April 2015
EM004921-00

Operation and Maintenance Manual

MD6240**C**
Rotary Blasthole Drill

DN2 1-Up

(1) Falling Objects (Winch)

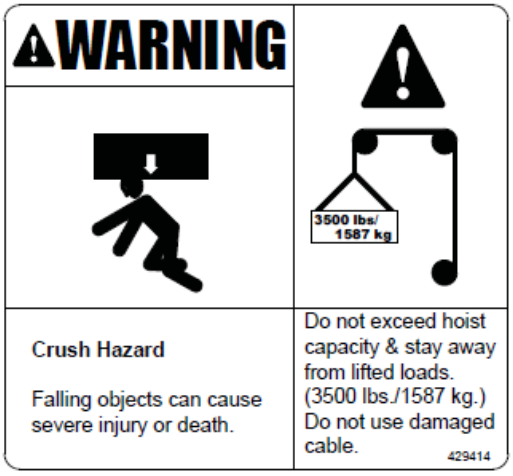


Figure 3

(2) Falling Objects (Carousel)

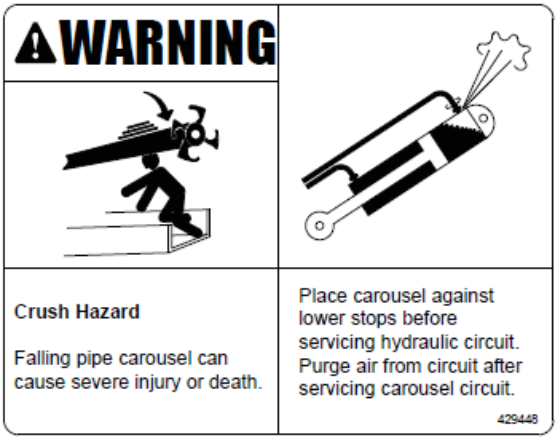


Figure 4

(3) Rotating Shaft

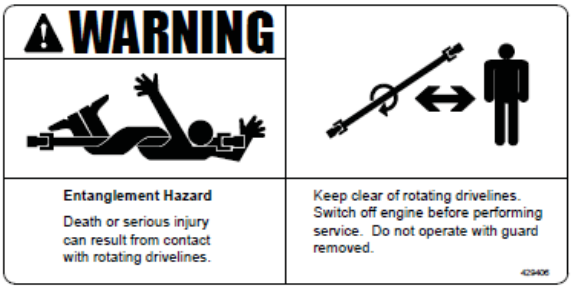


Figure 5

(4) Entanglement

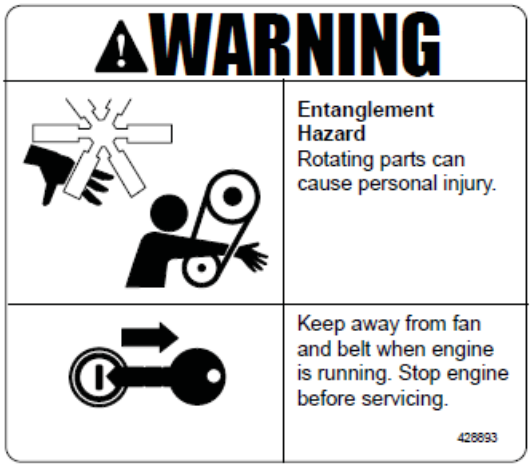


Figure 6

(5) Falling Mast

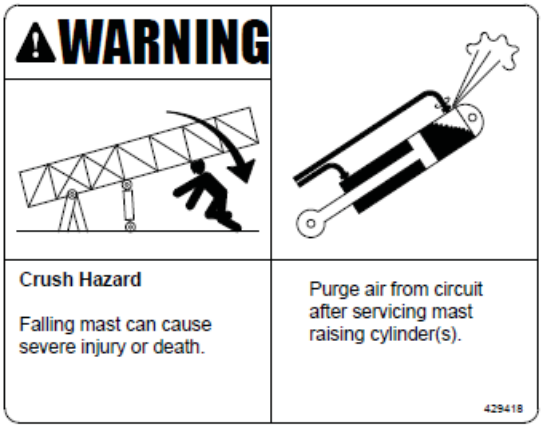


Figure 7

(6) Hot Pressurized Fluid

pressure can penetrate body tissue. Fluid penetration can cause serious injury and possible death. A pinhole 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, “Caterpillar 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

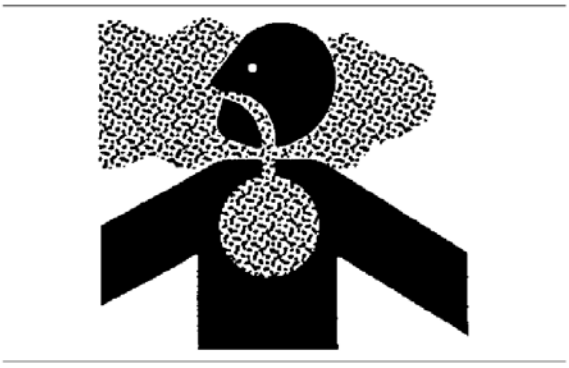


Figure 37

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”.
- Obey environmental regulations for the disposal of asbestos.
- Stay away from areas that might have asbestos particles in the air.

Dispose of Waste Properly

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.

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

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

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.

Machine Operation when the Machine is not Completely Assembled

Figure 45

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 mast in the event of a machine tip over or a machine rollover incident.

Engine Stopping

NOTICE

Do not stop the engine immediately after the machine has been operated under load. This 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 for five minutes before shutdown. This allows hot areas of the engine to cool gradually.

(5) Suspension Adjustment (If Equipped)
(6) Height/Slope Adjustment
(7) Horizontal Adjustment

The lumbar support is located on the side of the seat. Turn knob (3) (if equipped) counterclockwise in order to increase the force of the lumbar support. In order to decrease the lumbar support, continue to turn the knob counterclockwise.

Put slight pressure on the back of the seat and lift handle (4) to adjust. Release the lever.

For suspension adjustment set dial (5) according to body weight.

Pull lever (6) up in order to change the angle of the front of the seat. Release the lever.
Push lever (6) down in order to change the angle of the back of the seat. Release the lever.

To adjust the seat forward or backward, pull up lever (7) and hold the lever. Move the seat to the desired position. To lock the seat in the selected position, release the lever.

⚠ WARNING

Do not use damaged or faulty seat. Do not adjust the seat while traveling and always use seat belts.

Seat Belt

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 Non-Retractable Seat Belts

Adjust both ends of the seat belt. The seat belt should be snug but comfortable.

Lengthening the Seat Belt

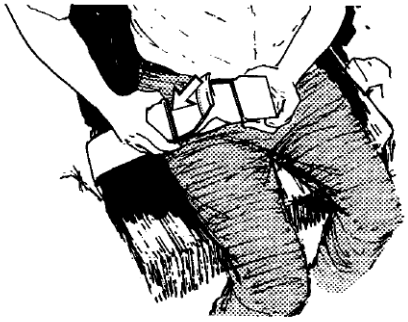


Figure 50

1. Unfasten the seat belt.

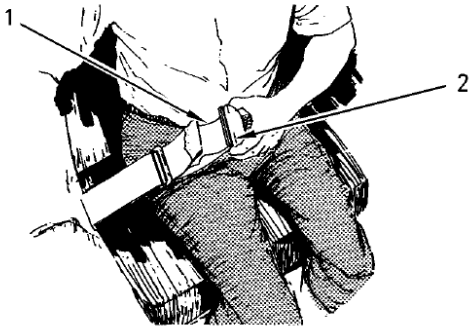


Figure 51

2. To remove the slack in outer loop (1), rotate buckle (2). This will free the lock bar. This permits the seat belt to move through the buckle.
3. Remove the slack from the outer belt loop by pulling on the buckle.
4. Loosen the other half of the seat belt in the same manner. If the seat belt does not fit snugly with the buckle in the center, readjust the seat belt.

Shortening the Seat Belt

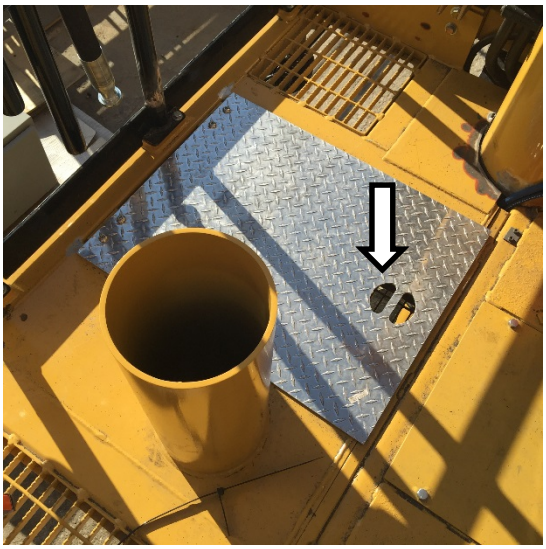
Battery Isolation Switch

1. Battery Isolation Switch Danger Tag
2. Starter Isolation Switch

Ensure that all site isolation procedures are followed prior to undertaking any servicing or preventative maintenance duties. Machine must be 'ISOLATED' before undertaking any maintenance or servicing duties. The starter isolator switch will disconnect main power to the starter motor, the battery isolator switch will disconnect all machine electrical power. The isolation control station is located on the left side of the machine adjacent the battery compartment.

Note: Danger tag or danger lock to be placed on the battery isolator switch immediately after isolating the machine.

Storage Box

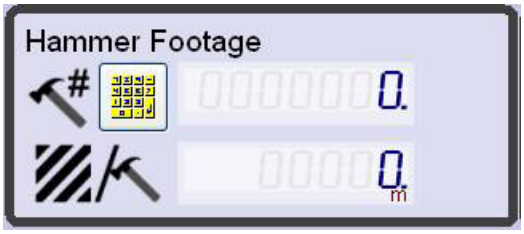


The storage box is located on the right side of the machine. The storage box is used to store miscellaneous tools.

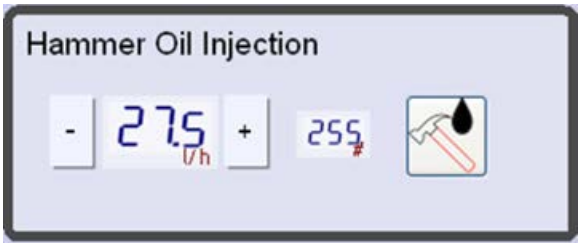
Cab Door

Drill Settings

Also on the dashboard is the panel for selecting hammer footage and oil injection. The hammer footage records how many feet or meters the hammer has drilled.
When a new hammer is installed, and a new serial number entered, the hammer footage will be reset to zero.



The hammer oil injection rate can be adjusted if required. The default setting is 6 liters per hour.
If hammer oil is not activated and bit air is above 150 psi with a depth greater than 3 meters drilled, the bit air pressure pop up will ask the operator to check if hammer oil should be activated. This indicates a hammer must be in use at this pressure.



Tram Screen

After login and engine startup, the dashboard screen will switch to the tram screen whenever the drill is switched into tram mode.

Alternatively the tram screen can be accessed manually by touching the green icon. The dash- board will change to level screen when input is received from a jack or mast lever and return to tram when either tram lever is used.

The tram screen provides the user with information about:

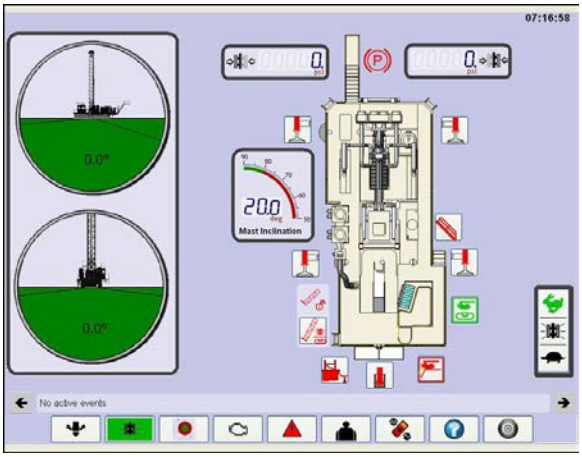
Tram pressures

Machine inclination

Mast angle

Tram interlock status

High and low tram speed select



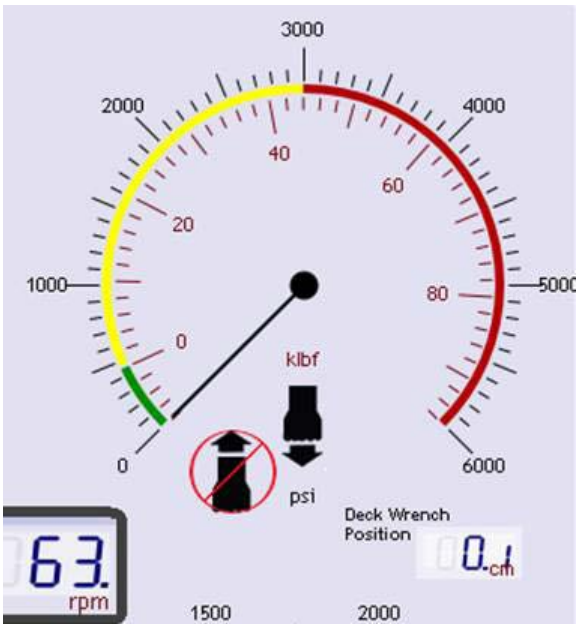
The tram pressures are displayed for the left and right track. The park brake icon displays the status of the brake. It shows red if the park brake is engaged and black if the brake is released.

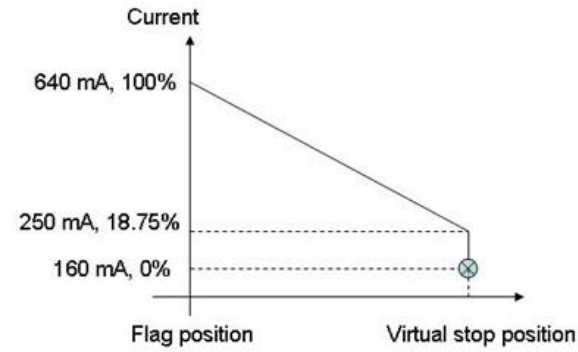
Note: The park brake icon is displaying the electrical output to the valve and is not indicating that the drill is ready to tram.

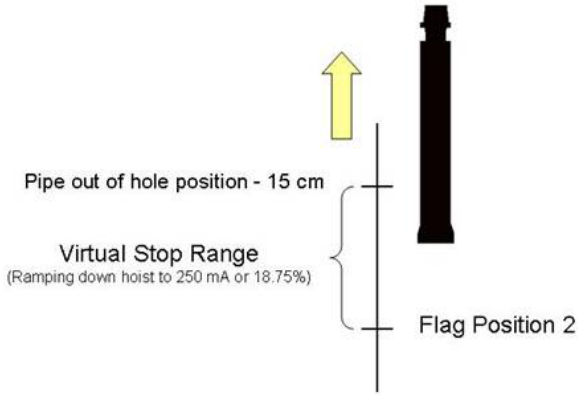
Tram Function Interlocks

Several conditions must be met before the tramming function will operate, as follows:

Each jack must be fully raised, then the corresponding proximity switch will be active (closed) and the jacking symbol will turn from red to green.







Carousel Interlock

If either the pipe rack “parked” or “load” proximity switches are active (closed) then the pipe rack interlock will be active. This means that the hoist and pulldown, and rotation function, will be interlocked and will not operate.
The pipe rack (carousel) must be in the PARKED or the LOAD position, otherwise the hoist/pulldown and rotation are interlocked. In the load position the max pulldown pressure is limited to 1000 psi and hoist speed is reduced.

 Parked

 Interlocked

 Load (Pulldown Reduced)

When drill mode is selected and mast locks indicate “locked”, the pipe rack is parked and under the rotary head. For load position, mast locks symbol on screen must be green and locked. The drill pipe rack symbol on screen must indicate parked or load position.

Auto Drill

Auto drill function is interlocked if the mast locks are not engaged or the rig is not levelled. Once the auto drill function is interlocked, the auto drill button on the drill screen will turn red. As a minimum, auto drill requires signals from all of the following sensors:
Mast lock and unlock limit switches
Both pressure transducers in each jack
RH pump/pulldown pressure sensor
LH pump/rotation pressure
Depth transducer

Back Pressure

When a pneumatic tool is operating near the surface, it is exhausting directly to atmosphere and is producing the maximum horsepower for a given inlet pressure. If any positive pressure above atmospheric pressure (back pressure) is encountered at the exhaust, the tool's efficiency will be reduced.

As the hole is drilled deeper, back pressure is constantly increasing; therefore blow energy will be reduced.

To compensate for this reduced efficiency, it is necessary to increase air pressure at the inlet. Increase the inlet pressure until normal drilling rate is obtained.

Rotation Speed

- Proper rotation speed is important for long bit life and good penetration.
- Refer to manufacturer's bit size vs. rotation speed specifications.
- **Recommended Rotation Speed Range: 5–60 RPM**
- Use slower rotation for hard abrasive formations.
- Use faster rotation for softer, less abrasive formations.
- The bit should penetrate about 3/8 in. (9.7 mm) per tool revolution (except for bits 10 in. (251 mm) diameter and larger).
- For example: If the rate of penetration is 50 ft. (15.25 m) per hour, the RPM should be about 25. RPM is about one-half of the penetration rate in feet per hour.
- Adjust the rotation to obtain the best drilling rate and to minimize wear on the bit.

Water or Foam Injection

During drilling operations, water or foam injection can be beneficial in some applications.

- Reduces dust damage to drilling equipment on the surface.
- Reduces dust inhalation of the drilling personnel.
- Reduces temperature of the compressed air, preventing close fitting parts from seizing or galling.
- Helps clean the drilled hole when the formation is producing small amounts of water.

The following are helpful hints when using water or foam injection:

1. Increase the oil injection rate when water or foam is being used.
2. Test water periodically to assure the proper pH factor. Water with a pH of less than 10 will cause corrosion on steel parts.
3. Insure that water being used is free from solids contamination.
4. Upon completion of each hole or any time tool is not being used for three or more hours, clean the tool and the drill pipe by blowing lubricated air through the system.
5. Water or foam injection will cause the tool to corrode if the tool is not properly maintained. Follow the manufacturer's

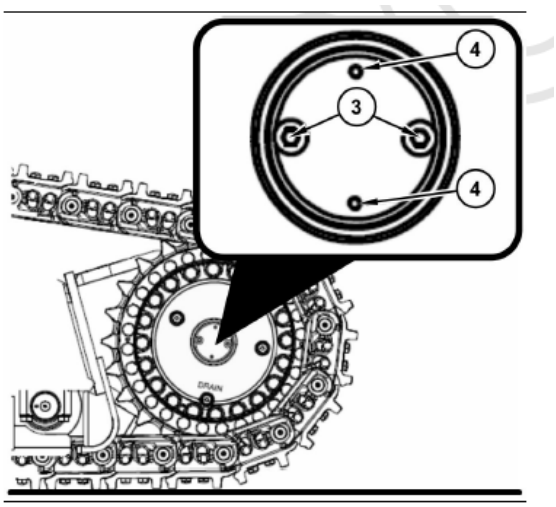


Illustration 2 g03807265

2. Remove the two M8 x 1.25 x 70 bolts from holes (3).

3. Install two M8 x 1.25 x 120 mm bolts in holes (3)

4. Install two M10 x 1.5 x 70 mm bolts equally into holes (4). Tighten the bolts until the flange is retracted 47 mm

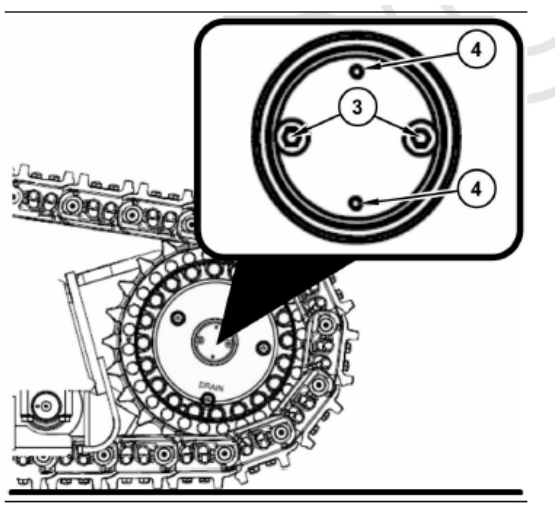
5. Repeat steps 1 through step 4for the other final drive.
Note: The parking brake has now been released.
The machine is ready for towing.

6. After the machine has been towed, return the brake and the brake valve to the original condition.
Verify that the brake and the brake valve activate correctly.

Parking Brake Manual Release

Chock both tracks before you release the brakes.

1. Clean the final drive and nearby areas.



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The machine is ready for towing.

6. After the machine has been towed, return the brake and the brake valve to the original condition.
Verify that the brake and the brake valve activate correctly.

Engine Starting with Jump Start Cables

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.

Lubrication and Maintenance Chart

C/A = Check/Add if required				
Interval	**Service Point**	**Service Required**	**Lubricant Required [5]**	**Capacity**
Daily or Each Shift	Hydraulic Oil Tank		Chevron AW MV ISO 32 [3]	5.4 gal. (20.8 L)
	Separator Tank (low press)	C/A	Dexron III ATF (factory fill)	223.5 gal. (846 L)
	Separator Tank (high press)	C/A	Dexron III ATF (factory fill)	58 gal. (220 L) 35
	Water Tank (optional)	C/A	Water/Anti-freeze	gal. (132.5 L)
	Pump Drive Gearcase	C/A	80W-90 Gear Oil	varies by model
	Air Cleaners	Check Service Indicators	– – – – –	6.75 qt. (6.4 L) –
	Oil Filters	Check Service Indicators [4]	– – – – –	– – – –
	Radiator & Coolers	Check/Clean	– – – – –	– – – – –
	Shock Sub & Air Swivel	Lubricate	NLGI No. 2 Grease	– – – – –
	Tracks, Rollers, Sprockets	Check/Clean	– – – – –	~~as requir~~ed
	Track Frames, Axles, Mounts	Inspect Integrity/Damage	– – – – –	– – – – –
	Mast & A-Frame	Inspect Integrity/Damage	– – – – –	– – – – –
	Cab Mountings	Inspect Integrity/Damage	– – – – –	– – – – –
	Deck & Surrounds	Inspect Integrity/Damage	– – – – –	– – – – –
	Rotary Head & Motor(s)	Check for leaks & loose bolts	– – – – –	– – – – –
	Pulldown/Hoist Ropes	Inspect	– – – – –	– – – – –
	Pulldown Sheaves	Check they are getting grease	– – – – –	– – – – –
	Grease Pump Lubricator	Top Up	NLGI No. 1 Grease	– – – – –
	Pipe Thread Lubricator	Top Up	NLGI No. 2 Grease [9]	– – – – –
	DTH Hammer Reservoir [7]	Top Up	Rock Drill Oil - Grade 30	15 gal. (57 L)
	Fire Suppression System	Charged	– – – – –	– – – – –
	Fire Extinguisher	Charged/Secure	– – – – –	– – – – –
	Operating Controls	Check for correct function	– – – – –	– – – – –
	Walk Around Inspection	Check for leaks, damage, etc	– – – – –	– – – – –
Weekly or 50 Hrs	Cooler Fan	Check/Torque mounting bolts	– – – – –	– – – – –
	Hydraulic Filters	Initial Change, then every 500 hrs	– – – – –	– – – – –
	Coolant Filter (if equipped)	Initial Change, then every 500 hrs	– – – – –	– – – – –
	Separator Tank (low press)	Initial Change, then every 300 hrs	Dexron III ATF	58 gal. (220 L)
	Separator Tank (high press)	Initial Change, then every 300 hrs	Dexron III ATF	35 gal. (132.5 L)
	Compressor Oil Filter	Initial Change, then every 250 hrs	– – – – –	– – – – –
	Rotary Drive Gearbox	C/A	80W-90 Gear Oil	20 gal. (75.5 L)
	Water Pump (vertical)	Initial Change, then every 3 mnths	80W-90 Gear Oil	1 qt. (.95 L)
	Water Pump (horizontal)	Initial Change, then every 300 hrs	ISO 68	42 oz. (1.26 L)
	Track Final Drive Gearbox [6]	Initial Change, then every 1000 hrs	80W-90 Gear Oil	2.1 gal. (8 L)
	PLUS ALL ITEMS LISTED IN DAILY SERVICE			

In order for an operator to be sure his drill is ready for operation at any time, a regular program of preventive maintenance should be adopted. It is recommended that such a maintenance program be established on the basis of the operator and/or maintenance personnel performing specific maintenance work during various periods of equipment operations, at intervals during which the equipment will be idle, and during extended periods of time when the equipment will be in storage.

When the drill is in continual, daily use, it is further recommended that a program of daily service requirements be established with preventive maintenance being performed on a "before operation", "during operation", and "after operation" schedule.

NOTE **For additional preventive maintenance information, refer to vendor manuals provided in the drill Service Manual.**

Mast Trunnion Bolt Torque

Model	Dry Torque	Lube Torque
MD6240C 1-1/2-6 UNC Gr8 (4)	3160 ft. lbs. (4284 Nm)	2360 ft. lbs. (3200 Nm)

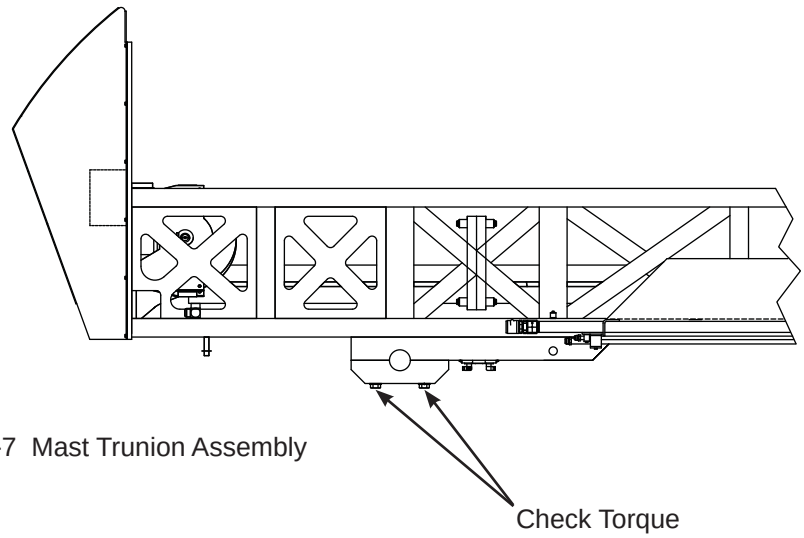

Fig. 8-7 Mast Trunion Assembly

NOTE **See additional bolted joint maintenance guidelines in this section.**

- **Vibratory Overload**

Abusive, unusual or unforeseen loads can cause bolted joint separation. This can result in the loosening of bolts, which in turn can cause bolt fatigue failure. Bolt fatigue will generally result in a fracture surface and ultimately failure at the first engaged thread of the bolt or sometimes in the fillet under the bolt head. Loose bolts can also fail quickly in fatigue. As an example, tests conducted by a bolt manufacturer indicated that a bolt tightened to 1420 lb tension and stressed cyclically to 9215 lb failed after 5960 load cycles. Identical bolts tightened to 8420 lb and stressed to the same 9215 lb survived 4.65 million cycles before failure. If the bolts had been tightened beyond 9215 lb, it would have been impractical to cycle them to failure.

- **Thermal Relaxation**

Bolted joints exposed to high temperatures or thermal cycling have a tendency relax or lose bolt tension over time, due to stress creep. Since pre-loading stretches bolts, and only stretches them a few thousandths of an inch. It is easy to imagine that a bolt heated to the operating temperature limits of an air compressor could increase the plasticity of the bolt material, allowing it to lose some of its initial loading. Bolted joints of a new machine that are subjected to high heat should be checked and re-torqued to specification after the first 500 hours of operation.

Critical Bolted Joint Maintenance

Critical bolted joints are those joints which hold major structures together or hold overhead loads. Failure of these joints could endanger personnel or seriously damage equipment. As stated earlier, these are identified in the drawing “Critical Fastener ID & Inspection Schedule. We recommend that critical bolted joints of drills should be ***checked for proper torque*** every ***120 days or 2000 operating hours*** for machines that have ***less than 10,000*** operating hours, and every ***90 days or 1500 operating hours*** for machines that have ***greater than 10,000 operating hours.***

If a bolt is found to be loose (less than 90% of specified torque value), it should be removed and replaced. If the joint contains more than one bolt, all bolts in the joint should be replaced. The joint mating surfaces and bolts should be inspected for signs of corrosion, surface degradation, and the presence of hardened washers or Nordlock washers. Joints with Nordlock washers require the replacement of the washers as well. Hardened washers can generally be reused as long as the washer is undamaged. The new bolts should be lubricated with NLGI2 molycoat grease and torqued to the proper specification. Bolts should be replaced with the same grade bolt that was originally in the assembly. These drills primarily use SAE Grade 5 and Grade 8 bolts. These are identified by the markings on the head of the bolt. Chart #1 of the drawing for each machine titled “Critical Fastener Torque Values” graphically depicts the standard indentifying bolt markings.

Bolts in critical joints should also be removed and ***visually inspected for corrosion and re-lubricate every 2.5 years or 15,000 hours of operation***. If bolts are not damaged, they maybe re-installed and returned to service. Any damaged or corroded bolts should be discarded and replaced. In addition, bolts in critical joint should be ***replaced every 5 years or 30,000 hours of operation***, regardless of apparent condition.

Other Bolt Maintenance

All bolts contained in these drills are subject to the same topics described above, but generally do not have the same degree of risk involved should a bolt failure occur. Every machine should have a “walk-around” inspection performed at the beginning of each operating shift, which includes looking for loose hardware. Other significant bolted joints include all pressurized fittings, flange connections and all bolted pin retainer/keeper plate bolts. All machine bolts should be inspected for proper torque specification annually at a minimum.

Maintenance Section

Refill Capacities

i05615594

Refill Capacities

SMCS Code: 1000; 1348; 1395; 7560

Lubricant Capacities

The capacity of the engine lubrication system includes the capacity of the oil filters that are installed at the factory. Auxiliary oil filter systems (if equipped) will require additional oil. Refer to the specifications that are provided by the OEM of the auxiliary oil filter system. Refer to the illustrations below for lubricant refill capacities of the available oil pan configurations.

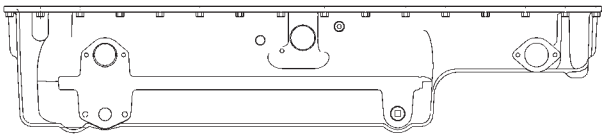

Illustration 24 g03557591

Table 6

C32 Industrial Engines Approximate Refill Capacities		
Compartment or System	**Liters**	**Quarts**
Engine Crankcase	68	72

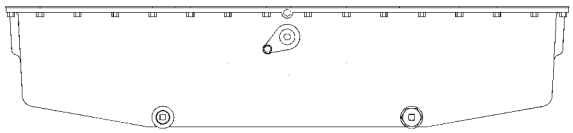

Illustration 25 g03557594

Table 7

C32 Industrial Engines Approximate Refill Capacities		
Compartment or System	**Liters**	**Quarts**
Engine Crankcase	85	90

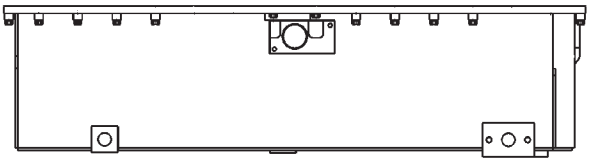

Illustration 26 g03557595

Table 8

C32 Industrial Engines Approximate Refill Capacities		
Compartment or System	**Liters**	**Quarts**
Engine Crankcase	114	121

5. Stop the engine and allow the engine to cool. Loosen the cooling system filler cap slowly in order to relieve any pressure. Remove the cooling system filler cap. Open the drain valve (if equipped) or remove the cooling system drain plugs. Allow the water to drain. Flush the cooling system with clean water. Close the drain valve (if equipped). Clean the drain plugs. Install the drain plugs. Refer to the Specifications Manual, SENR3130, “Torque Specifications” for more information on the proper torques.

Fill

NOTICE
Fill the cooling system no faster than 19 L (5 US gal) per minute to avoid air locks.

1. Fill the cooling system with coolant/antifreeze. Refer to the Operation and Maintenance Manual, “Refill Capacities and Recommendations” topic (Maintenance Section) for more information on cooling system specifications. Do not install the cooling system filler cap.

2. Start and run the engine at low idle. Increase the engine rpm to 1500 rpm. Run the engine at high idle for 1 minute in order to purge the air from the cavities of the engine block. Stop the engine.

3. Check the coolant level. Maintain the coolant level within 13 mm (0.5 inch) below the bottom of the pipe for filling. Maintain the coolant level within 13 mm (0.5 inch) to the proper level on the sight glass (if equipped).

4. Clean the cooling system filler cap. Inspect the gasket that is on the cooling system filler cap. If the gasket that is on the cooling system filler cap is damaged, discard the old cap and install a new filler cap. If the gasket that is on the cooling system filler cap is not damaged, perform a pressure test. A 9S-8140 Pressurizing Pump is used to perform the pressure test. The correct pressure for the cooling system filler cap is stamped on the face of the cooling system filler cap. If the cooling system filler cap does not retain the correct pressure, install a new cooling system filler cap.

5. Start the engine. Inspect the cooling system for leaks and for proper operating temperature.

i04314894

Coolant (ELC) - Change

SMCS Code: 1350-070; 1395-044

Clean the cooling system and flush the cooling system before the recommended maintenance interval if the following conditions exist:

- The engine overheats frequently.
- Foaming is observed.
- The oil has entered the cooling system and the coolant is contaminated.
- The fuel has entered the cooling system and the coolant is contaminated.

Note: When the cooling system is cleaned, only clean water is needed when the ELC is drained and replaced.

Note: Inspect the water pump and the water temperature regulator after the cooling system has been drained.

Drain

⚠ WARNING

Pressurized System: Hot coolant can cause serious burns. To open the cooling system filler cap, stop the engine and wait until the cooling system components are cool. Loosen the cooling system pressure cap slowly in order to relieve the pressure.

1. Stop the engine and allow the engine to cool. Loosen the cooling system filler cap slowly in order to relieve any pressure. Remove the cooling system filler cap.

2. Open the cooling system drain valve (if equipped). If the cooling system is not equipped with a drain valve, remove the cooling system drain plugs.

Allow the coolant to drain.

NOTICE
Dispose of used engine coolant properly or recycle. Various methods have been proposed to reclaim used coolant for reuse in engine cooling systems. The full distillation procedure is the only method acceptable by Caterpillar to reclaim the used coolant.

For information regarding the disposal and the recycling of used coolant, consult your Cat dealer or consult Cat Dealer Service Tool Group :

Inspecting the Primary Air Cleaner Elements

Illustration 34 g00281693

Inspect the clean, dry primary air cleaner element. Use a 60 W blue light in a dark room or in a similar facility. Place the blue light in the primary air cleaner element. Rotate the primary air cleaner element. Inspect the primary air cleaner element for tears and/or holes. Inspect the primary air cleaner element for light that may show through the filter material. If necessary to confirm the result, compare the primary air cleaner element to a new primary air cleaner element that has the same part number.

Do not use a primary air cleaner element that has any tears and/or holes in the filter material. Do not use a primary air cleaner element with damaged pleats, gaskets, or seals. Discard damaged primary air cleaner elements.

Storing Primary Air Cleaner Elements

If a primary air cleaner element that passes inspection will not be used, the primary air cleaner element can be stored for future use.

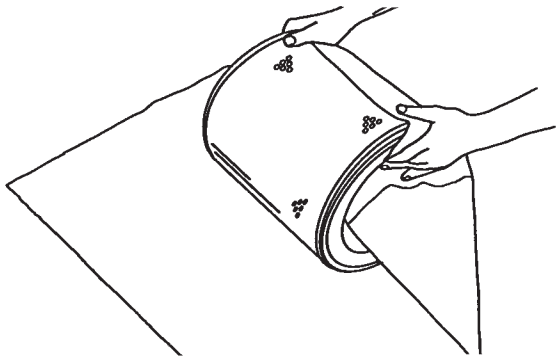

Illustration 35 g00281694

Do not use paint, a waterproof cover, or plastic as a protective covering for storage. Restricted air flow may result. To protect against dirt and damage, wrap the primary air cleaner elements in Volalite Corrosion Inhibited (VCI) paper.

Place the primary air cleaner element into a box for storage. For identification, mark the outside of the box and mark the primary air cleaner element. Include the following information:

- Date of the cleaning
- Number of cleanings

Store the box in a dry location.

For more detailed information on cleaning the primary air cleaner element, refer to Special Publication, SEBF8062, “Procedure to Inspect and Clean Air Filters”.

i04315030

Engine Air Cleaner Element (Single Element) - Inspect/Clean/Replace

SMCS Code: 1051; 1054-040; 1054-070; 1054-510

Perform the Operation and Maintenance Manual, “Engine Air Cleaner Service Indicator-Inspect” procedure and perform the Operation and Maintenance Manual, “Engine Air Precleaner - Clean” procedure (if equipped) before performing the following procedure.

NOTICE

Never run the engine without an air cleaner element installed. Never run the engine with a damaged air cleaner element. Do not use air cleaner elements with damaged pleats, gaskets or seals. Dirt entering the engine causes premature wear and damage to engine components. Air cleaner elements help to prevent airborne debris from entering the air inlet.

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.

5. Remove the fuel filter bowl and wash the fuel filter bowl with clean diesel fuel.

6. Remove the fuel filter.

7. Clean the gasket sealing surface of the fuel filter base. Ensure that all of the old gasket is removed.

8. Apply clean diesel fuel to the new fuel filter gasket.

NOTICE
In order to maximize fuel system life and prevent premature wear out from abrasive particles in the fuel, use Cat fuel filters.

Consult your Cat dealer for proper part numbers.

9. Install the new fuel filter. Spin the fuel filter onto the fuel filter base until the gasket contacts the base. Use the rotation index marks on the filters as a guide for proper tightening. Tighten the filter for an additional 3/4 turn by hand. Do not overtighten the filter.

NOTICE
Do not fill the fuel filters with fuel before installing them. The fuel would not be filtered and could be contaminated. Contaminated fuel will cause accelerated wear to fuel system parts.

10. Install the clean fuel filter bowl on the new fuel filter.

NOTICE
The water separator is under suction during normal engine operation. Ensure that the vent plug is tightened securely to help prevent air from entering the fuel system.

11. Open the fuel tank supply valve.

12. Start the engine and check for leaks. Run the engine for 1 minute. Stop the engine and check the engine for leaks again.

Detection of leaks is very difficult especially if the engine is running. The primary filter/water separator is under suction. A leak will allow air to enter the fuel. The air in the fuel can cause low power due to aeration of the fuel. If air enters the fuel, check the components for overtightening or under tightening.

i01463757

Fuel System Primary Filter/ Water Separator - Drain

SMCS Code: 1260-543; 1263-543

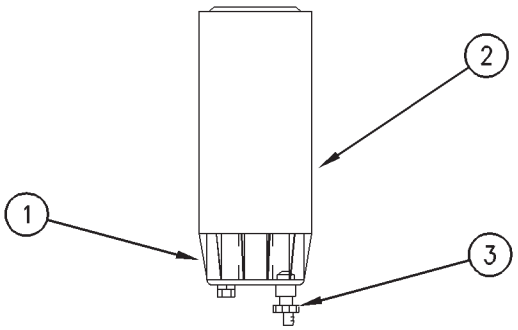

Illustration 48 g00668636

(1) Bowl
(2) Element
(3) Drain

Bowl (1) should be monitored daily for signs of water. If water is present, drain the water from the bowl.

1. Open drain (3). The drain is a self-ventilated drain. Catch the draining water in a suitable container. Dispose of the water properly.

2. Close drain (3).

NOTICE
The water separator is under suction during normal engine operation. Ensure that the drain valve is tightened securely to help prevent air from entering the fuel system.

Reduced engine efficiency and increased fuel consumption translates into higher operating costs. Therefore, Caterpillar Inc. recommends repairing out-of-spec parts or replacing out-of-spec parts.

Inspection and/or Replacement

Piston Rings, Crankshaft Bearings, Valve Rotators, and Crankshaft Seals

The following components may not last until the second overhaul.

- Thrust bearings
- Main bearings
- Rod bearings
- Valve rotators
- Crankshaft seals
- Nonmetallic fuel lines (if equipped)

Caterpillar Inc. recommends the installation of new parts at each overhaul period.

Inspect these parts while the engine is disassembled for an overhaul.

Inspect the crankshaft for any of the following conditions:

- Deflection
- Damage to the journals
- Bearing material that has seized to the journals

Check the journal taper and the profile of the crankshaft journals. Check these components by interpreting the wear patterns on the following components:

- Rod bearing
- Main bearings

Note: If the crankshaft is removed for any reason, use the magnetic particle inspection process to check for cracks in the crankshaft.

Inspect the camshaft for damage to the journals and to the lobes.

Note: If the camshaft is removed for any reason, use the magnetic particle inspection process to check for cracks in the camshaft.

Inspect the following components for signs of wear or for signs of scuffing:

- Camshaft bearings
- Camshaft followers

Caterpillar Inc. recommends replacing the crankshaft vibration damper.

Oil Cooler Core and Aftercooler Core

During an overhaul, the removal of the oil cooler core and the aftercooler core is recommended. The oil cooler core and the aftercooler core should be cleaned and pressure tested.

NOTICE
Do not use caustic cleaners to clean the core.

Caustic cleaners can attack the internal metals of the core and cause leakage.

Note: Use this cleaning procedure to clean the oil cooler core and the aftercooler core.

1. Remove the oil cooler core and the aftercooler core.
2. Remove any debris from the oil cooler core and the aftercooler core. To remove debris from the oil cooler core, turn the oil cooler core onto one end. To remove debris from the aftercooler core, turn the aftercooler core upside-down.
3. Flush the oil cooler core and the aftercooler core internally with cleaner in order to loosen foreign substances. This will also help to remove oil from the oil cooler core and the aftercooler core.

Note: The use of Hydrosolv Liquid Cleaners is recommended. Table 17 lists the Hydrosolv Liquid Cleaners that are available from your Caterpillar dealer.

Table 17

Hydrosolv Liquid Cleaners[1]		
Part Number	**Description**	**Size**
1U-5490	Hydrosolv 4165	19 L (5 US gallon)
174-6854	Hydrosolv 100	19 L (5 US gallon)

(1) Use a two to five percent concentration of the cleaner at temperatures up to 93°C (200°F). Refer to Application Guide, NEHS0526 or consult your Caterpillar dealer for more information.

4. Use steam to clean the oil cooler core and the aftercooler core. This removes any remaining residue from the cleaner. Flush the fins of the oil cooler core and the aftercooler core. Remove any other trapped debris.