \text{m}$ ($50 \pm 5 \text{ lb ft}$).
11. Open the access door on the right side of the machine.
12. Clean the pump, the hydraulic lines, and the hydraulic tank.

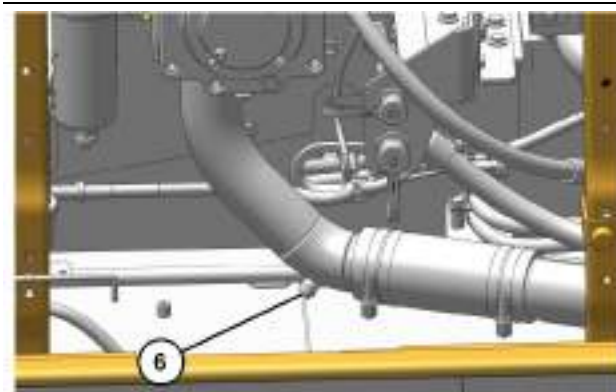


Illustration 583

g06182196

13. Remove plug (6) from the tube. Allow the oil to drain into a container.
14. Inspect the O-ring. Replace the O-ring if wear or damage is evident.
15. Clean the plug. Install the plug and the O-ring into the drain port.

Hydraulic Tank Screen - Clean

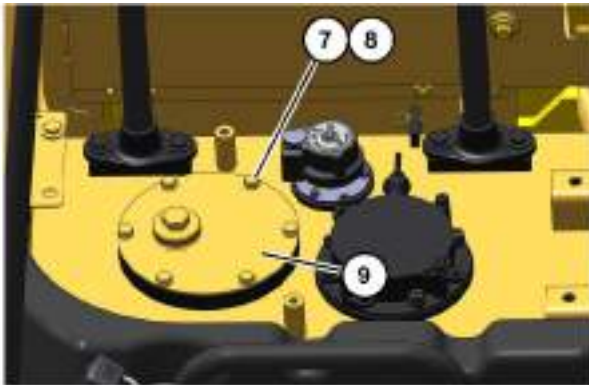


Illustration 584

g06182201

- (7) Bolts
(8) Washers
(9) Cover

1. Remove bolts (7), washers (8), and cover (9).



Illustration 585

g06182213

- (10) Spring
(11) Screen

2. Remove spring (10) and screen (11).

Note: Do not allow spring (10) to fall back into the tank.

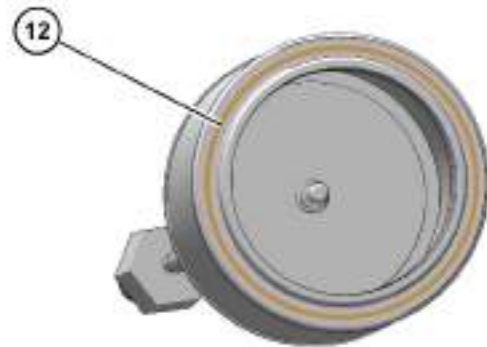


Illustration 586

g06182515

- (12) O-ring seal

3. Remove O-ring seal (12) from the screen.

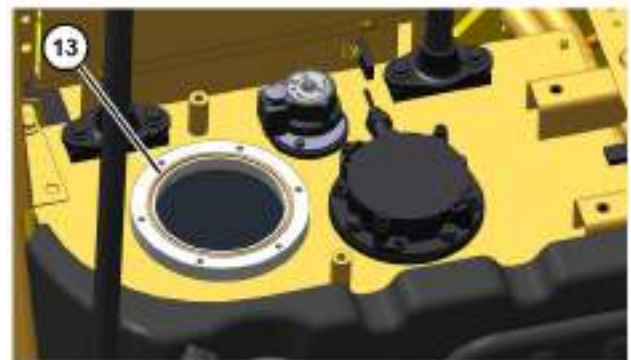


Illustration 587

g06182229

- (13) O-ring seal

4. Remove O-ring seal (13) from the tank.

5. Inspect O-ring seals (12) and (13). Replace the O-ring seals if wear or damage is evident.

6. Wash the screen in a clean nonflammable solvent. Allow the screen to dry. Inspect the screen. Replace the screen, if the screen is damaged.

7. Install O-ring seal (12) on screen (11).

8. Install screen (11) and spring (10). Then install cover (9), washers (8), and bolts (7).

Note: Make sure that the O-ring seals and the spring are properly positioned during installation.

Case Drain Filter - Clean

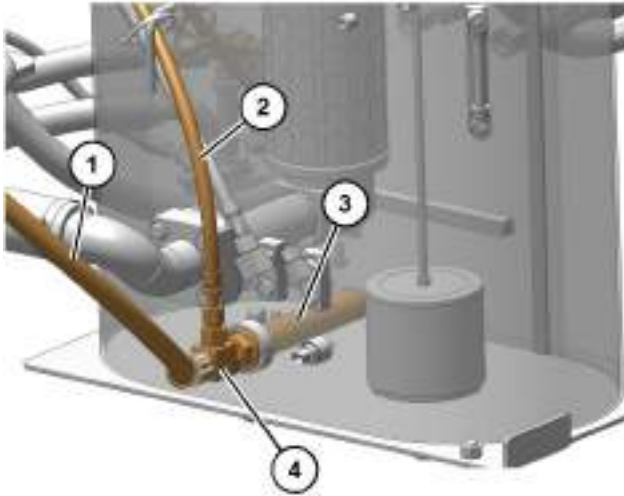


Illustration 588

g06220559

- (1) Hose
- (2) Hose
- (3) Case drain filter
- (4) Tee

1. Remove hose (1) and hose (2) from tee (4). Remove tee (4).
2. Remove case drain filter (3) from the hydraulic tank.
3. Wash the screen of the case drain filter in a clean nonflammable solvent. Allow the filter to dry. Inspect the filter. Replace the filter if the filter is damaged.
4. Inspect the O-ring seal on the filter. Replace the O-ring seal if wear or damage is evident.
5. Install the filter in the hydraulic tank. Tighten the filter to $175 \pm 26 \text{ N}\cdot\text{m}$ ($129 \pm 19 \text{ lb ft}$).
6. Install the tee onto the filter. Tighten the tee to $65 \pm 10 \text{ N}\cdot\text{m}$ ($48 \pm 7 \text{ lb ft}$).
7. Install the two hoses onto the tee.

Hydraulic System Oil - Fill

1. Fill the hydraulic system oil tank. Refer to Operation and Maintenance Manual, "Capacities (Refill)".
2. Inspect the O-ring seal on the filler cap for damage. Replace the O-ring, if necessary. Clean the filler cap. Install the filler cap.

Note: Make no attempt to start the engine until the pump has been filled with hydraulic oil. Serious damage to the hydraulic components can result.

Main Pump and Hydraulic System Air Purge

1. Access the hydraulic pump. The hydraulic pump is located behind the right access door.

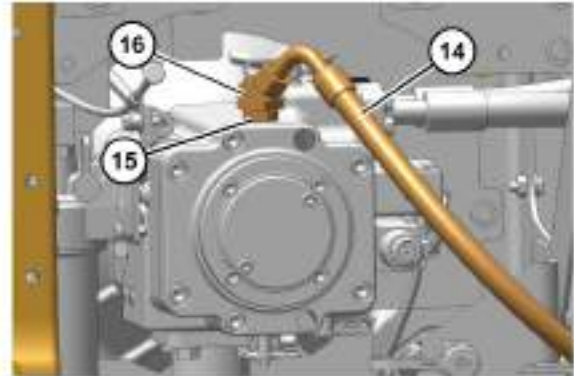


Illustration 589

g06205207

- (14) Hose
- (15) Connector
- (16) Elbow

2. While the engine is stopped, remove hose (14), elbow (15), and connector (16) from the top of the pump. Add hydraulic oil through the opening.
3. Check the condition of the seals. If a seal is damaged, replace the seal.
4. After the pump has been filled with oil, install drain hose (14), connector (15), and seal (16) to the original locations.
5. Start the engine. When the engine is at low idle, raise the boom. Hold the boom in this position.
6. Stop the engine. Slowly lower the boom until the work tool is on the ground. The hydraulic tank will pressurize.
7. Slowly loosen hose (14) until hydraulic oil flows from the connection. Oil flowing from the connection indicates that the air has been released from the pump.
8. Tighten hose (14).
9. Start the engine. Operate the engine at idling speed for 5 minutes.



Illustration 590

g06181120

10. Operate the joysticks to circulate the hydraulic oil. Lower the bucket to the ground so that the stick is vertical to the ground. Stop the engine.

11. Check the hydraulic oil level.

Reference: For the correct procedure, refer to Operation and Maintenance Manual, "Hydraulic System Oil Level - Check".

12. Close the access door.

13. Close the engine hood and latch the engine hood.

Fast Fill

If your machine is equipped with a deluxe service center, you may drain the hydraulic oil through the fast fill port. You may also add the hydraulic oil through a fast fill port.



Illustration 591

g06182545

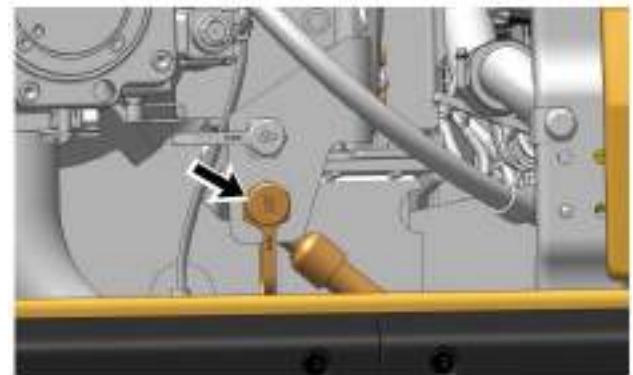


Illustration 592

g06182544

1. Remove the dust cover.
2. Attach the hose to the male coupling.
3. Drain the oil or add the oil, as needed.

i07833122

Hydraulic System Oil Filter (Return) - Replace

SMCS Code: 5068-510-RJ



Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact skin.

The return filter is a cartridge type filter. The amount of foreign material that enters the hydraulic system is reduced when the filter element is replaced.

Two different filters are available for the return filter. One filter is used for standard applications such as digging and normal use of a hammer. The second filter is used for an application such as demolishing a ceiling in a tunnel with a hammer.

Note: If the message display shows that the hydraulic return filter is plugged, turn off the machine. After you make sure that the warning has disappeared, start the machine and run the machine on level ground for approximately 10 minutes. If the warning still appears in the message display, inspect the filter and replace the filter, if necessary.

Hydraulic Hammer Use

The use of hydraulic hammers shortens the life of hydraulic oil. If a hydraulic hammer is used, the maintenance interval is shortened, refer to Table 30 for the intervals.

Table 30

Percentage of Hammer Use	Hydraulic System Oil Filter (Return) - Replace
50%	Every 500 service hours
100%	Every 250 service hours

Return Filter Replacement Procedure

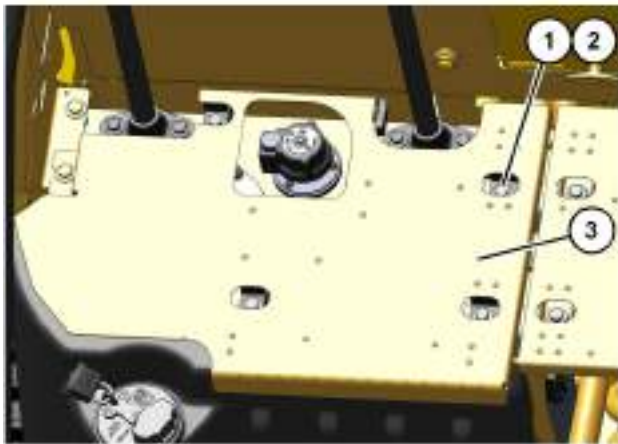


Illustration 593

g06182169

1. Remove five bolts (1) and washers (2). Remove cover (3) from the top of the hydraulic tank.
2. Clean the area thoroughly to keep dirt out of the return filter and filler cap.

WARNING

Pressurized system!

The hydraulic tank contains hot oil under pressure. To prevent burns from the sudden release of hot oil, relieve the tank pressure with the engine off. Relieve pressure by slowly turning the cap until the cap reaches the secondary stop.

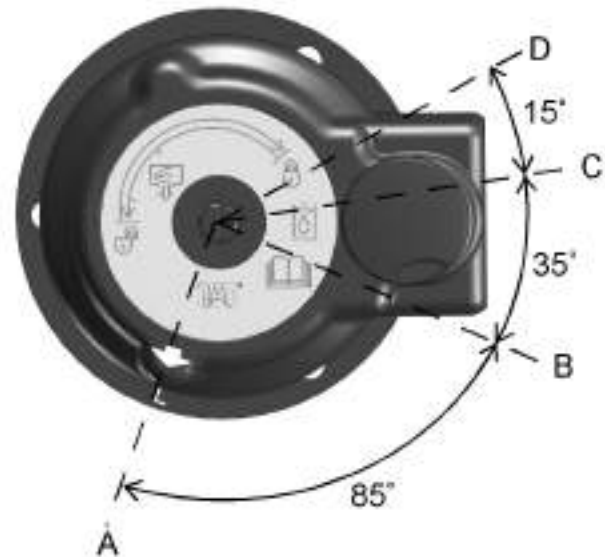


Illustration 594

g06184990

Filler cap

- (A) LOCK position
(B) PRESSURE RELEASE - START position
(C) PRESSURE RELEASE - END position
(D) OPEN position

3. Release the pressure that may be present in the return hydraulic circuit with the following procedure. Refer to Illustration 594 for filler cap positions.
 - a. Turn the filler cap counterclockwise and move the arrow from position (A) to position (B).
 - b. Release the pressure for a minimum of 45 seconds by moving the arrow from position (B) to position (C).
 - c. Move the arrow from position (C) to position (D).
 - d. After the tank pressure is relieved, tighten the filler cap on the hydraulic tank to position (A).
4. Check the hydraulic system oil level.

Reference: For the correct procedure, refer to Operation and Maintenance Manual, "Hydraulic System Oil Level - Check".



Illustration 595

g06254537

- 5.** Remove four bolts (4), disconnect the harness connector from the filter bypass switch, and remove cover assembly (5) from the tank. Inspect the O-ring on the cover for damage and replace as necessary.



Illustration 597

g06254537

- 7.** Place cover assembly (5) into position in the tank. Install four bolts (4) and tighten to 30 ± 7 N·m (22 ± 5 lb ft). Install the harness connector on the filter bypass switch.

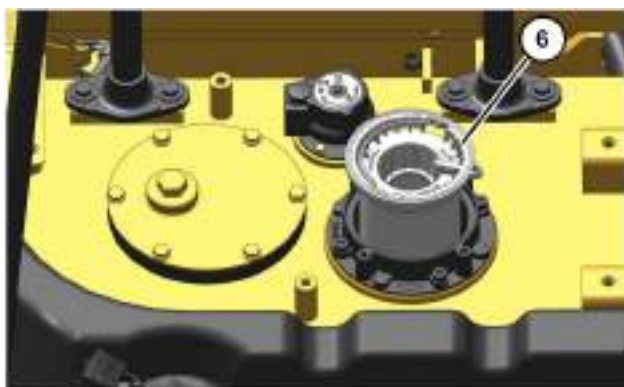


Illustration 596

g06254829

- 6.** Remove filter element (6) and discard. Install a new element into the filter case.

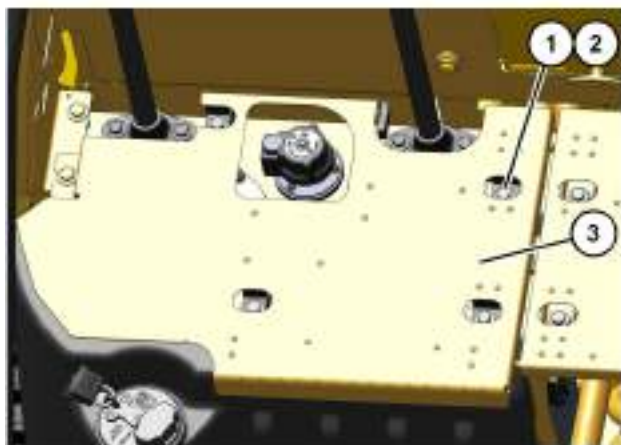


Illustration 598

g06182169

8. Position cover (3) in place on the top of the hydraulic tank. Install five bolts (1) and washers (2).

i07174987

Hydraulic System Oil Level - Check

SMCS Code: 5050-535

WARNING

Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact skin.

NOTICE

Never remove the fill/vent plug from the hydraulic tank if the oil is hot.

Air can enter the system and cause pump damage.



Illustration 599

g06181120

1. Park the machine on level ground. Lower the bucket to the ground with the stick in a vertical position, as shown.



Illustration 600

g06219991

2. Open the access door on the right side of the machine.

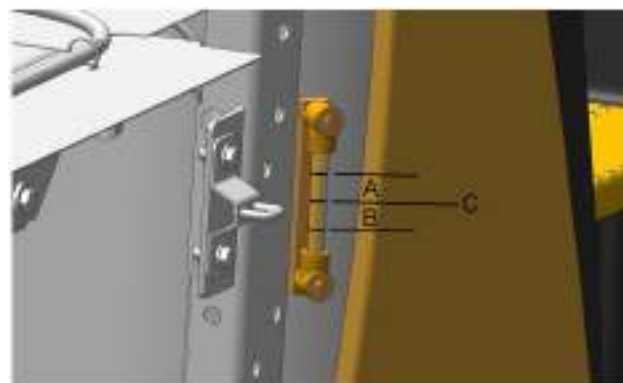


Illustration 601

g06182648

- (A) High temperature range
(B) Low temperature range
(C) Mid temperature range

3. If the hydraulic oil temperature is between 10° to 30° C (50° to 86° F), maintain the oil level in low temperature range (B). If the hydraulic oil temperature is between 50° to 80° C (122° to 187° F), maintain the oil level in high temperature range (A). If the hydraulic oil temperature is between 31° to 49° C (87° to 121° F), maintain the oil level in mid temperature range (C).

4. Close the access door.

Note: Perform Step 5 through Step 8 if the oil level is low.

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information that pertains to Containing Fluid Spillage.



WARNING

Pressurized system!

The hydraulic tank contains hot oil under pressure. To prevent burns from the sudden release of hot oil, relieve the tank pressure with the engine off. Relieve pressure by slowly turning the cap until the cap reaches the secondary stop.

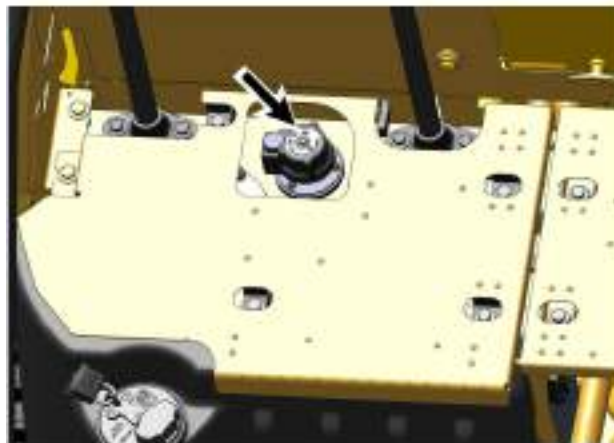


Illustration 602

g06182653

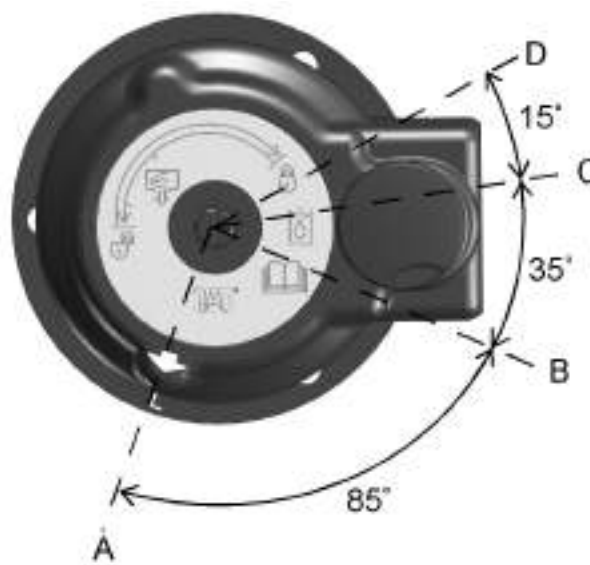


Illustration 603

g06184990

Filler cap

- (A) LOCK position
(B) PRESSURE RELEASE - START position
(C) PRESSURE RELEASE - END position
(D) OPEN position

5. Release the pressure that may be present in the return hydraulic circuit with the following procedure. Refer to Illustration 603 for filler cap positions.

- a. Turn the filler cap counterclockwise and move the arrow from position (A) to position (B).

- b. Release the pressure for a minimum of 45 seconds by moving the arrow from position (B) to position (C).
 - c. Move the arrow from position (C) to position (D).
 - d. After the tank pressure is relieved, remove the filler cap.
6. Add oil if necessary. See Operation and Maintenance, "Lubricant Viscosities"
7. Check the O-ring seal on the filler cap. Replace the O-ring seal if the seal is damaged.
8. Clean the filler cap and install on the tank. Tighten the filler cap on the hydraulic tank to position (A).

i07590874

Hydraulic System Oil Sample - Obtain

SMCS Code: 5050-008-OC; 5095-008; 5095-SM; 7542-008; 7542

Note: If Cat HYDO Advanced hydraulic oils are used, the hydraulic oil change interval is extended to 6000 hours. S·O·S services after 3,000 hour is recommended. Consult your Cat dealer for details.

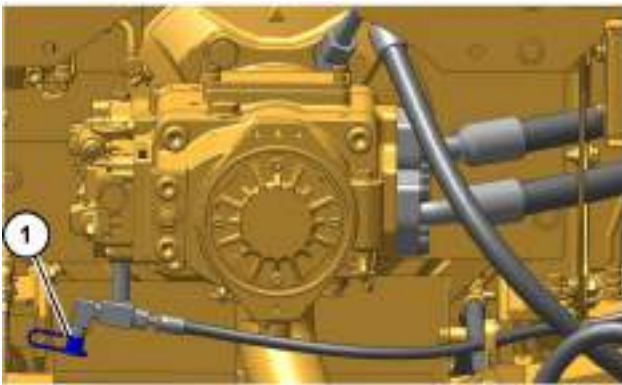


Illustration 604

g06373208

The hydraulic oil sampling valve (1) is connected to the pilot line of the main hydraulic pump regulator. Obtain a sample of the hydraulic oil from the hydraulic oil sampling valve. Refer to Special Publication, SEBU6250, "S·O·S Oil Analysis" for information that pertains to obtaining a sample of the hydraulic oil. Refer to Special Publication, PEGJ0047, "How To Take A Good Oil Sample" for more information about obtaining a sample of the hydraulic oil.

i03753191

Indicators and Gauges - Test

SMCS Code: 7450-081; 7490-081

- 1. Look for broken lenses on the gauges, broken indicator lights, broken switches, and other broken components in the cab.
- 2. Start the engine.
- 3. Look for inoperative gauges.
- 4. Turn on all machine lights. Check for proper operation.
- 5. Move the machine forward. Release the travel levers and the travel pedals. The machine should stop.
- 6. Stop the engine.
- 7. Make any repairs that are required before operating the machine.

i07833447

Oil Filter (Hydraulic Hammer) - Replace (If Equipped)

SMCS Code: 5068-510

WARNING

Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact skin.

The use of hydraulic hammers shortens the life of hydraulic oil. If a hydraulic hammer is used, the maintenance interval is shortened, refer to Table 31 for the intervals.

Table 31

Percentage of Hammer Use	Oil Filter (Hydraulic Hammer) - Replace
50%	Every 250 service hours
100%	Every 100 service hours



Illustration 605

g06181120

1. Park the machine on level ground in the service position as shown.
2. Move the hydraulic lockout control to the UNLOCKED position.
3. Turn the engine start switch to the ON position.
4. Move the joysticks and the travel levers/pedals to the full stroke positions to relieve the pressure in the hydraulic lines.
5. Turn the engine start switch to the OFF position and return the lever for the hydraulic lockout control to the LOCKED position.

WARNING

Pressurized system!

The hydraulic tank contains hot oil under pressure. To prevent burns from the sudden release of hot oil, relieve the tank pressure with the engine off. Relieve pressure by slowly turning the cap until the cap reaches the secondary stop.

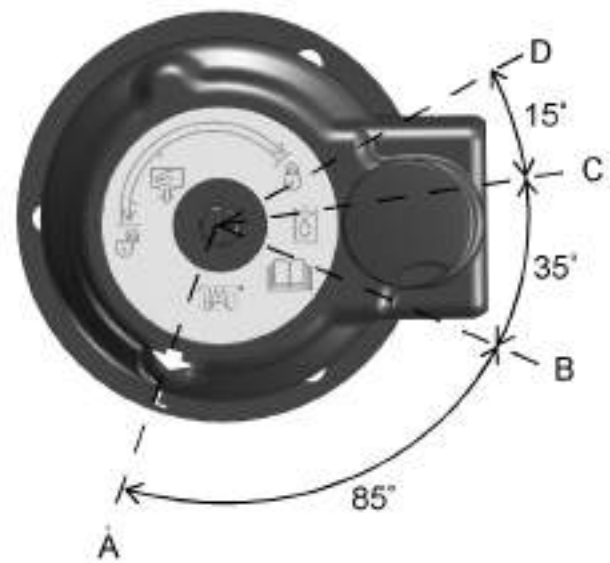


Illustration 606

g06184990

Filler cap

- (A) LOCK position
- (B) PRESSURE RELEASE - START position
- (C) PRESSURE RELEASE - END position
- (D) OPEN position

6. Release the pressure that may be present in the return hydraulic circuit with the following procedure. Refer to Illustration 606 for filler cap positions.
 - a. Turn the filler cap counterclockwise and move the arrow from position (A) to position (B).
 - b. Release the pressure for a minimum of 45 seconds by moving the arrow from position (B) to position (C).
 - c. Move the arrow from position (C) to position (D).
 - d. After the tank pressure is relieved, remove the filler cap.
7. The oil filter for the hammer is located near the base of the boom.

Note: Some configurations may invert the hammer filter installation.

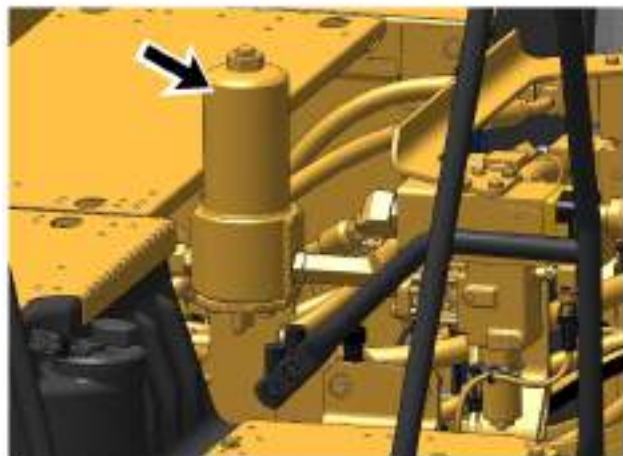


Illustration 607

g06211151

8. Position a suitable container to contain the oil.

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information on containing fluid spillage.

9. Loosen the filter housing and remove. Inspect the plug on the top of the housing. If there are signs of leakage, replace the O-ring on the plug. Tighten the plug to $59 \pm 5 \text{ N}\cdot\text{m}$ ($44 \pm 4 \text{ lb ft}$).

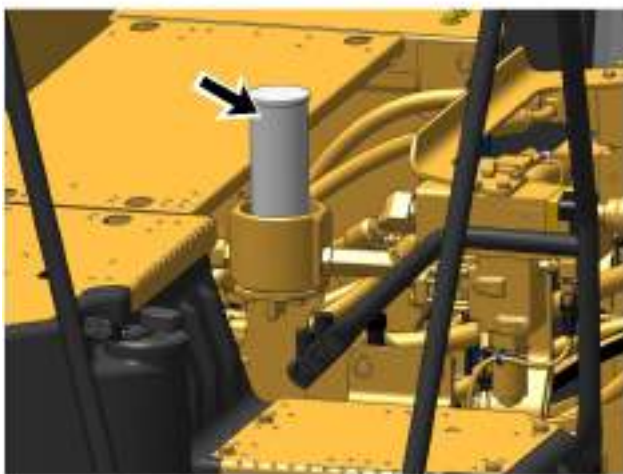


Illustration 608

g06211156

10. Remove the filter element and discard. The element cannot be reused.

Note: Used filter elements should always be disposed of according to local regulations.

11. Install the new filter element.

12. Clean the filter housing and install on the filter base. Tighten the nut on the filter case to $98 \pm 10 \text{ N}\cdot\text{m}$ ($72 \pm 7 \text{ lb ft}$).

13. Start the engine and operate the machine slowly for 10 to 15 minutes. Move each cylinder evenly through several cycles and operate the hammer.

14. Return the machine to the service position. Check the machine for oil leaks.

15. Stop the engine.

16. Check the hydraulic oil level.

Reference: For the correct procedure, refer to Operation and Maintenance Manual, "Hydraulic System Oil Level - Check".

i07349186

Oil Filter - Inspect

SMCS Code: 1308-507; 5068-507

Inspect a Used Filter for Debris



Illustration 609

g06224663

The element is shown with debris.

Use a filter cutter to cut the filter element open. Spread apart the pleats and inspect the element for metal and for 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 can indicate wear from steel parts and on cast iron parts.

Nonferrous metals can indicate wear from the aluminum parts of the engine such as main bearings, rod bearings, or turbocharger bearings.

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

Using an oil filter element that is not recommended by Caterpillar can result in severe engine damage to engine bearings, to the crankshaft, and to other parts. This can result in larger particles in unfiltered oil. The particles could enter the lubricating system and the particles could cause damage.

i06972489

Radiator, Aftercooler and Oil Cooler Cores - Clean

SMCS Code: 1063-070-KO; 1353-070-KO; 1374-070-KO

WARNING

Personal injury can result from air pressure.

Personal injury can result without following proper procedure. When using pressure air, wear a protective face shield and protective clothing.

Maximum air pressure at the nozzle must be less than 205 kPa (30 psi) for cleaning purposes.



Illustration 610

g06179792

1. Open the access door on the left side of the machine.

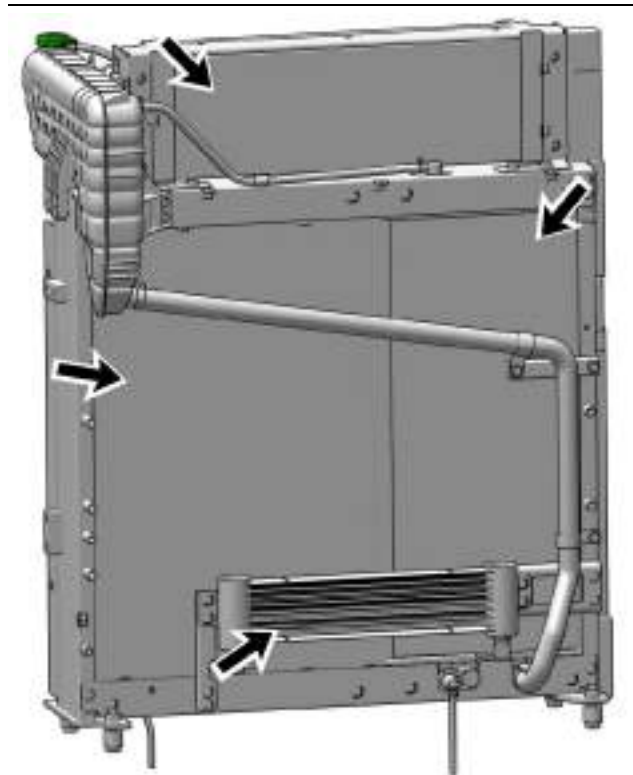


Illustration 611

g06183814

2. Remove dust and debris from all the core fins.

Compressed air is preferred, but high-pressure water or steam can be used to remove dust and general debris from a core.

See Special Publication, SEBD0518, "Know Your Cooling System" for more detailed information about cleaning core fins.

3. Close the access door on the left side of the machine.

i08192239

i07349192

Receiver Dryer (Refrigerant) - Replace

SMCS Code: 7322-510; 7322-710

WARNING

Personal injury can result from contact with refrigerant.

Contact with refrigerant can cause frost bite. Keep face and hands away to help prevent injury.

Protective goggles must always be worn when refrigerant lines are opened, even if the gauges indicate the system is empty of refrigerant.

Always use precaution when a fitting is removed. Slowly loosen the fitting. If the system is still under pressure, release it slowly in a well ventilated area.

Personal injury or death can result from inhaling refrigerant through a lit cigarette.

Inhaling air conditioner refrigerant gas through a lit cigarette or other smoking method or inhaling fumes released from a flame contacting air conditioner refrigerant gas, can cause bodily harm or death.

Do not smoke when servicing air conditioners or wherever refrigerant gas may be present.

Use a certified recovery and recycling cart to properly remove the refrigerant from the air conditioning system.

NOTICE

If the refrigerant system has been open to the outside air (without being plugged) for more than 30 minutes, the receiver-dryer must be replaced. Moisture will enter an open refrigerant system and cause corrosion which will lead to component failure.

Prepare the machine for maintenance. Refer to Operation and Maintenance Manual, "Prepare the Machine for Maintenance".

Refer to Service Manual, "Air Conditioning and Heating R-134a for All Caterpillar Machines" for the proper procedure to change the receiver-dryer assembly and for the procedure to reclaim the refrigerant gas.

Rollover Protective Structure (ROPS) - Inspect

SMCS Code: 7323-040; 7325-040



Illustration 612

g06184357

Consult your Cat dealer for repair of any cracks in the ROPS.

Inspect the ROPS for loose bolts or for damaged bolts. Replace any damaged bolts or missing bolts with original equipment parts only. Tighten the M24 bolt (1) to $425 \pm 50 \text{ N}\cdot\text{m}$ ($315 \pm 40 \text{ lb}\cdot\text{ft}$).

Note: Apply oil to all ROPS bolt threads before you install the bolts. Failure to apply oil to the bolt threads can result in improper bolt torque.

Do not straighten the ROPS. Do not repair the ROPS by welding reinforcement plates to the ROPS.

Consult your Cat dealer for inspection of any potential damage or repair of any damage to any operator protective structure. (Including ROPS, FOPS, TOPS, OPS, and OPG) Refer to Special Instruction, SEHS6929, "Inspection, Maintenance, and Repair of Operator Protective Structures (OPS) and Attachment Installation Guidelines for All Earthmoving Machinery"

i07103309

i06970675

Seat Belt - Inspect

SMCS Code: 7327-040

Always inspect the condition of the seat belt and the condition of the seat belt mounting hardware before you operate the machine. Replace any parts that are damaged or worn before you operate the machine.



Illustration 613

g06224278

Typical example

Inspect buckle (2) for wear or for damage. If the buckle is worn or damaged, replace the seat belt.

Inspect seat belt (1) for webbing that is worn or frayed. Replace the seat belt if the webbing is worn or frayed.

Inspect all seat belt mounting hardware for wear or for damage. Replace any mounting hardware that is worn or damaged. Make sure that the mounting bolts are tight.

If your machine is equipped with a seat belt extension, also perform this inspection procedure for the seat belt extension.

Contact your Cat dealer for the replacement of the seat belt and the mounting hardware.

Note: The seat belt should be replaced within 3 years of the date of installation. A date of installation label is attached to the seat belt retractor and buckle. If the date of installation label is missing, replace belt within 3 years from the year of manufacture as indicated on belt webbing label, buckle housing, or installation tags (non-retractable belts).

Seat Belt - Replace

SMCS Code: 7327-510

The seat belt should be replaced within 3 years of the date of installation. A date of installation label is attached to the seat belt retractor and buckle. If the date of installation label is missing, replace the belt within 3 years from the year of manufacture as indicated on the belt webbing label, buckle housing, or installation tags (non-retractable belts).

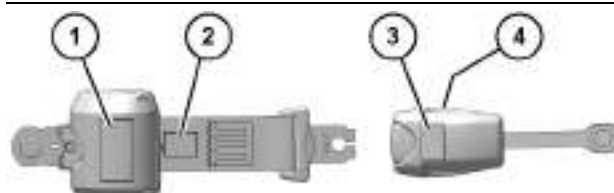


Illustration 614

g06183390

- (1) Date of installation (retractor)
- (2) Year of manufacture (tag) (fully extended web)
- (3) Date of installation (buckle)
- (4) Year of manufacture (underside) (buckle)

Consult your Cat dealer for the replacement of the seat belt and the mounting hardware.

Determine the age of a new seat belt before installing on seat. A manufacture label is on the belt webbing and imprinted on the belt buckle. Do not exceed the install by date on the label.

A complete seat belt system should be installed with new mounting hardware.

Date of installation labels should be marked and affixed to the seat belt retractor and buckle.

Note: Date of installation labels should be permanently marked by punch (retractable belt) or stamp (non-retractable belt).

If your machine is equipped with a seat belt extension, also perform this replacement procedure for the seat belt extension.

i06987212

Swing Bearing - Lubricate

SMCS Code: 7063-086

Note: Refer to Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations" for more information on grease.

Note: Do not overgrease the swing bearings. Do not grease more than the recommended maintenance interval. Refer to Operation and Maintenance Manual, "Maintenance Interval Schedule" for more information.

Wipe the fittings before you lubricate the swing bearing.



Illustration 615

g06210366

The swing bearing grease zerks are located at the front of the swing drive housing near the boom cylinders.

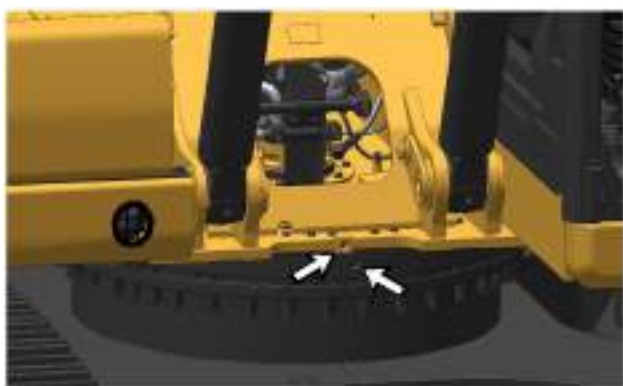


Illustration 616

g06188212

Apply lubricant through the fittings until the lubricant overflows the bearing seals.

i07349198

Swing Drive Oil - Change

SMCS Code: 5459-044



Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact skin.



Illustration 617

g06188541

1. Remove the access cover that is located below the swing drives.

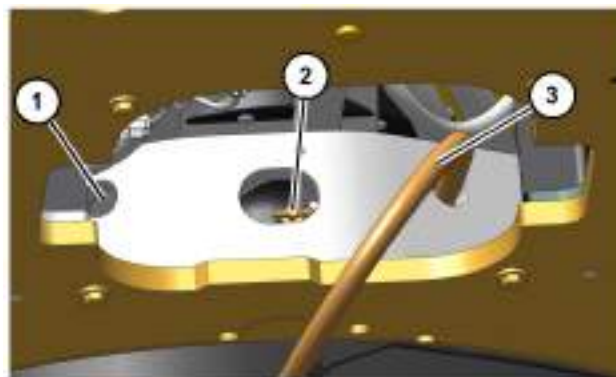


Illustration 618

g06192018

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information that pertains to Containing Fluid Spillage.

2. Remove drain hose (3) from holder (1) on the upper frame. Face the end of the hose toward the container.
3. Loosen drain valve (2). Drain the oil into a suitable container.

Note: Drained fluids should always be disposed of according to local regulations.

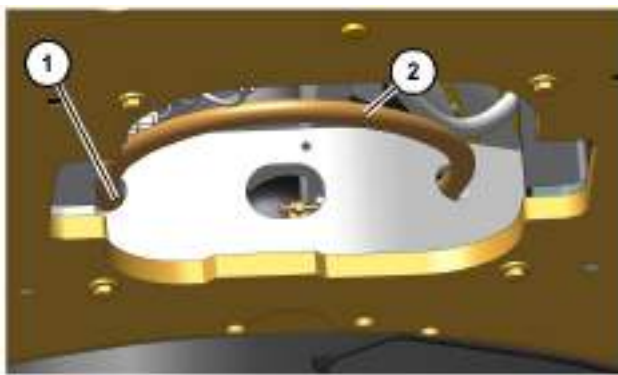


Illustration 619

g06192024

4. Tighten the drain valve. Return the drain hose to holder (1). Make sure that the end of the hose is facing upward.

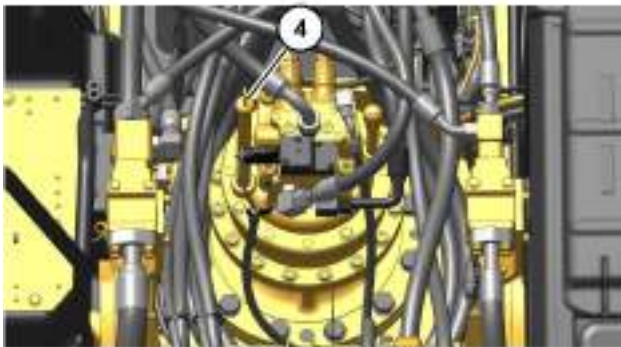


Illustration 620

g06188581

5. Remove dipstick (4).
6. Add the specified quantity of oil through the dipstick tube. See Operation and Maintenance, "Capacities (Refill)".



Illustration 621

g06188660

7. Maintain the oil level between the "ADD" and "FULL" marks on the dipstick.
8. Check the oil that has been drained for metal chips or metal particles. Consult your Cat dealer if any metal chips or metal particles are found.
9. Drained materials should always be disposed of according to local regulations.

i06988089

Swing Drive Oil Level - Check

SMCS Code: 5459-535-FLV

WARNING

Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact skin.



Illustration 622

g06188672

The dipstick for the swing drive oil is on the swing drive at the rear base of the boom.

i06988143

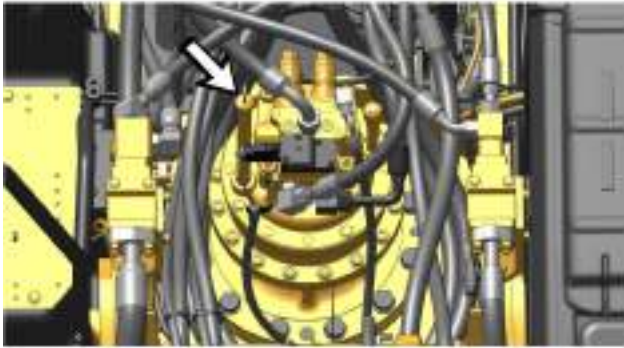


Illustration 623

g06188677

1. Remove the dipstick.



Illustration 624

g06188660

Note: Refer to Operation and Maintenance Manual, "General Hazard Information" for information that pertains to Containing Fluid Spillage.

2. Check the dipstick. Maintain the oil level between the "ADD" and "FULL" marks on the dipstick. Add oil through the dipstick tube, if necessary. Refer to Operation and Maintenance Manual, "Lubricant Viscosities" when you select an oil. If the oil level is above the "FULL" line, then remove oil from the system. Restore the oil to the correct level position.
3. Insert the dipstick.

Swing Drive Oil Sample - Obtain

SMCS Code: 5459-554-OC; 5459-008; 5459-008-OC; 5459-OC; 7542-008

WARNING

Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact skin.

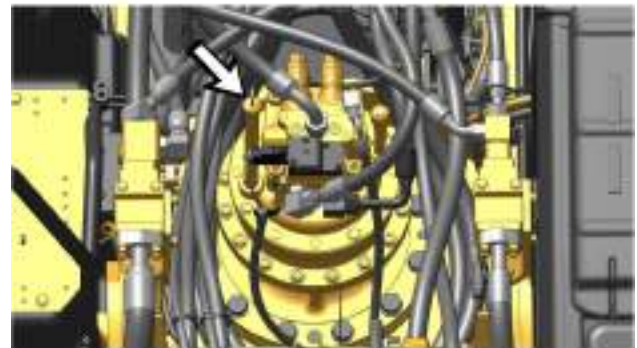


Illustration 625

g06188677

Obtain an oil sample of the swing drive oil through the opening for the dipstick. Refer to Special Publication, SEBU6250, "S·O·S Oil Analysis" for information that pertains to obtaining an oil sample from the swing drive housing. Refer to Special Publication, PEGJ0047, "How To Take A Good Oil Sample" for more information about obtaining an oil sample from the swing drive housing.

i06988169

Swing Gear - Lubricate

SMCS Code: 7063-086

Note: Refer to Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations" for more information on grease.

NOTICE

Improper lubrication can cause damage to machine components.

To avoid damage, make sure that the proper amount of grease is applied to the swing drive.

When the amount of grease in the compartment becomes too large, the agitation loss becomes large, thereby accelerating grease deterioration.

Grease deterioration can cause damage to the pinion gear of the swing drive and swing internal gear.

Not enough grease will result in poor gear lubrication.

Remove the inspection cover that is located near the boom base. Inspect the grease.

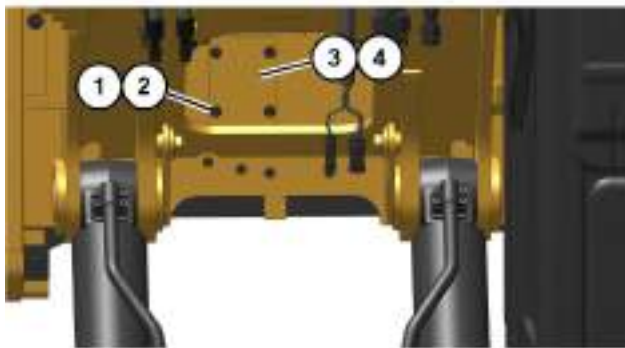


Illustration 626

g06188728

- (1) Bolts
- (2) Washers
- (3) Cover
- (4) Gasket

1. Remove bolts (1) and washers (2). Remove cover (3) and gasket (4).
2. Inspect gasket (4). Replace the gasket if damage is evident.

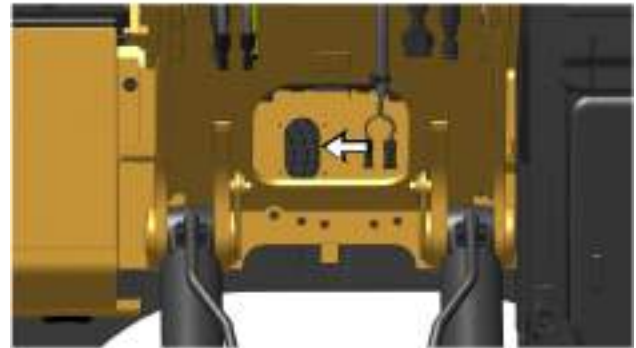


Illustration 627

g06188736

3. Check the level of grease. The level of grease is correct when:

- Waves of grease are present from the rotating swing drive pinion.
- The grease is evenly distributed on the floor of the pan.

Note: Smeared or waveless areas are evidence for a lack of grease.

Note: Add grease, as needed. Remove grease, as needed. Too much grease will result in the deterioration of the grease because of excessive movement of the grease. Too little grease will result in poor lubrication of the swing gear.

Refer to Operation and Maintenance Manual, "Capacities (Refill)" for the size of the pan.

4. Check for contamination and for discolored grease.

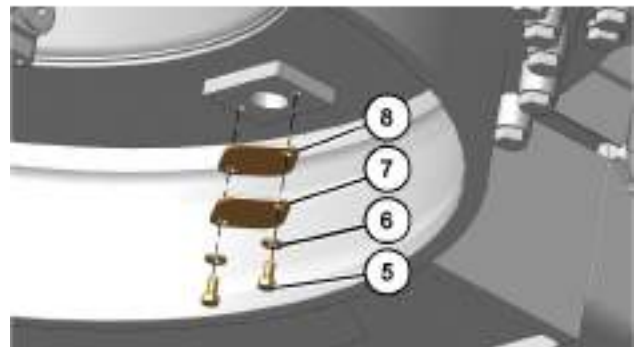


Illustration 628

g06188788

- (5) Bolts
- (6) Washers
- (7) Cover
- (8) Gasket

Maintenance Section

Track Adjustment - Adjust

5. If the grease is contaminated or discolored with water, change the grease. Remove the covers from below the swing drive underneath the undercarriage frame.
6. Remove bolts (5), washers (6), cover (7), and gasket (8) to allow the water to drain. When you reinstall cover (7), inspect gasket (8). Replace the gasket if damage is evident.



Illustration 629

g06188791

7. Raise the boom and turn the upper structure by 1/4 turn. Lower the bucket to the ground.
8. Repeat Step 7 at every 1/4 turn in four places. Add grease, as needed.
9. Install gasket (4), cover (3), washers (2), and bolts (1).

i06988628

Track Adjustment - Adjust

SMCS Code: 4170-025

WARNING

Personal injury or death can result from grease under pressure.

Grease coming out of the relief valve under pressure can penetrate the body causing injury or death.

Do not watch the relief valve to see if grease is escaping. Watch the track or track adjustment cylinder to see if the track is being loosened.

Loosen the relief valve one turn only.

If track does not loosen, close the relief valve and contact your Caterpillar dealer.

NOTICE

Keeping the track properly adjusted will increase the service life of the track and drive components.

Note: The track tension must be adjusted according to the current operating conditions. Keep the track as slack as possible if the soil is heavy.

Measuring Track Tension

1. Operate the machine in the direction of the idlers.



Illustration 630

g06188816

2. Stop with one track pin directly over the front carrier roller. Park the machine and turn off the engine.



Illustration 631

g06208711

3. Place a straight edge on top of the track grousers between the front carrier roller and the idler. The straight edge should be long enough to reach from the front carrier roller to the idler.

Note: If your machine is equipped with three carrier rollers, place a straight edge on the tracks between the carrier rollers. The straight edge should be long enough to reach from one carrier roller to another carrier roller.

4. Measure the maximum amount of sag in the track. The sag is measured from the highest point of the track grouser to the bottom of the straight edge. A track that is properly adjusted will have a sag of 40.0 to 55.0 mm (1.57 to 2.17 inch).

5. If the track is too tight, or if the track is too loose, adjust the track tension according to the appropriate procedure below.

Adjusting Track Tension



Illustration 632

g06188820

Typical example

The track adjuster is located on the track frame.

Tightening the Track



Illustration 633

g06188830

(1) Grease valve

Wipe the fitting before you add grease.

1. Add grease through grease valve (1) until the correct track tension is reached.
2. Operate the machine back and forth in order to equalize the pressure.
3. Check the amount of sag. Adjust the track, as needed.

Loosening the Track

i06954313



Illustration 634

g06188830

(1) Grease valve

1. Loosen grease valve (1) carefully until the track begins to loosen. One turn should be the maximum.
2. Tighten grease valve (1) to $34 \pm 5 \text{ N}\cdot\text{m}$ ($25 \pm 4 \text{ lb ft}$) when the desired track tension is reached.
3. Operate the machine back and forth in order to equalize the pressure.
4. Check the amount of sag. Adjust the track, as needed.

i06969791

Track Adjustment - Inspect

SMCS Code: 4170-040

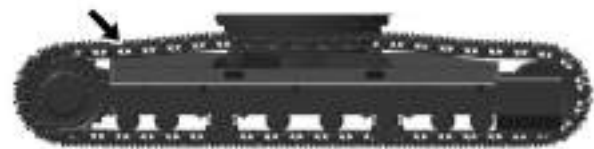


Illustration 635

g06182929

Check the track adjustment. Check the track for wear and for excessive dirt buildup.

If the track appears to be too tight or too loose, refer to Operation and Maintenance Manual, "Track Adjustment - Adjust".

Travel Alarm - Test (If Equipped)

SMCS Code: 7429-081

Move the machine to test the travel alarm.

1. Start the engine. Move the hydraulic lockout control to the UNLOCKED position.
2. Raise the work tool to avoid any obstacles. Make sure that there is adequate overhead clearance.



Illustration 636

g06181402

3. Use the travel levers or the travel pedals to move the machine forward. The travel alarm should sound.
4. Release the travel levers and the travel pedals to stop the machine.
5. Use the travel levers and the travel pedals to move the machine backward. The travel alarm should sound.

i08233399



Illustration 637

g06181631

6. Press the alarm mute button. The travel alarm should shut off.
7. Stop the machine. Lower the work tool to the ground. Move the hydraulic lockout control to the LOCKED position. Stop the engine.

Undercarriage - Check

SMCS Code: 4150-535



Illustration 638

g06182923

1. Check the carrier rollers, the track rollers, and the idler wheels for possible leakage.
2. Check the surface of the track, the carrier rollers, the track rollers, the idler wheels, the track shoes, and the drive sprockets. Look for signs of wear and loose mounting bolts.
3. Listen for any abnormal noises while you are moving slowly in an open area.
4. If required, clean the undercarriage to keep excess material from building up and solidifying.
5. If abnormal wear exists or abnormal noises or leaks are found, consult your Cat[®] dealer.

i06954326

Window Washer Reservoir - Fill

SMCS Code: 7306-544-KE

NOTICE

When operating in freezing temperatures, use Caterpillar or any commercially available nonfreezing window washer solvent.



Illustration 639

g06181546

1. Open the access door on the left side of the machine.



Illustration 640

g06181644

2. Remove the filler cap.
3. Fill the window washer reservoir with washer fluid through the filler opening.
4. Install the filler cap.
5. Close the access door.

i01258249

Window Wiper - Inspect/Replace

SMCS Code: 7305-040; 7305-510

Inspect the condition of the wiper blades. Replace the wiper blades if the wiper blades are worn or damaged or if streaking occurs.

Windows - Clean

SMCS Code: 7310-070; 7340-070

Clean the outside of the windows from the ground, unless handholds are available.



Illustration 641

g06224268

Typical example

Cleaning Methods

Aircraft Window Cleaner

Apply the cleaner with a soft cloth. Rub the window with moderate pressure until all the dirt is removed. Allow the cleaner to dry. Wipe off the cleaner with a clean soft cloth.

Soap and Water

Use a clean sponge or a soft cloth. Wash the windows with a mild soap or with a mild detergent. Also use plenty of lukewarm water. Rinse the windows thoroughly. Dry the windows with a moist chamois or with a moist cellulose sponge.

Stubborn Dirt and Grease

Wash the windows with a good grade of naphtha, of isopropyl alcohol, or of Butyl Cellosolve. Then, wash the windows with soap and with water.

Polycarbonate Windows (If equipped)

Special care is needed to clean polycarbonate windows.

Wash polycarbonate windows with mild soap and warm water that does not exceed 50° C (122° F). Use a soft sponge, or damp cloth. Never use a dry cloth or paper towels on polycarbonate windows. Rinse the windows with a sufficient amount of clean cold water.

Note: Naphtha or kerosene can be used to remove labels, films, paint, or marking pen from polycarbonate windows.

Note: Do not use abrasive, or highly alkaline cleaners. Do not use sharp instruments, such as squeegees or razor blades on polycarbonate windows. Do not clean polycarbonate windows in the hot sun or at elevated temperatures.

Warranty Section

Warranty Information

i06044323

Emissions Warranty Information

SMCS Code: 1000

The certifying engine manufacturer warrants to the ultimate purchaser and each subsequent purchaser that:

1. New non-road diesel engines and stationary diesel engines less than 10 liters per cylinder (including Tier 1 and Tier 2 marine engines < 37 kW, but excluding locomotive and other marine engines) operated and serviced in the United States and Canada, including all parts of their emission control systems ("emission related components"), are:

- a. Designed, built, and equipped so as to conform, at the time of sale, with applicable emission standards prescribed by the United States Environmental Protection Agency (EPA) by way of regulation.
- b. Free from defects in materials and workmanship in emission-related components that can cause the engine to fail to conform to applicable emission standards for the warranty period.

2. New non-road diesel engines (including Tier 1 and Tier 2 marine propulsion engines < 37 kW and Tier 1 through Tier 4 marine auxiliary engines < 37 kW, but excluding locomotive and other marine engines) operated and serviced in the state of California, including all parts of their emission control systems ("emission related components"), are:

- a. Designed, built, and equipped so as to conform, at the time of sale, to all applicable regulations adopted by the California Air Resources Board (ARB).
- b. Free from defects in materials and workmanship which cause the failure of an emission-related component to be identical in all material respects to the component as described in the engine manufacturer's application for certification for the warranty period.

3. New non-road diesel engines installed in construction machines conforming to the South Korean regulations for construction machines manufactured after January 1, 2015, and operated and serviced in South Korea, including all parts of their emission control systems ("emission related components"), are:

- a. Designed, built, and equipped so as to conform, at the time of sale, with applicable emission standards prescribed in the Enforcement Rule of the Clean Air Conservation Act promulgated by South Korea MOE.
- b. Free from defects in materials and workmanship in emission-related components that can cause the engine to fail to conform to applicable emission standards for the warranty period.

The aftertreatment system can be expected to function properly for the lifetime of the engine (emissions durability period) subject to prescribed maintenance requirements being followed.

A detailed explanation of the Emission Control Warranty that is applicable to new non-road and stationary diesel engines, including the components covered and the warranty period, is found in a supplemental Special Publication. Consult your authorized Cat dealer to determine if your engine is subject to an Emission Control Warranty and to obtain a copy of the applicable Special Publication.

Reference Information Section

Reference Materials

i08292374

Reference Material

SMCS Code: 1000; 7000

Additional literature regarding your product may be purchased from your local Cat dealer or by visiting publications.cat.com. Use the product name, sales model, and serial number to obtain the correct information for your product.

publications.cat.com

i08292382

Decommissioning and Disposal

SMCS Code: 1000; 7000

When the product is removed from service, local regulations for the product decommissioning will vary. Disposal of the product will vary with local regulations.

Improperly disposing of waste can threaten the environment. Obey all local regulations for the decommissioning and disposal of materials.

Utilize appropriate personal protective equipment when decommissioning and disposing product.

Consult the nearest Cat dealer for additional information. Including information for component remanufacturing and recycling options.

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Product and Dealer Information

Note: For product identification plate locations, see the section “Product Identification Information” in the Operation and Maintenance Manual.

Delivery Date: _____

Product Information

Model: _____

Product Identification Number: _____

Engine Serial Number: _____

Transmission Serial Number: _____

Generator Serial Number: _____

Attachment Serial Numbers: _____

Attachment Information: _____

Customer Equipment Number: _____

Dealer Equipment Number: _____

Dealer Information

Name: _____ Branch: _____

Address: _____

	<u>Dealer Contact</u>	<u>Phone Number</u>	<u>Hours</u>
Sales:	_____	_____	_____
Parts:	_____	_____	_____
Service:	_____	_____	_____

