CATERPILLAR®

SEBU8192-02
July 2007

Operation and Maintenance Manual

CX31 On-Highway Transmission

B3X1-Up (Transmission)

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. 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 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.

⚠ WARNING

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.

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. 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 the product will not be damaged or be made unsafe by the operation, lubrication, maintenance or repair procedures that you choose.

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. Caterpillar dealers have the most current information available.

⚠ WARNING

When replacement parts are required for this product Caterpillar recommends using Caterpillar replacement parts or parts with equivalent specifications including, but not limited to, physical dimensions, type, strength and material.

Failure to heed this warning can lead to premature failures, product damage, personal injury or death.

Table of Contents

Foreword

Literature Information

This manual should be stored in the literature holder.

This manual contains safety information, operation instructions, and maintenance recommendations.

Some photographs or illustrations in this publication show details or attachments that can be different from your product.

Continuing improvement and advancement of product design might have caused changes to your product which are not included in this publication. Read, study and keep this manual with the product.

Whenever a question arises regarding your product, or this publication, please consult your Caterpillar 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.

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, product controls, attachment controls, and programming information.

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

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

Maintenance

The maintenance section is a guide to equipment care.

Safety Section

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Safety Messages

SMCS Code: 7000; 7405

Universal Warning

WARNING

Do not operate or work on this equipment unless you have read and understand the instructions and warnings in the Operation and Maintenance Manuals. Failure to follow the instructions or heed the warnings could result in serious injury or death.

Illustration 1 g00934493

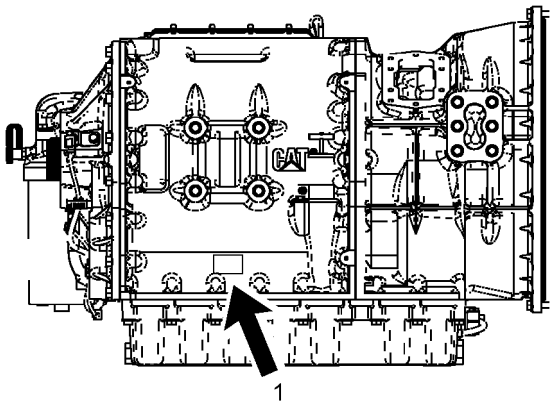

Illustration 2 g01327637

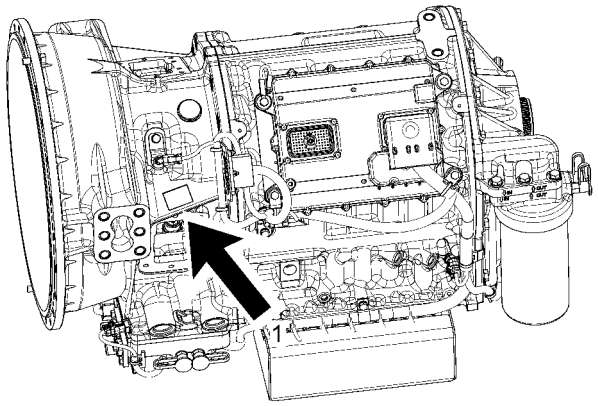

Illustration 3 g01327640

Illustrations 2 and 3 are examples of (1) Universal Warning 228-3581 decal.

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General Hazard Information

SMCS Code: 7000

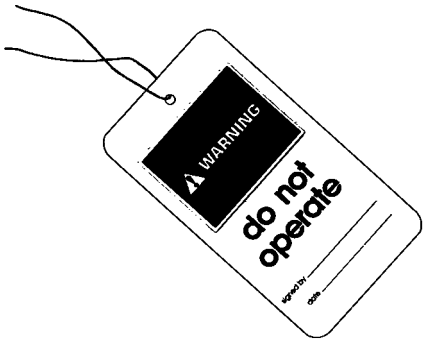

Illustration 4 g00104545

Attach a “Do Not Operate” warning tag or a similar warning tag to the start switch or to the controls before you service the equipment or before you repair the equipment. These warning tags (Special Instruction, SEHS7332) are available from your Caterpillar dealer.

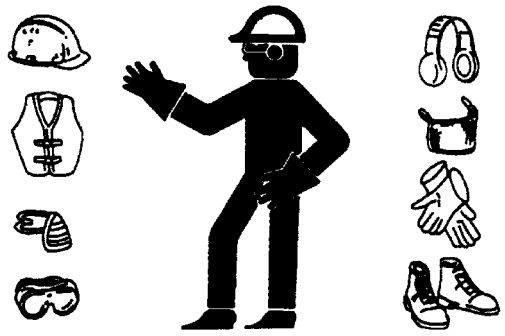

Illustration 5 g00702020

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.

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.

Pressure Air and Water

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

When pressure air and/or pressure 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 below 205 kPa (30 psi). The maximum water pressure for cleaning purposes must be below 275 kPa (40 psi).

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 engine 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.

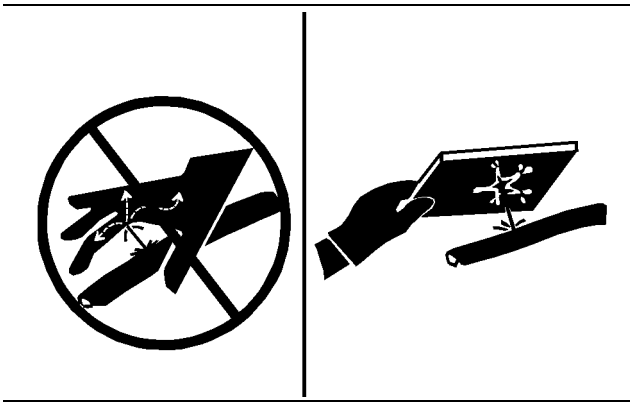

Illustration 6 g00687600

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, "Tools and Shop Products Guide" 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.

Asbestos Information

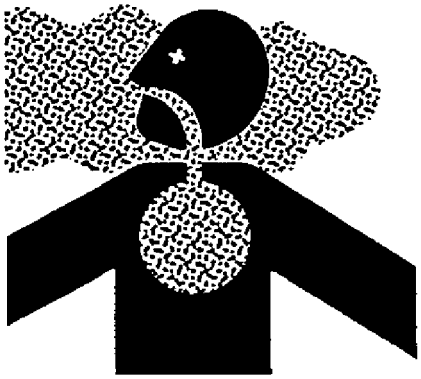

Illustration 7 g00702022

Caterpillar equipment and replacement parts that are shipped from Caterpillar are asbestos free. Caterpillar recommends the use of only genuine Caterpillar 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 usually 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

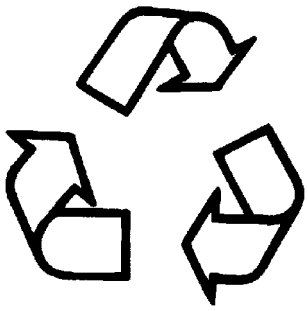

Illustration 8 g00706404

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.

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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.

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

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

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.

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.

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Fire Prevention and Explosion Prevention

SMCS Code: 7000

Illustration 9 g00704000

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

Flammable fluids that are leaking or spilled onto hot surfaces or onto electrical components can cause a fire. Fire may cause personal injury and property damage.

Remove all flammable materials such as fuel, oil, and debris from the machine. Do not allow any flammable materials to accumulate on the machine.

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

Do not operate the machine near any flame.

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

Do not weld on lines or on tanks that contain flammable fluids. Do not flame cut lines or tanks that contain flammable fluid. Clean any such lines or tanks thoroughly with a nonflammable solvent prior to welding or flame cutting.

Check all electrical wires daily. Repair any wires that are loose or frayed before you operate the machine. Clean all electrical connections and tighten all electrical connections.

Inspect all lines and hoses for wear or for deterioration. The hoses must be properly routed. The lines and the hoses must have adequate support and secure clamps. Tighten all connections to the recommended torque. Leaks can cause fires.

Fire Extinguisher

Make sure that a fire extinguisher is available. 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.

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.

Repair any lines that are loose or damaged. Leaks can cause fires. Consult your Caterpillar dealer for repair or for replacement parts.

Check lines, tubes and hoses carefully. Do not use your bare hand to check for leaks. Use a board or cardboard to check for leaks. Tighten all connections to the recommended torque.

Replace the 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 ballooning.
- Flexible part of the hoses are kinked.
- Outer covers have 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, and excessive heat.

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Before Operation

SMCS Code: 7000

Clear all obstacles that are around this product. Beware of hazards such as wires, ditches, etc.

Whenever you are working around this product always wear appropriate personal protective safety equipment. Personal equipment include the following: safety glasses, safety shoes, ear plugs, hard hat, gloves, and etc.

Refer to the Operation and Maintenance Manual, “Daily Inspection” for more information on inspecting this product before use.

Product Information Section

Identification Information

i02793264

Serial Number Plate

SMCS Code: 1000; 7000

Nomenclature

The CX31 nomenclature covers a broad range of transmission products with the same clutch sizes. As a result, it is very important for the owners, users, and service personnel to use the correct CX31 arrangement numbers. All CX31 transmissions have the same serial number prefix B3X but there are a variety of options within the serial number. The options include but are not limited to the following: torque converters, retarders, PTOs, sumps, filters, yokes, and flex plates. The Caterpillar Dealer will need the prefix and all of the serial number to properly identify a particular transmission.

For a quick reference, record the serial numbers by writing the serial numbers in the space that is provided below the illustration.

Product Identification

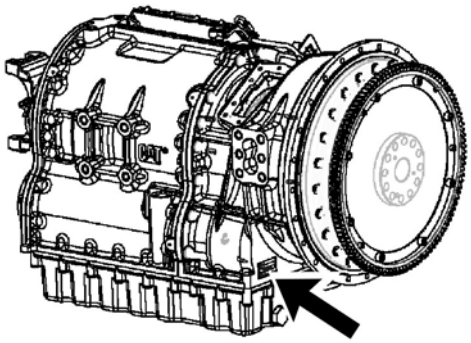

Illustration 10 g01299006

Transmission Serial Number_____

Torque converter Serial Number_____

Serial Number Plate (SN)

TRANS. SERIAL NO.		
TRANS. ARRANG. NO.		
○ ALWAYS GIVE ALL NUMBERS ○		
CONVERTER SERIAL NO.		
	6V1720 3	

Illustration 11 g01299008

Model Views

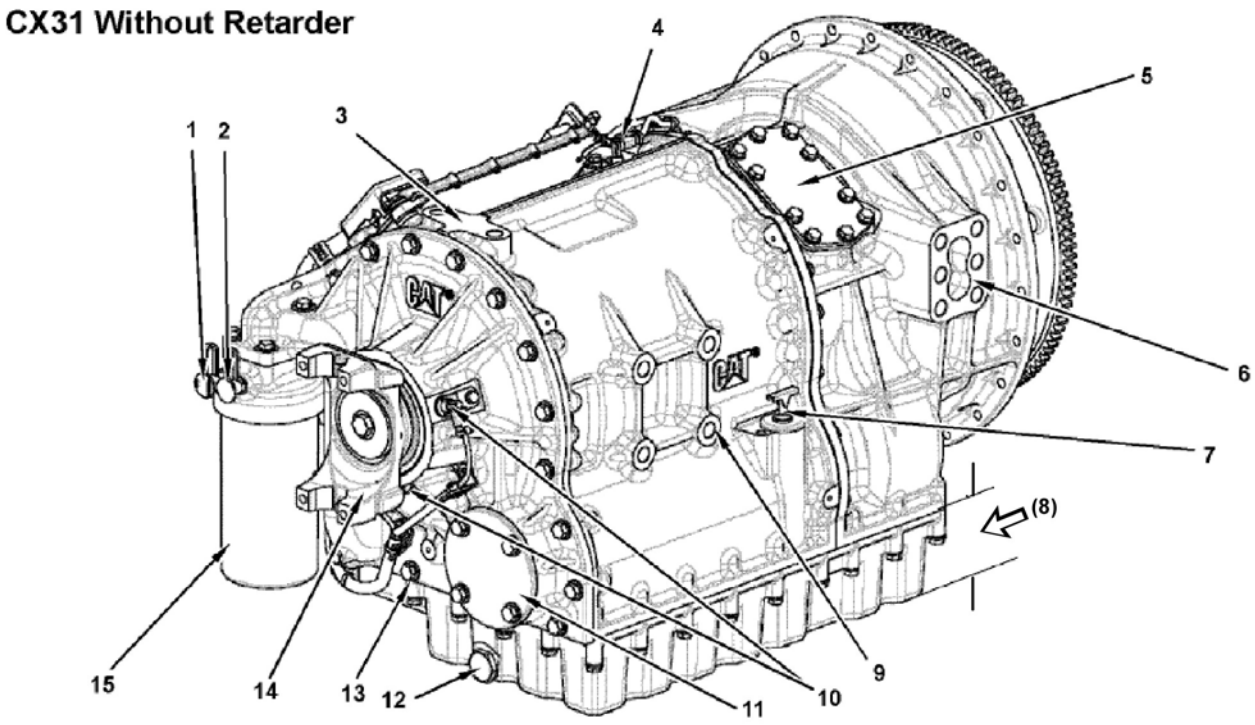

Illustration 12 g01194054

(1) Filter inlet pressure coupler (SOS)
(2) Filter outlet pressure coupler
(3) Two M16x2 rear mounting and lifting points (lifting points can also provide invehicle support)
(4) Torque converter output speed sensor
(5) Conventional 10 bolt PTO at 1:00 o'clock position
(6) No. 1 SAE J615 side mounting bolt pad spacing six M16 x 2 threads
(7) Oil filler and dipstick location
(8) Standard sump/oil pan shown 120 mm (4.72 inch) deep. Not displayed shallow sump 80 mm (3.2 inch) deep. Not displayed retarder sump 142 mm (5.6 inch) deep.
(9) Four M16x2 threaded mounts
(10) Transmission output speed sensor
(11) Option 1085 N·m (800 lb ft) rear PTO capability. Specifications in PTO section
(12) Rear magnetic drain plug (SAE J1926 #12 port)
(13) SAE J1926 #4 auxiliary PTO lube port
(14) Output yoke (six options)
(15) Transmission mounted cartridge type oil filter (spin-on filter shown in Illustration 14)

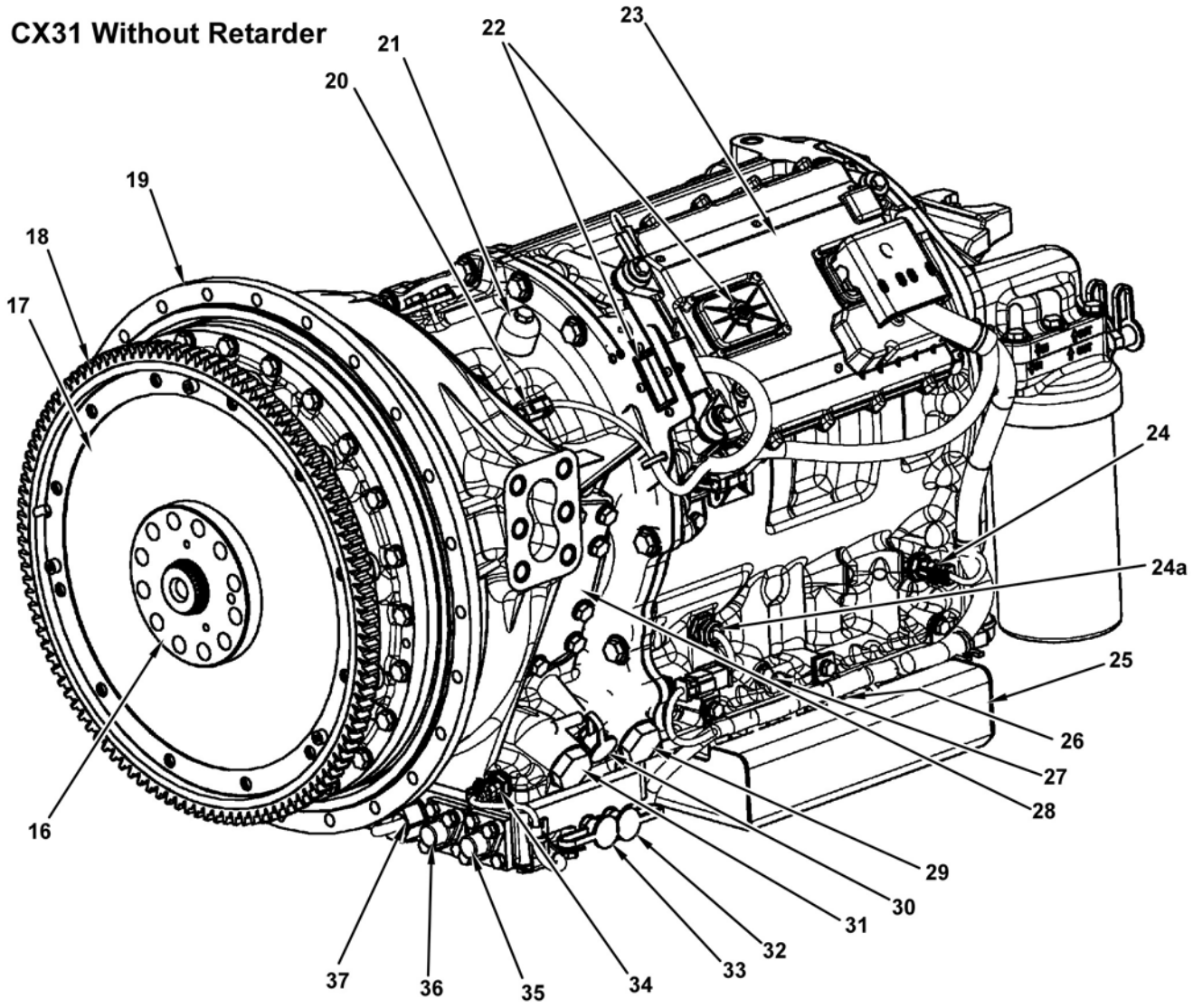

Illustration 13 g01394787

(16) Crankshaft to flex plate adapter
(17) Flex plates
(18) Engine starter ring gear
(19) No. 1 SAE J617 flywheel housing for 12 and 24 bolt mounts
(20) Engine output speed sensor
(21) Transmission breather/filter
(22) OEM electrical interface for 24 and 70 pin connectors
(23) Electronic Control Unit (ECU)
(24) Transmission oil temperature sensor
(24a) Oil level sensor
(25) Solenoid protective shield
(26) Solenoids (six clutch controls)
(27) SAE J1926 #4 auxiliary PTO lube at clutch pressure port
(28) Conventional 10 bolt PTO at 8:00 o'clock position
(29) SAE J1926 #16 inlet from cooler port
(30) Lube pressure coupler (cooler outlet)
(31) SAE J1926 #16 outlet to cooler port
(32) Converter outlet pressure coupler
(33) Cooler inlet pressure coupler
(34) Converter outlet temperature sensor
(35) Converter outlet relief pressure
(36) Transmission main relief pressure
(37) Filter bypass switch

CX31 Without Retarder (Bottom View)

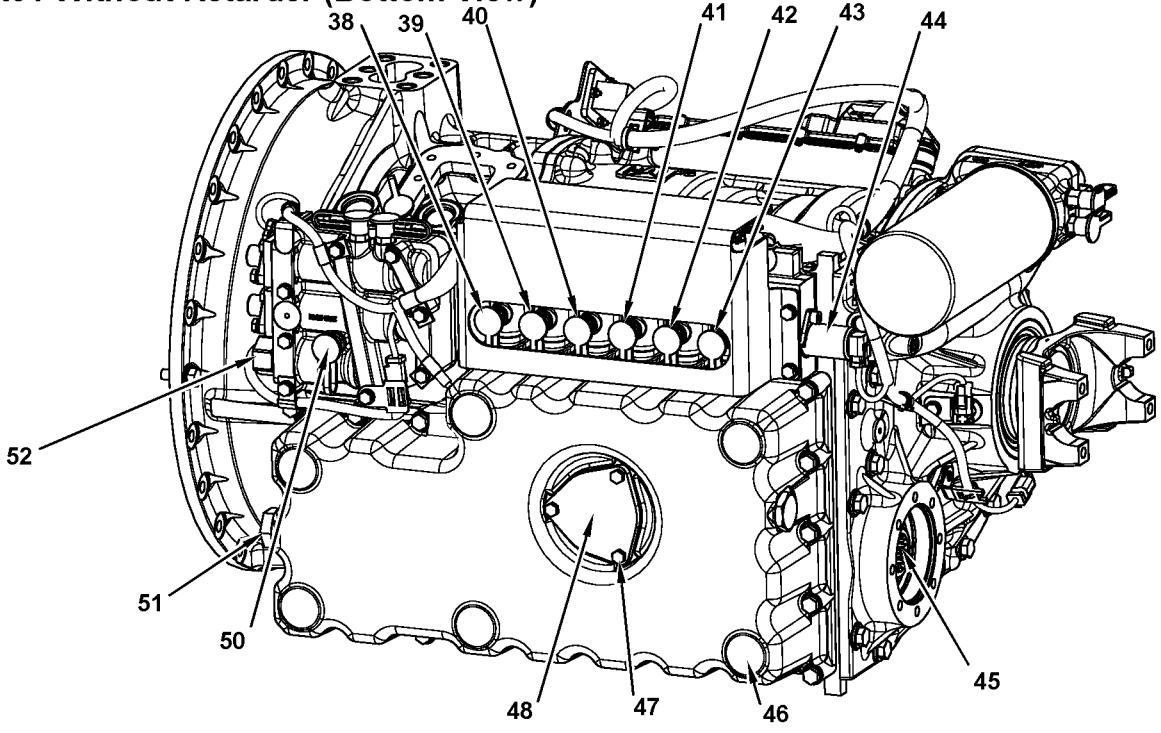

Illustration 14 g01394795

(38) Lockup clutch pressure coupler
(39) Clutch #1 (C1) pressure coupler
(40) C2 pressure coupler
(41) C3 pressure coupler
(42) C4 pressure coupler
(43) C5 pressure coupler
(44) Latching fail-in-gear solenoid (optional)
(45) Optional rear PTO w/o cover
(46) Six base supports
(47) Three M8x1 bolts
(48) Magnetic filter (access cover)
(50) Converter inlet pressure coupler
(51) Sump heater SAE J1928 #16 port
(52) Filter bypass switch

Lifting

- Acceptable lifting points for CX31 Transmissions include the side and rear transmission mounts. The transmission is designed to sit level on the transmission's six base supports as shown in Illustration 14.
- Care must be taken when lifting to avoid damaging the following components that are mounted externally on the transmission: ECM, ECPC valves, solenoids, wire harness, and sensors.

Altitude Restrictions

Note: There are no restrictions based on altitude.

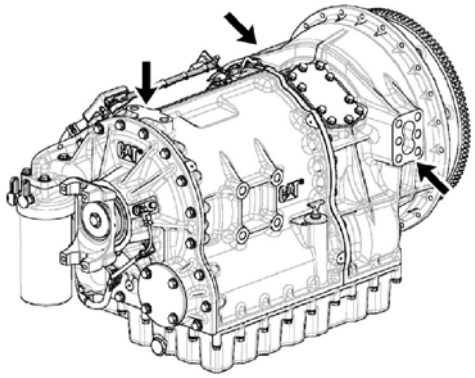

Illustration 15 g01238589

Lifting points

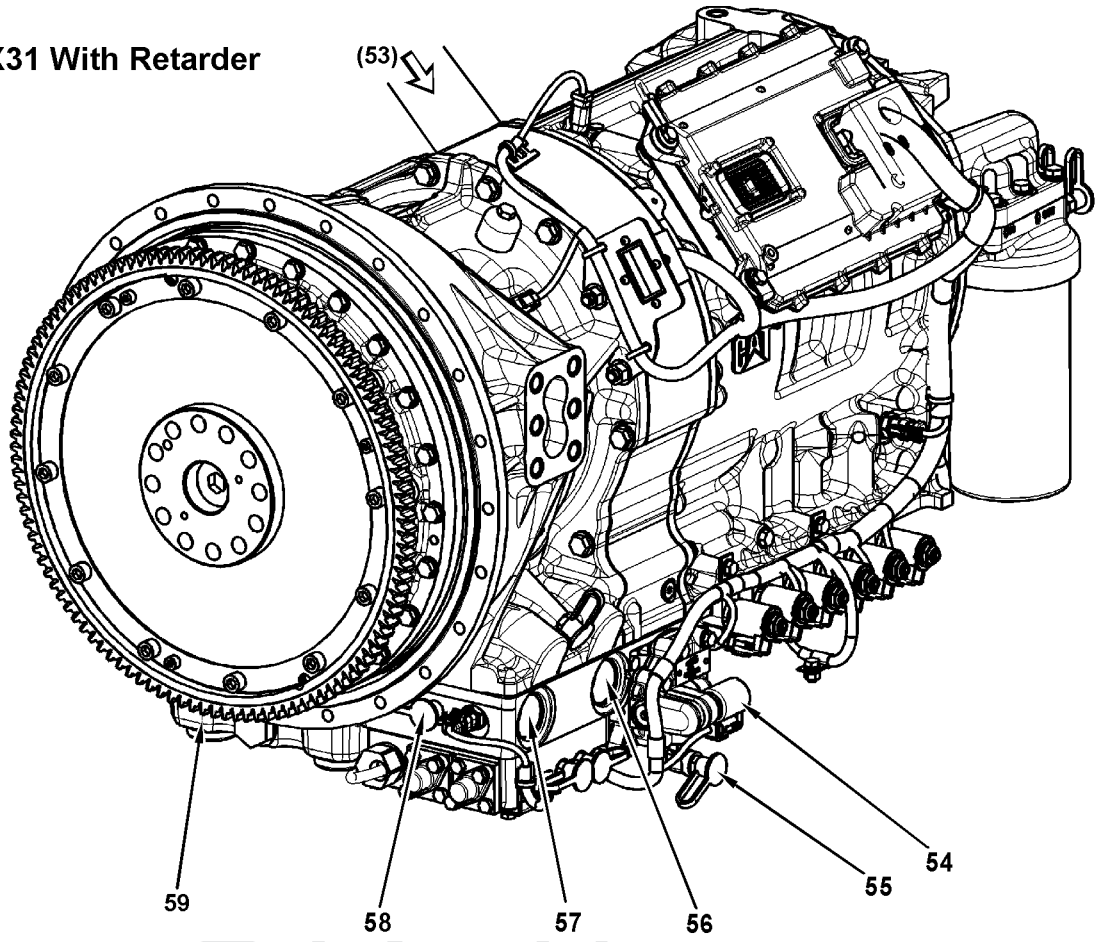

Illustration 16 g01245670

(53) Retarders will add 104 mm (4.09 inch) to the length of the CX31.
(54) Retarder activation solenoid
(55) Retarder activation pressure coupler
(56) SAE J1926 #24 inlet from cooler port
(57) SAE J1926 #24 outlet to cooler port
(58) Retarder outlet pressure coupler
(59) Identification and serial plate

Note: Caterpillar transmissions are manufactured, assembled, and tested by using hydraulic diagnostic couplers. These quick disconnect couplers for checking system pressures remain on the transmission for the convenience of the owners and service personnel. Unless otherwise stated, all quick disconnect couplers conform to SAE-J1502 standards.

Operation Section

Before Operation

i02545666

Daily Inspection

SMCS Code: 1000; 7000

For maximum service life of the transmission, make a thorough walk-around inspection before you operate the vehicle.

Look around the vehicle and under the vehicle. Inspect the condition of all major components. Look for the following discrepancies:

- Loose bolts (mounts)
- Oil leaks (wet areas)
- Broken parts or wear at U-joint yokes
- Evidence of movement or rubbing of the hose or wiring harness
- Indication of the transmission being hit or damaged on the bottom cover
- Trash (mud) buildup

Remove any trash, debris, or mud. Report to the shop any condition that requires service. Make sure that any necessary repairs are completed before operating the vehicle.

Perform all daily service requirements at the beginning of each operation. Refer to the Operation and Maintenance Manual for the procedures.

Inspection Before Operation

- Inspect hoses, tubes, and lines.
- Check the oil level in the transmission case.

Inspection After Operation

- Check for loose bolts.
- Check for oil leaks.
- Check for broken parts.
- Check the wiring harness.
- Remove trash buildup.

Daily Maintenance

Perform the following procedures on a daily basis:

- Operation and Maintenance Manual, “Transmission Oil Level - Check”

Transmission Operation

i02800275

Transmission Warm-up

SMCS Code: 3001; 3030; 3101

When the oil is allowed to warm-up gradually, the bearing components maintain optimum operating conditions. High speeds during a cold start-up may decrease the durability of the bearing components. During warm-up, electronic control systems on the transmission will restrict available transmission gears for certain cold oil temperature ranges. If the temperature is less than −23 °C (−10 °F), warm up the engine for approximately 20 minutes.

Transmission Oil Heater

If ambient temperature are -23° C (-10° F) the transmission owner or operator may choose to install a transmission oil heater. Heaters facilitate starting vehicles in cold climates and they reduce the warm up time needed to get a vehicle operational. The CX31 has an SAE J1926 #16 straight thread “O” ring oil sump heater port located under the converter housing. As a general rule, suppliers recommend 8 to 10 watts per quart of sump oil. Commercial heaters with and without thermostats are available in 150, 300 and 500 watt capacities that are compatible with the CX31 transmission.

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Transmission Control

SMCS Code: 1435; 3065; 4800

Warning Light Indicator

Caterpillar requires that OEM transmission users install a RED and AMBER operator warning lamps. The lamps may have several locations within the operator station depending on the OEM’s design. The lamps provide an indication of transmission condition.

1. AMBER Caution Lamp

The diagnostic lamp is yellow or AMBER. The diagnostic lamp will communicate the status of the transmission electronic system. If the amber lamp (trouble code) is activated, the lamp alerts the operator that a diagnostic condition is active within the transmission. The amber lamp does not require immediate operator attention, but normal operation of the transmission may be affected.

2. RED Warning Lamp

The RED warning lamp warns the operator of conditions which require immediate attention. The warning lamp indicates either a transmission oil filter bypass or an excessive oil temperature. Immediate operator action is required in order to reduce the temperature of the transmission oil or immediate action is required to service the oil filters.

3. Fail-In-Gear Operator Information

The **optional** fail-in-gear feature will continue to propel the vehicle forward in the event of certain transmission ECU or vehicle electrical system failures. Lack of electrical power to the ECU is a typical failure mode addressed by the fail-in-gear feature. The transmission shift pad will not respond to shift commands and will display two dashes when the fail-in-gear is active. The fail-in-gear option is intended as a **temporary** assistance measure so that operators can move the vehicles to a safe location for repairs. The transmission lockup clutch will not engage when the fail-in-gear is active, resulting in significantly reduced engine braking. The fail-in-gear will only select a forward gear if forward is engaged when this option is activated. Transmission neutral can only be achieved by turning the engine off.

NOTICE
Shutting the engine off may not allow the engine to restart after shutdown. Shutting the engine off will put the transmission in NEUTRAL until repaired. Before shutting off the engine, assure the vehicle is parked in a safe location.

The CX transmission’s ECUs provide wiring that allows the OEMs to install a starter interlock. If the OEM does not install the starter interlock, the engine will restart after an ECU failure. However, the transmission will remain in neutral until the ECU or electrical fault is repaired. Caterpillar does not recommend using the starter interlock, if the only purpose of the starter interlock is to assist fail-in-gear operations.

Temperature monitors that are ECU driven will not function when the fail-in-gear feature is active. Torque converter outlet temperatures may reach unacceptable levels if the operator continues to drive the vehicle for an extended period of time in converter drive. In order to safeguard against inadvertent converter overheating with the fail-in-gear option, Caterpillar recommends that a secondary converter outlet temperature switch be installed to notify the operator if the converter starts to overheat. A backup switch to monitor transmission oil temperature is not recommended when the OEM uses a non-ECU activated temperature gauge.

A convenient secondary outlet converter temperature switch can be added to the outlet converter line to the cooler. The switch can be set to close at 149 °C (300 °F). As a result, turning on the transmission **RED warning lamp**.

SHIFT SELECTOR PAD

The transmission control in Illustration 17 is the operator interface for Caterpillar's CX series transmissions.

- The CX31 Transmission Shift Selector Pad has 6 operator buttons and a two-digit display.
- N Button (The N activates transmission neutral. Pressing this button will cause the transmission to shift to neutral.)
- D Button (The D activates transmission forward gears. Pressing this button will cause the transmission to shift into the first forward gear.)
- R Button (The R activates transmission reverse gear. Pressing this button will cause the transmission to shift into the reverse direction gear.)
- Mode Button (The Mode button is used to access different shift modes available in the transmission software. This button has an embedded Red LED that will illuminate indicating that the Mode Button has been pressed.)
- Arrow Buttons (The Arrow buttons are used to upshift or downshift the transmission one gear per activation.)

Note: The Mode button may be used to control one of several features enabled through software embedded in the transmission's Electronic Control Unit.

Basic Operation

With the ignition key switch in the ON position, the Shift Selector Pad will display a pair of N's on the display, indicating that the transmission is in Neutral.

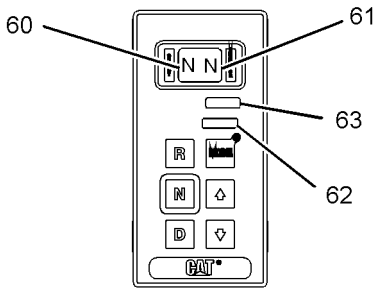

Illustration 17 g01300826

Shift Pad

(60) Left character
(61) Right character
(62) Mode One decal and LED light
(63) Mode Two decal and lamp

Range Selection

To shift the transmission into a desired Range or Gear, the operator pushes the D for Forward or the R for Reverse.

Note: The transmission will not shift into a range from Neutral or between D and R if the engine's rpm is over 1000 rpm.

Forward Range

When D is selected, the Shift Selector Pad will display the maximum gear the transmission has available on the left side of the display. The CX31 transmissions have a maximum of 6 forward gears. The transmission's Actual Gear, a 1, will be displayed on the right side of the display as the transmission shifts into first gear.

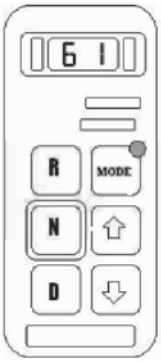

Illustration 18 g01300849

The Actual Gear will be displayed on the right side of the transmission as the transmission shifts.

Once in a Forward Range, the operator has the ability to force a downshift by pressing the arrow on the right side of the Shift Selector Pad.

Reverse Range

To select the Reverse Range, the operator selects the R button. The Shift Selector Pad displays the Desired Gear or R on the left side of the display and N on the right.

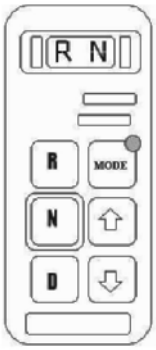

Illustration 19 g01300906

When the transmission shifts into Reverse Range, the display will have an R in both locations. There is only one gear in the Reverse range.

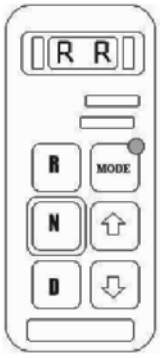

Illustration 20 g01301022

Flashing Desired Gear

Several circumstances may prevent the transmission from shifting into a desired Range. When this happens, the Desired Gear value will flash and the transmission will not shift into the selected range.

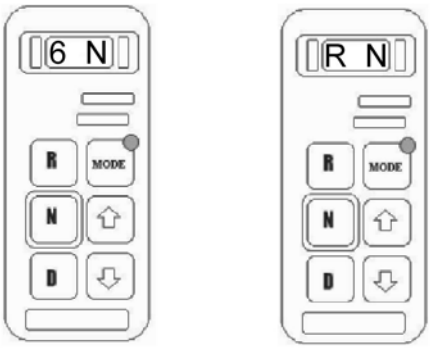

Illustration 21 g01394825

Circumstances preventing shift into the desired range include the following:

- Engine speed too high
- Vehicle speed too high
- Programmable parameters
- Neuteralized by park brake
- Auto Neutral
- PTO
- Driveline PTO
- Neutral to gear inhibit
- Direction inhibit

Once the switch and speed requirements have been met, the transmission will shift normally. Some circumstances may require the operator to select Neutral range and then re-select the desired range in order for the transmission to shift into that range.

Note: If the Left character “flashes” N, then the transmission is locked in Neutral by the ECU. The most common cause of a “flash” N is when the parking brake is applied. To resume operation, the N button needs to be pressed before the D or R button will respond. The parking brake will still need to be released before driving the vehicle. There are other operations that may cause the “flash” N to be displayed based on how the OEM has requested the ECU to be programmed. See Special Instruction, REHS2791, “Application and Installation Guide (Electrical)” for additional information about the Operator Shift Pad.

Additional Features

NOTICE
The mode functions listed in this OMM may or may not be available based on the customer programming provided.

Mode Feature Access

The OEMs, body builder, and dealers have the capability of programming Mode features. At this time two of the available features can be accessed using the Mode button. The two features are requested using different techniques of pressing the Mode button. A quick press and release of the Mode button will provide the first mode displayed by the programmer decal in position 62 on the shift pad. Pressing and holding the Mode button for three seconds request the second mode feature indicated by the decal on the lamp in position 63 on the shift pad.

Mode Button

The Mode button is available to control a variety of functions provided by the customer programmer. Its primary purpose is to select a different shift schedule designed to improve fuel economy. Other modes may be selected through transmission parameter programming. When the Mode button is pushed and quickly released, the LED in the upper right corner of the Mode button turns ON informing the operator that the selected feature in the decal above the Mode button is active. Mode one is most often used to change the transmission shift schedule. Pressing the Mode button a second time will disable the feature and the LED will turn off. If the Mode button is depressed and held for three seconds the second programmed mode will be displayed by the lamp and decal in position 63 on the shifter pad.

Illustration 22 g01301284

Economy Mode

Selecting the Economy mode will reduce the engine speed at which the transmission shifts in order to provide earlier upshifts. This will enhance fuel economy.

PTO ON/OFF

Selecting the PTO mode will engage the control of PTO devices.

Note: This functionality is only available if the PTO is controlled by the transmission ECU.

Hold In Gear

The Hold In Gear feature is used to enable the operator to limit upshifts of the transmission. The transmission will hold the current gear and only upshift to prevent an engine overspeed condition. Normal downshifting is allowed as the vehicle speed decreases. As the transmission downshifts, the hold continues which means that the transmission will stay in the downshifted gear until a mode change is requested, or an overspeed of the engine requires an upshift. The Mode button is used to enable the Hold In Gear feature. If the operator presses and releases the Hold button a 2nd time or selects a different gear, the Hold function will be disabled. When the Mode button is used as the switch, activating the Hold function will enable the Mode button LED. This LED will remain enabled as long as the Hold feature is active.

Quick First Gear Limit

The Quick Gear Limit feature utilizes the shift pad MODE switch activation to indicate that the transmission should not upshift beyond first gear. This feature can be used to effectively limit vehicle speed during refuse applications. The Quick Gear Limit feature only inhibits upshifts past first gear. If the transmission is in second gear, the transmission will continue to operate normally until first gear is attained at which upshifts will be inhibited. The Quick First Gear Limit feature may be programmed by OEM vehicle manufacturers to either Enable or Inhibit Reverse gear. Vehicle operation conditions that cause the engine to overspeed in first gear will result in an engine protection upshift to higher gears.

Oil Level Check

The Caterpillar Shift Selector Pad allows the operator to check the oil level of the transmission from the operator station by using an electronic oil level sensor (internal to the transmission).

Vehicle requirements for initiating the Oil Level Check

1. Engine at idle

2. Vehicle stationary

3. Transmission Oil Temperature more then 80 °C (176 °F)

4. Vehicle on Level Ground

5. Transmission in Neutral

To initiate the transmission oil level check, simultaneously press and release the Up and Down arrows on the Shift Selector Pad. This action starts a two-minute timer. If conditions are not correct for the oil level check to take place, the Shift Selector Pad will display one of the following using the range display. The display will only display two characters at a time.

Table 1

Display	Description
OL-ES-LO	Engine speed too low
OL-ES-HI	Engine speed too high
OL-TX-N	Neutral not selected
OL-OT-LO	Oil temperature too low
OL-OT-HI	Oil temperature too high
OL-VS-HI	Vehicle speed not zero
OL-SE	System error

Once all conditions are met, the range display will show 90 and will count down to 0 during the two-minute counter period. At the end of two-minute countdown, one of the following will be displayed using the range display, two characters at a time.

Table 2

Display	Description
OL-LO-XX	Oil Level is low by XX quarts
OL-HI-XX	Oil Level is high by XX quarts
OL-OK	Oil Level is full

The Oil Level Message continues to display until the operator exits the mode by pressing a range button or the Up/Down arrows simultaneously. The transmission will not take any action at the end of the oil level check. This check is for the operator's information and it is up to the operator to take any appropriate action for an indicated oil level that is either high or low.

Note: Periodically the manual oil level dip stick should be compared to the electronic oil level display to insure both methods provide comparable results.

Dual Shift Selector Pads

Some vehicle configurations require that the transmission be temporarily controlled from a remote location. Up to two Shift Selector Pads may be used on one vehicle. A vehicle mounted **Shifter Selector switch** is used to tell the transmission which shifter is to be in control of shifting. To change between Shift Selector Pads, both shift selector pads must be in Neutral and the vehicle must be stationary. The Shifter Selector switch may then be used to designate which shift selector pad is to be used.

When the primary shifter is selected, the maximum gear available will be displayed on the left side of the display. When the secondary shifter is selected, the maximum forward gear displayed on the left side of the display will be 1 (one). The transmission will not automatically shift into a higher gear except for engine overspeed protection. The operator may use the arrow buttons to increase the highest desired forward gear when using the secondary shifter.

Display Illumination

The display's illumination level is normally tied to the dash illumination level control. An optional vehicle mounted switch, if so equipped, may be used to disable the display.

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Retarder Operation

SMCS Code: 3073; 3120; 3167

An **optional** hydraulic retarder is available with the CX31 transmission. The retarder acts as a secondary braking system that is activated by electrical inputs from the transmission controller. The retarder will only be enabled in the following conditions: if the torque converter is locked up, fuel is not requested by the governor, fuel is not requested by the cruise control, and fuel is not requested by the throttle. The vehicle manufacturer selects the retarder controller and the location for the retarder controller at the operator station. The following three types of controllers are most commonly used: floor mounted pedal, column mounted hand lever, and dash mounted set of switches. The pedal and lever determine the degree of retarding from 0 to 100 percent based on the movement of the pedal or the movement of the lever. The retarder switches are preprogrammed in order to provide off, low, medium, or a high percentage of retarding.

1. There are the following three modes of operation: **Coast**, **Latch**, and **Manual**. The automatic **Coast** and **Latch** modes require the Cruise Control and the retarder controls be in the ON position. When programmed to **Coast**, the retarder is enabled only while the service brakes are being applied. The retarder will be applied to the preprogrammed setting selected (low, medium or high). The retarder disengages when the operator's foot is removed from the service brake. When programmed to **Latch**, the retarder stays on during and after the service brakes have been applied to the preprogrammed level selected. The retarder will remain in **Latch** mode until a request for engine fuel is active from the following: governor, cruise control, and throttle. **Manual Mode** does not require the Cruise Control switch to be in the ON position. In the Manual Mode, the retarder will activate anytime the retarder switch is ON and a request for engine fuel is not present.

2. The retarder will not engage while the ABS is active. If the ABS becomes active while the retarder is active, the retarder will disengage.

3. The transmission retarder will not engage while a compression brake or an exhaust brake is operating. Should a compression brake or exhaust brake begin operation while the retarder is active, the retarder will disengage.

4. If the engine speed is turning faster than 2,600 rpm, the retarder will not engage. If the retarder is engaged and the engine speeds reach or exceed 2,600 rpm, the retarder will continue to function in order to help the operator reduce speed. The engine is protected against over speeding by the shift logic. However, there are conditions when the control logic is used to protect the hardware.

5. The retarder takes about one second before the transmission detects the performance of the retarder. Operators need to anticipate this delay in order to prevent the unnecessary use of the service brakes.

6. If the retarder has a lever that is not returned to the off position and the operator steps on the throttle, the accelerator pedal will disengage the retarder. The retarder will not engage again until the operator returns the lever to the OFF position and the operator engages the retarder again.

7. Do not use the retarder when the roads are slick. The use of the retarder on slick roads may cause a loss of vehicle control.

8. Retarder performance is reduced during transmission overheating in order to protect the transmission.

9. Low transmission fluid level will reduce retarder performance.

10. If the engine cooling system overheats during retarder operations, the engine cooling system pressure, coolant level, and engine rpm may be the source of the problem. Applications and ambient conditions may occur when a proper operating engine cooling system overheats while the retarder is applied. During such applications, the operator needs to decrease the percentage of retarding and the operator needs to apply the service brake.

i02793464

Transmission Operation

SMCS Code: 3001; 3030; 3101

Transmission Cooling (General Recommendations)

Automatic transmissions generate heat due to converter slippage, charging pump losses, and friction in rotating components. The transmission fluid absorbs this heat, and an oil cooler is required to dissipate it. Keeping the oil cool maintains the oil's lubricating properties. Keeping the oil cool allows the transmission to operate properly. Also, this extends the life of the transmission components.

The engine coolant (antifreeze) and the automatic transmission fluid (ATF) absorb the heat generated by the engine and transmission. The two fluids carry the heat to a heat exchanger (radiator or cooler) and the oil or antifreeze is cooled.

Fluid Requirements

Caterpillar recommends a 1:1 ratio of ethylene glycol to water and the proper anti-corrosive additives as a cooling medium for the engine's radiator. If the vehicle operates below minus 1.7 °C (35 °F), a 60:40 ratio of ethylene glycol to water is recommended. See the Truck Application and Installation Guide for additional information.

Do not use water without using the proper cooling additives. Using water alone does not provide adequate boiling and freezing protection. Also, using water without additives is corrosive to the engine's cooling system.

Torque Converter Cooling

Caterpillar On-Highway Transmissions have lockup clutches that reduce the heat generated by torque converters in all gears except first gear and reverse. Under normal operating conditions, the transmission will upshift and downshift to the proper gear ratio and spend the majority of the time operating time in the converter lockup clutch mode. The lockup clutch reduces the torque converter cooling requirements. If the driver selects first gear hold the lockup clutch is disabled. This mode of operation will result in continuous torque converter usage. As a result, torque converter slippage will generate higher heat loads. The following conditions will dictate transmission cooling requirements: the application, ambient temperatures, the horsepower being transmitted, and the length of time in converter drive.

Temperature Operating Limits

The maximum allowable transmission oil temperatures for normal (continuous) and intermittent (testing) conditions are the following:

Continuous sump ..... 93 °C (200 °F)

Continuous transmission out ..... 121 °C (250 °F)

Intermittent sump ..... 121 °C (250 °F)

Intermittent transmission out ..... 149 °C (300 °F)

Temperature Gauges

If the OEM chooses to use a transmission/converter color coded **outlet temperature gauge**, the following requirements and recommendations apply: recommended **Green - Safe** zone is below 121 °C (250 °F), **Yellow - Caution** zone is 121 °C (250 °F) to 149 °C (300 °F), and REQUIRED **Red - Warning** above 149 °C (300 °F).

If the OEM chooses to use a transmission color coded **sump temperature gauge**, the following recommendations and requirements apply: **Green - Safe** below 93 °C (200 °F), **Yellow - Caution** between 93 °C (200 °F) and 121 °C (250 °F) , and a REQUIRED **Red - Warning** zone above 121 °C (250 °F)

NOTICE

Operators may use the **Yellow** zone on an intermittent basis for short time intervals. Operation above the **Red** line for short periods of time can result in damage to the oil and the transmission.

Transmission Overheating

In the unlikely event that the transmission does over heat, the transmission should be shifted to neutral and engine speed should be elevated to high idle until the transmission temperature returns to the proper operating temperature. Elevating the engine speed to high idle causes the engine fan to provide the most airflow across the radiator and maximizes oil flow through the cooler.

Towing and Coasting

Since the transmission hydraulic pump is driven by the engine, the rpm of the pump will vary with the speed of the engine. One of the many functions of this pump is to provide lubrication. If the engine speed is non-existent (towing) or at a lower level than intended (coasting), considerations must be taken into account. If the CX31 is installed in a wheeled vehicle that requires towing, the drive shaft must be disconnected from the transmission or the drive axle(s) lifted off the ground. Coasting in NEUTRAL is not recommended by Caterpillar. Although, if coasting in neutral situation should occur, the engine speed must be increased in order to provide the proper lubrication to the transmission.

Power Take-Off (PTO)

The CX31 Transmission has three PTO mounting pads. There is one pad on each side of the transmission near the input end. Also, there is one pad at the rear of the transmission. Bolt-on PTO units are available from aftermarket suppliers. The bolt-on PTO units can be specified in order to adapt to a variety of output options. Specifying and designing the installation of the PTO devices are the responsibility of the OEM, body builder, or the end user.

The capability for side PTO operation is standard on the CX31 Transmission. When the side PTO positions are viewed from the rear, side PTO positions are 8 o'clock and 1 o'clock. In addition, there is an optional rear power take-off (RPTO) that is positioned on the lower right, adjacent to the transmission output shaft.

⚠ WARNING

To avoid personal injury due to entanglement with rotating shaft, keep PTO master cover and all power drive system covers in place. Install PTO shaft guard when the system is not in use.

Note: Serious injury can be prevented with proper drive shaft guards. It is the OEM or the auxiliary PTO installer's responsibility to provide guards on the exposed rotating parts.

Direction of Rotation

Engine (Rotation SAE J824 - Standard)

- Counterclockwise as viewed from the flywheel end of the engine

Transmission (Output Rotation)

- Forward Same as Input (Converter)
- Reverse Opposite of Input

PTO (Rotation)

- Transmission side PTO drive gear rotates at engine rpm and same direction as transmission input.
- Rear PTO shaft rotates at 1.25 X Engine rpm and in the opposite direction of transmission input.

Transmission PTO Control

The CX31 Transmission ECU may be used to program PTO functions or the PTO supplier may provide separate PTO controls. The programmable features may include, but are not limited to the following conditions:

- PTO operation in Neutral only
- PTO engagement below a specific engine speed
- PTO overspeed protection

Side PTO Mounting Bolts

- M10 x 1.5 externally threaded fastener
- Minimum fastener Grade 10.9 in accordance with SAE J1199 (1040 MPa min)
- Minimum quantity of 8 bolts are required to secure the PTO to the transmission. Alignment dowels are optional hardware that may be provided by the PTO supplier.

Side PTO Electrical Connections

- Refer to Special Instruction, REHS2791, "Application and Installation Guide (Electrical)" for specific OEM electric interface definitions and requirement.
- Refer to the supplier of the PTO attachment for installation instructions of the PTO electrical connections.

Rear PTO Interface

Removal of the rear PTO cover after the transmission has been properly filled with oil may cause the loss of some fluid. The amount of oil lost will depend on the installation angle of the transmission and the surface plane of the vehicle when the cover is removed. (Some PTO component suppliers recommend draining the transmission oil prior to installation of PTO components). Check the transmission oil level after installing the PTO components in order to make sure that any oil that may be lost has been replaced. Also, check the oil level in order to make sure that the added component did not increase the oil requirements of the transmission. The installation dimensional drawings provide additional specifications for the rear PTO mounting pad.

Note: Rear PTO will accept a 4 bolt SAE J744 "B" pump drive and pilot. A supplier adapter is required to mate with the 17 tooth Caterpillar spline.

Rear PTO Bolt Requirements

- M12 x 1.75 externally threaded fastener
- Minimum fastener Grade 10.9 in accordance with SAE J1199 (1040 Mpa min)
- Minimum quantity of 8 bolts required to secure the PTO to the transmission.

Rear PTO Sealing Requirements

- The rear PTO is designed for a standard 241, 6V-1197 O-Ring Seal.
- The O-ring is intended to provide a static radial sealing over the pilot diameter of the unit mating to the rear PTO pad.
- O-ring Seal material is FKM (Viton)

Side and Rear PTO Torque Limits

Table 3

Maximum Output Torque Permitted at the Side and Rear PTO Couplings	
CX31 PTOs	**Maximum Torque**
Single Side PTO	700 ft lb
Single Rear PTO	800 ft lb
Maximum Total PTOs	1200 ft lb

Driveline Power Take-Off (DPTO)

Nomenclature

DPTO is a feature that allows the transmission to deliver power to a PTO load through the transmission output shaft instead of delivering power to the vehicle wheels.

Features

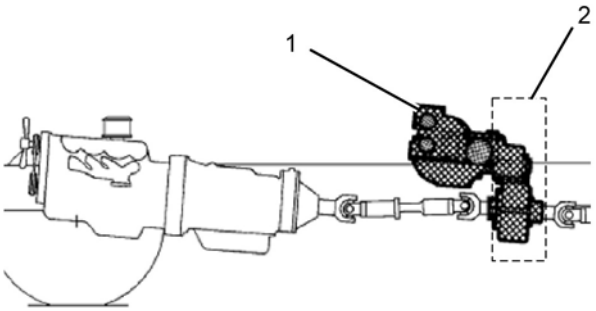

Illustration 23 g01382463

(1) Pump
(2) Transfer case (split shaft PTO)

The objective of this section of the Application and Installation Guide is to supply the OEM builder with information needed to design a DPTO system. The Special Instruction, REHS2884, "Application and Installation Guide (Electrical)" provides programming and wiring information about the DPTO. This Mechanical Application and Installation Guide outlines features and the guide sets the reflected inertia limits for the transmission brake. Programmable options include the following options: the selection of the transmission operating gear, lockup clutch engagement, disengaging engine speeds, and appropriate on and off features.

The ECU provides a fuel efficient mode of operation for the DPTO feature when activated. Typical applications uses fourth gear, which is 1.0:1.0 ratio (engine speed) as the DPTO output. The torque converter lockup function is normally set to engage at engine speeds above 1,000 rpm. The torque converter lockup function is normally set to revert to converter drive below engine speeds of 800 rpm. Converter drive provides higher starting torques for DPTO applications and converter drive allows the engine to run with a stalled output DPTO.

The software provides a driveline brake that can be used in applications to stop the rotation of the transmission output shaft. The driveline brake feature uses two of the transmission's stationary clutches engaged at 40 psi that act as the brake. The clutches have energy limits that must not be exceeded. Therefore, the braking software will only allow the braking feature to become active below a transmission output shaft speed of 175 rpm.

The program also causes the brake to disengage (time out) after 10 seconds if the rotating inertia has not come to a stop. A cooling off period for the clutches is also provided in the software that will only allow the braking function to be reapplied after a 30 second cool down. The driveline brake must not be used for large generators or to decelerate extremely large pumps.

The brake feature is limited to inertias that are reflected at the transmission output shaft of less than 58 lb ft^2.

TYPICAL DRIVELINE

PUMP SHAFT SPEED = 1.96 X INPUT SHAFT SPEED

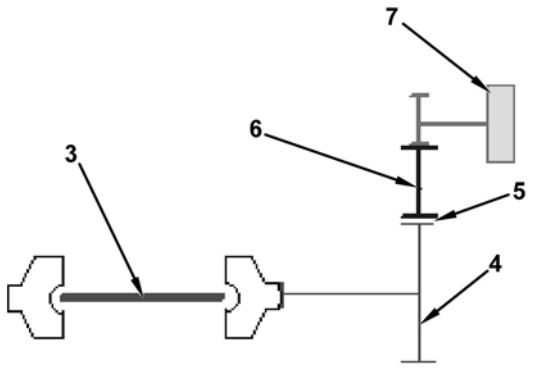

Illustration 24 g01391211

A formula for calculating the inertia limits is given in the following example:

(3) Drive Shaft Inertia = 5.73 lb ft^2

(4) Input Shaft Inertia = 3.77 lb ft^2

(5) Gear Ratio = 1.96

(6) Intermediate Shaft Inertia = 2.86 lb ft^2

(7) Pump/Rotor (wet) Inertia = 9.87 lb ft^2

Total Reflected Inertia Limit = TRIL#

Maximum Inertia Example (Worst Case)

Note: All inertia units are: lb ft^2 = #

TRIL# = 5.73# + 3.77# + 1.96^2(2.86# + 9.87#) = 58.4#

Locations for the Support Brackets

NOTICE

If bolts are removed from the CX31 transmission to add mounting brackets, etc. they must be replaced with longer bolts so that thread engagement is maintained. The replacement bolts must be of the same grade and torqued to the required specifications.

Thread engagement length and bolt torques are critical on the Aluminum Case and Cover of the CX Transmissions. The bolts selected must have a thread engagement length of twice the bolt diameter. Standard torques on short bolts will strip the threads. The bolts must not be too long because the bolts will bottom out and crack the case.

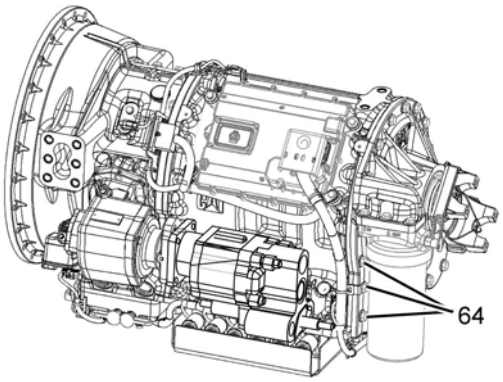

Illustration 25 g01308538

(64) Bolt locations for support brackets

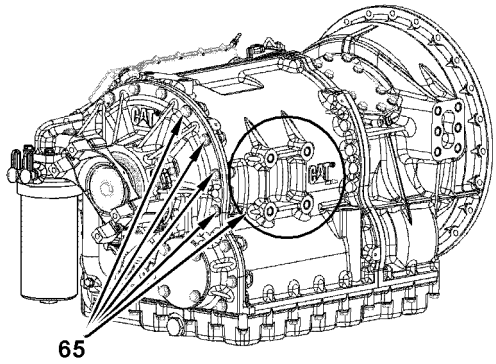

Illustration 26 g01308542

(65) Bolt locations for support brackets

BOLT TORQUES

Tightening torques are called out in the installation dimensional drawings. Tightening torques that are called out in the installation dimensional drawing take precedence over the standard torque values. The dimensional drawings are in the Appendix of Special Instruction, REHS2790, “Application and Installation Guide (Mechanical)”.

Standard Bolt Torques

Note: The torques in the following tables are based on metric Grade 10.9 or higher fasteners (SAE Grade 8 or higher inch fasteners). Use hardened washers. Split lock washers are not permitted.

Table 4

Inch Nuts and Bolts	
Thread Size (Inch)	**Standard Torque**
1/4	12 ± 3 N·m (9 ± 2 lb ft)
5/16	25 ± 6 N·m (18 ± 4 lb ft)
3/8	47 ± 9 N·m (35 ± 7 lb ft)
7/16	70 ± 15 N·m (50 ± 11 lb ft)
1/2	105 ± 20 N·m (75 ± 15 lb ft)
9/16	160 ± 30 N·m (120 ± 22 lb ft)
5/8	215 ± 40 N·m (160 ± 30 lb ft)
3/4	370 ± 50 N·m (275 ± 37 lb ft)
7/8	620 ± 80 N·m (460 ± 60 lb ft)
1	900 ± 100 N·m (660 ± 75 lb ft)
1 1/8	1300 ± 150 N·m (960 ± 110 lb ft)
1 1/4	1800 ± 200 N·m (1320 ± 150 lb ft)
1 3/8	2400 ± 300 N·m (1780 ± 220 lb ft)
1 1/2	3100 ± 350 N·m (2280 ± 260 lb ft)

Table 5

Metric Nuts and Bolts	
Thread Size (Metric)	**Standard Torque**
M6	12 ± 3 N·m (9 ± 2 lb ft)
M8	28 ± 7 N·m (21 ± 5 lb ft)
M10	55 ± 10 N·m (41 ± 7 lb ft)
M12	100 ± 20 N·m (75 ± 15 lb ft)
M14	160 ± 30 N·m (120 ± 22 lb ft)
M16	240 ± 40 N·m (175 ± 30 lb ft)
M20	460 ± 60 N·m (340 ± 44 lb ft)
M24	800 ± 100 N·m (590 ± 75 lb ft)
M30	1600 ± 200 N·m (1180 ± 150 lb ft)
M36	2700 ± 300 N·m (2000 ± 220 lb ft)

Maintenance Section

Lubricant Viscosities and Refill Capacities

i02794038

Lubricant Viscosities

SMCS Code: 1000; 7000; 7581

Maintenance Intervals and Service

Distance (odometer), service **hours** or calendar **time**, **whichever occurs first,** can be used to determine the maintenance intervals. Frequency of fluid and filter changes are determined by the severity of the transmission application. More frequent changes are necessary when high levels of contamination, overheating or S·O·S oil analysis indicates that the transmission oil has been contaminated. Contamination may include a viscosity change, a strong odor or a discolored black appearance.

1. Caterpillar recommends the CX31 main transmission filter be changed after the initial 5,000 miles (8,000 km) or 200 hours of operations (**whichever occurs first**).

2. Always inspect and clean the magnetic screen with each oil change.

3. The breather needs to be cleaned with a petroleum based solvent at the overhaul or as necessary based on the operating environment.

When a maintenance interval has been reached, all of the specified maintenance for that particular interval must be performed.

Fluid Recommendations

The CX Series of on-highway transmissions are designed to operate with ATF fluids that meet Caterpillar AT-1 or Dexron® IIIH specifications. Extended oil change intervals require synthetic oils meeting Caterpiller AT-1 specifications. Caterpillar ATF synthetic oil is available through Caterpillar dealers. Refer to the Operation and Maintenance Manual for oil change intervals based on applications.

Note: Do not use Caterpillar TDO-4 oil in the CX Series of on-highway transmissions.

Application Severity Definitions

Severe Application vehicles operate both on and off highway. Typical applications are the following: dump trucks, transit mixers, refuse trucks, all wheel drive public utility trucks, snow removal, yard spotters, and concrete pumpers. Heavy equipment transport and specialty PTO applications are also considered severe applications.

General Application vehicles operate exclusively on paved or improved roads. Typical applications are the following: line haul, pickup and delivery, beverage delivery, public service dump, emergency vehicles, and recreational vehicles with living accommodations.

Table 6

General Applications Standard Sump Dexron® III H		
Fluid Change Intervals	**Main Filter**	**Magnetic Screen**
25,000 miles[1] (40,000 km) 1000 hours 12 months	25,000 miles (40,000 km) 1,000 hours 12 months	25,000 miles (40,000 km) 1,000 hours 12 months
General Applications Standard Sump Synthetic ATF Meeting Caterpillar AT-1 Specifications[2][3]		
150,000 miles[4] (240,000 km) 4,000 hours 48 months	75,000 miles (120,000 km) 3,000 hours 36 months	150,000 miles (240,000 km) 4,000 hours 48 months

(1) Without retarders
(2) Synthetic oil required with retarders
(3) With acceptable S·O·S oil analysis results every 37,500 miles.
(4) Factory test oil is Dexron® III H. Residual oil in the transmission will dilute the first use of synthetic oil. Caterpillar recommends a reduced oil change scheduled for the first installation of synthetic oil.

Table 7

General Applications Shallow Sump Dexron® III H		
Fluid Change Intervals	**Main Filter**	**Magnetic Screen**
25,000 miles(1) (40,000 km) 1000 hours 12 months	25,000 miles (40,000 km) 1,000 hours 12 months	25,000 miles (40,000 km) 1,000 hours 12 months
General Applications Shallow Sump Synthetic ATF Meeting Caterpillar AT-1 Specifications(2)(3)		
150,000 miles(4) (240,000 km) 4,000 hours 48 months	50,000 miles (80,000 km) 2,000 hours 24 months	150,000 miles (240,000 km) 4,000 hours 48 months

(1) Without retarders
(2) Synthetic oil required with retarders
(3) With acceptable S·O·S oil analysis results every 25,000 miles.
(4) Factory test oil is Dexron® III H. Residual oil in the transmission will dilute the first use of synthetic oil. Caterpillar recommends a reduced oil change scheduled for the first installation of synthetic oil.

Table 8

Severe Applications Standard Sump Dexron® III H		
Fluid Change Intervals	**Main Filter**	**Magnetic Screen**
12,000 miles(1) (20,000 km) 500 hours 6 months	12,000 miles (20,000 km) 500 hours 6 months	12,000 miles (20,000 km) 500 hours 6 months
Severe Applications Standard Sump Synthetic ATF Meeting Caterpillar AT-1 Specifications(2)(3)		
75,000 miles(4) (120,000 km) 3,000 hours 36 months	75,000 miles (120,000 km) 3,000 hours 36 months	75,000 miles (120,000 km) 3,000 hours 36 months

(1) Without retarders
(2) Synthetic oil required with retarders
(3) With acceptable S·O·S oil analysis results every 15,000 miles.
(4) Factory test and fill oil is Dexron® III H. Residual oil in the transmission will dilute the first use of synthetic oil. Caterpillar recommends a reduced oil change scheduled for the first installation of synthetic oil.

Table 9

Severe Applications Shallow Sump Dexron® III H		
Fluid Change Intervals	**Main Filter**	**Magnetic Screen**
12,000 miles(1) (20,000 km) 500 hours 6 months	12,000 miles (20,000 km) 500 hours 6 months	12,000 miles (20,000 km) 500 hours 6 months
Severe Applications Shallow Sump Synthetic ATF Meeting Caterpillar AT-1 Specifications(2)(3)		
50,000 miles(4) (80,000 km) 2,000 hours 24 months	50,000 miles (80,000 km) 2,000 hours 24 months	50,000 miles (80,000 km) 2,000 hours 24 months

(1) Without retarders
(2) Synthetic oil required with retarders
(3) With acceptable SOS oil analysis results every 12,500 miles.
(4) Factory test and fill oil is Dexron® III H. Residual oil in the transmission will dilute the 1st use of synthetic oil. Caterpillar recommends a reduced oil change scheduled for the 1st installation of synthetic oil.

S·O·S Information

S·O·S Services is a highly recommended process for Caterpillar customers to use in order to minimize owning and operating costs. Customers provide oil samples, coolant samples, and other vehicle 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.

Refer to the OMM for a specific sampling location and a service hour maintenance interval for your application.

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

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Capacities (Refill)

SMCS Code: 7560

Table 10

Transmission Type	Estimated Initial Fill	Service Refill
CX31 Shallow Sump	38 L (10 US gal)	20 L (5.3 US gal)
CX31 Standard Sump	45 L (12 US gal)	25 L (6.5 US gal)
CX31 with Retarder	49 L (13 US gal)	27 L (7 US gal)

Note: The estimated initial fill volumes will vary by each application. The fluid volume that is required for the initial fill can be estimated by adding the fluid volume of the cooler and associated hoses to the transmission service refill volumes.

Installation Angle and Vehicle Slope Capability

The transmission was designed to operate in a horizontal plane that allows for proper hydraulic functionality of the lube circuit, control circuit, and pressure circuit. Refer to Tables 11 and 12 for slope capability.

Engine Forward Applications (Operating Angles)

Table 11

Maximum Operation Angle (Degrees) (Engine forward applications)			
Condition	**Shallow Sump**	**Standard Sump**	**Retarder Equipped**
Uphill	31	31	31
Downhill	24	31	31

Engine Aft Applications (Operating Angles)

Uphill and downhill conditions for the engine aft applications are the opposite of operating conditions for the engine forward applications. Refer to Tables 12 and 13 for slope capability.

Table 12

Maximum Operation Angle (Degrees) (Engine aft applications)			
Condition	**Shallow Sump**	**Standard Sump**	**Retarder Equipped**
Uphill	24	31	31
Downhill	31	31	31

Transmission Side Slope (Operating Angles)

Table 13

Maximum Operation Angle (Degrees Roll)			
Condition	**Shallow Sump**	**Standard Sump**	**Retarder Equipped**
Left/Right roll	16	16	16

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Maintenance Interval Schedule

SMCS Code: 1000; 7000

Every 10 Service Hours or Daily

Transmission Oil Level - Check

Initial 200 Service Hours or 8000 Kilometers (5000 Miles)

Oil Filter (Transmission) - Replace

Every 500 Service Hours or 6 Months or 20 000 Kilometers (12 000 Miles) for Vehicles Used in Severe Applications

Magnetic Screen (Transmission) - Clean
Oil Filter (Transmission) - Replace
Transmission Oil - Change
Transmission Oil Sample - Obtain

Every 1000 Service Hours or 1 Year or 40 000 Kilometers (25 000 Miles) for Vehicles Used in General Applications

Magnetic Screen (Transmission) - Clean
Oil Filter (Transmission) - Replace
Transmission Oil - Change
Transmission Oil Sample - Obtain

Every 2000 Service Hours or 2 Years or 80 000 Kilometers (50 000 Miles)for Vehicles Using Synthethic Transmission Oil in General Applications (Shallow Sump)

Oil Filter (Transmission) - Replace
Transmission Oil Sample - Obtain

Every 2000 Service Hours or 2 Years or 80 000 Kilometers (50 000 Miles)for Vehicles Using Synthethic Transmission Oil in Severe Applications (Shallow Sump)

Magnetic Screen (Transmission) - Clean
Oil Filter (Transmission) - Replace
Transmission Oil - Change
Transmission Oil Sample - Obtain

Every 3000 Service Hours or 3 Years or 120 000 Kilometers (75 000 Miles)for Vehicles Using Synthethic Transmission Oil in General Applications

Oil Filter (Transmission) - Replace
Transmission Oil Sample - Obtain

Every 3000 Service Hours or 3 Years or 120 000 Kilometers (75 000 Miles) for Vehicles Using Synthethic Transmission Oil in Severe Applications

Magnetic Screen (Transmission) - Clean
Oil Filter (Transmission) - Replace
Transmission Oil - Change
Transmission Oil Sample - Obtain

Every 4000 Service Hours or 4 Years or 240 000 Kilometers (150 000 Miles)for Vehicles Using Synthethic Transmission Oil in General Applications

Magnetic Screen (Transmission) - Clean
Oil Filter (Transmission) - Replace
Transmission Oil - Change
Transmission Oil Sample - Obtain

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Magnetic Screen (Transmission) - Clean

SMCS Code: 3030-070-MGS

WARNING

Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact the 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, NENG2500, "Caterpillar Dealer Service Tool Catalog" for tools and supplies suitable to collect and contain fluids on Caterpillar products.

Dispose of all fluids according to local regulations and mandates.

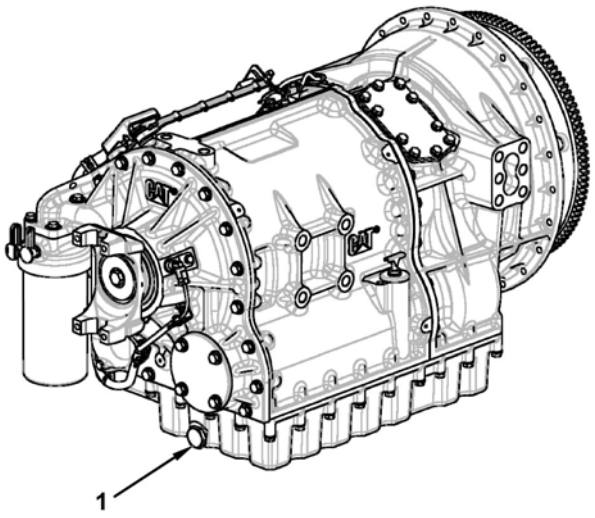

Illustration 27 g01299022

(1) **Drain plug**

1. Remove drain plug (1) from the bottom rear of the transmission. Allow the oil to drain into a suitable container.

2. After the oil has drained from the transmission case, clean the drain plug and install the drain plug. Torque the drain plug to 35 ± 10 N·m (26 ± 7 lb ft).

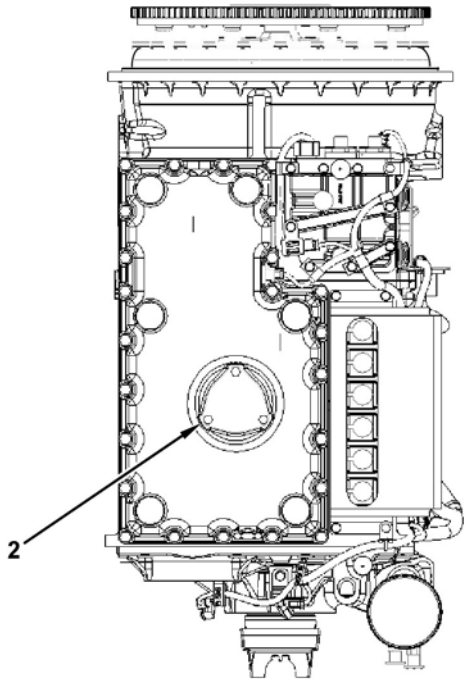

Illustration 28 g01274015

3. Remove the 3 bolts for the access plate (2).

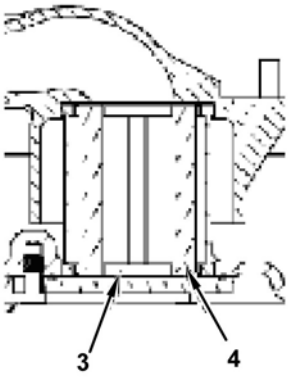

Illustration 29 g01237612

(3) **Suction screen**
(4) **Magnetic filter**

4. Remove suction screen (3). Remove magnetic filter (4).

Note: Additional oil may drain from the oil pan when the cover is removed. Ensure that a suitable container is in place in order to capture any oil that may drain from the torque converter housing.

5. Inspect suction screen (3) and magnetic filter (4) for large particles of debris. An excessive amount of debris may be an indication of possible failure. Discolored oil or oil with an odor requires a careful analysis of S·O·S results. If large particles are found, consult your Caterpillar dealer for further analysis and additional guidance.

NOTICE
Do not drop or rap the magnets against any hard objects. The magnets are very brittle. Replace broken magnets or damaged screens.

6. Wash the suction screen and the magnetic filter in clean, nonflammable solvent. Clean the magnets with a cloth or a stiff bristle brush.

7. Install the magnetic filter, the screen and the access plate. Tighten the access plate to 28 ± 7 N·m (21 ± 5 lb ft).

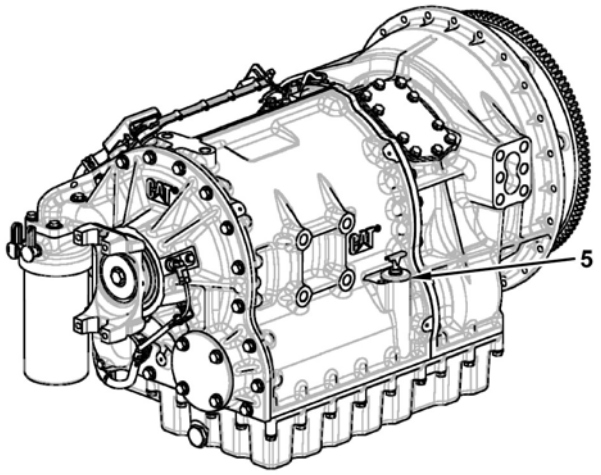

Illustration 30 g01299025
(5) **Filler tube**

8. Fill the transmission to the full mark on the dipstick at filler tube (5) with the recommended oil viscosity and volumes. Refer to Operation and Maintenance Manual, “Capacities (Refill)” for the appropriate oil volumes.

9. The vehicle must be on level ground and the transmission must be in neutral. Start the engine and operate at LOW IDLE. Check the oil filter and the suction screen for leaks.

10. Observe the oil level when the oil is warm and the transmission is in the NEUTRAL position. Make sure that the parking brake is engaged.

11. Stop the engine. If necessary, add oil.

i02795037

Oil Filter (Transmission) - Replace

SMCS Code: 3067-510

Filter Cartridge

Table 14

CX31 Oil Filters		
Filter Type	**Element Size**	**Part Number**
Cartridge	236 x 102 mm (9.3 x 4.0 in)	249-2329
Spin on	295 x 116 mm (11.6 x 4.6 in)	126-1817

⚠ WARNING

Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact the 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, NENG2500, “Caterpillar Dealer Service Tool Catalog” for tools and supplies suitable to collect and contain fluids on Caterpillar products.

Dispose of all fluids according to local regulations and mandates.

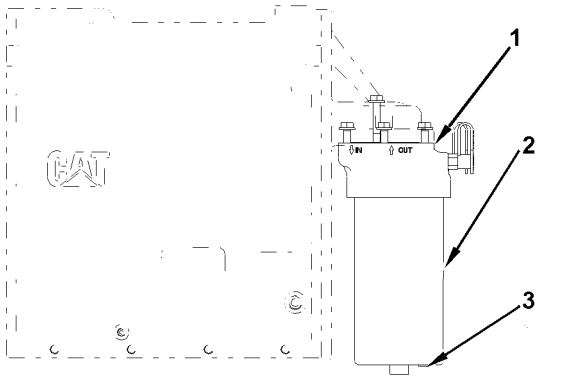

Illustration 31 g01237675
(1) Filter base
(2) Filter housing
(3) Filter drain plug

1. Remove filter drain plug (3). Allow the oil to drain into a suitable container. Replace filter drain plug (3). Tighten to 18 ± 3.5 N·m (13 ± 3 lb ft).

2. Remove oil filter housing (2). Discard the used oil filter element that is inside of housing (2). Additional oil will drain when you remove the filter. Allow the oil to drain into a suitable container.

3. Inspect the seal on the housing (2). If the seal is damaged, replace the seal with a new seal.

4. Install the new oil filter element in the housing (2).

5. Install housing (2) and the new element into filter base (1). Tighten the housing 55 ± 5 N·m (41 ± 4 lb ft). Do not use an air wrench to tighten.

6. Make sure that the transmission is in NEUTRAL. Start the engine and operate the engine at low idle. Check for any leaks and make the necessary repairs.

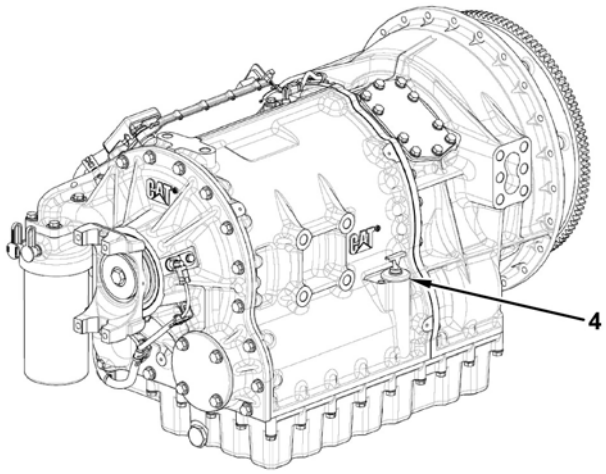

Illustration 32 g01240908

(4) Filler tube

7. Observe the oil level (4) when the oil is warm and the transmission is in the NEUTRAL position. Make sure that the parking brake is engaged.

8. Stop the engine. If necessary, add oil.

Spin-On Filter

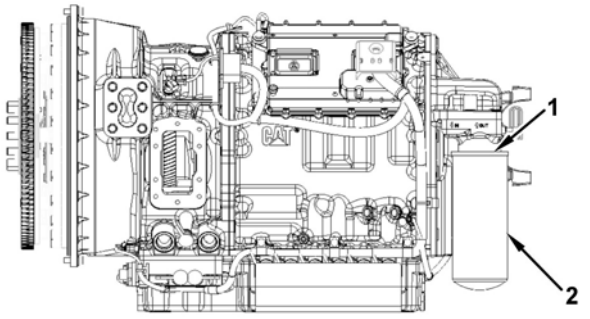

Illustration 33 g01237691

(1) Filter base
(2) Oil filter

1. Remove oil filter (2). Discard the used oil filter. Oil will drain during removal of the filter. Allow the oil to drain into a suitable container.

2. Install the oil filter. Tighten the oil filter until the oil filter gasket contacts base (1). Tighten the oil filter by hand according to the instructions that are shown on the oil filter. Do not overtighten the oil filter. Do not use an air wrench to tighten.

3. Make sure that the transmission is in NEUTRAL. Start the engine and operate the engine at low idle. Check for any leaks and make the necessary repairs.

4. Observe the oil level when the oil is warm and the transmission is in the NEUTRAL position. Make sure that the parking brake is engaged.

5. Stop the engine. If necessary, add oil.

i02595354

Transmission Oil - Change

SMCS Code: 3030-044; 3030; 3080-044; 3080

Table 15

CX31 Oil Filters		
Filter Type	**Element Size**	**Part Number**
Cartridge	236 x 102 mm (9.3 x 4.0 in)	249-2329
Spin on	295 x 116 mm (11.6 x 4.6 in)	126-1817

⚠ WARNING

Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact the 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, NENG2500, "Caterpillar Dealer Service Tool Catalog" for tools and supplies suitable to collect and contain fluids on Caterpillar products.

Dispose of all fluids according to local regulations and mandates.

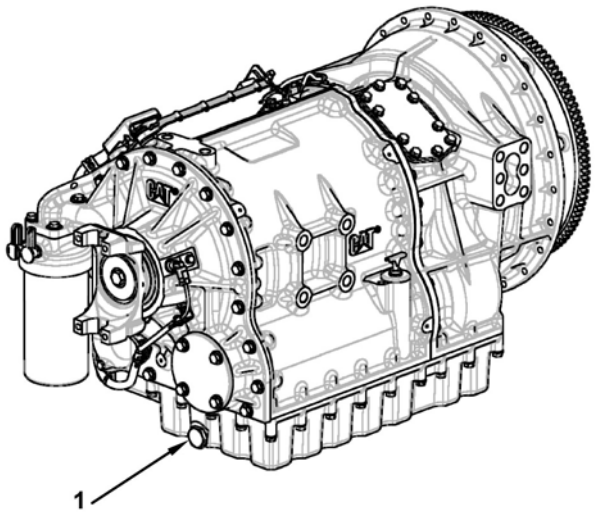

Illustration 34 g01299031

1. Remove drain plug (1) from the bottom of the transmission. Allow the oil to drain into a suitable container. Tighten the drain plug to 35 ± 10 N·m (26 ± 7 lb ft).

2. After the oil has drained from the transmission case, clean and install the drain plug.

3. Remove the magnetic screen and clean the screen.

4. Replace the magnetic screen and filter.

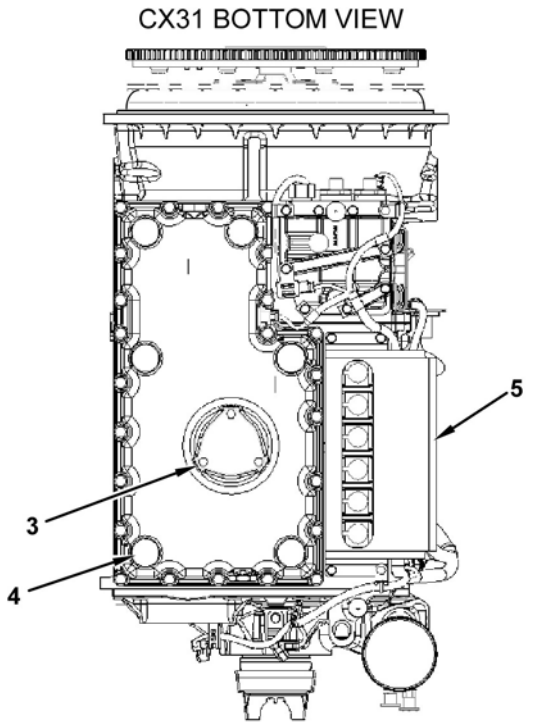

Illustration 35 g01273907

(3) **Magnetic filter**
(4) **Base support**
(5) **Solenoid guard**

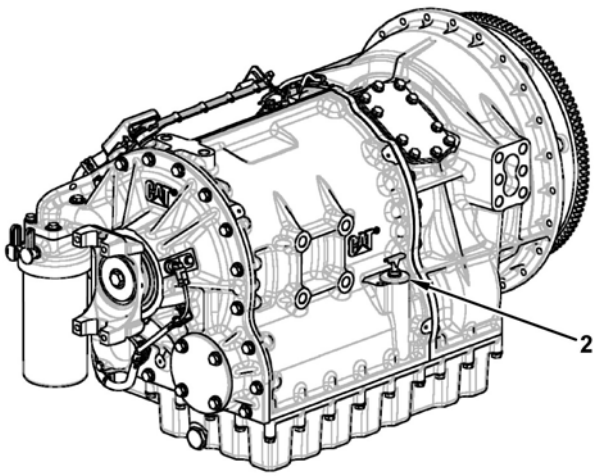

Illustration 36 g01299035

(2) Filler tube

5. Fill transmission case with oil (2). Refer to Operation and Maintenance Manual, "Lubricant Viscosities" and Operation and Maintenance Manual, "Capacities (Refill)".

6. Make sure that the vehicle is on level ground. Make sure that the transmission is in NEUTRAL. Start the engine and operate the engine at LOW IDLE. Check for leaks and make necessary repairs.

7. Check the oil level. Stop the engine and add oil, if necessary. Repeat Step 5 through 6 until the oil level is correct.

8. Install the filler cap.

9. Observe the oil level when the oil is warm and the transmission is in the NEUTRAL position.

10. Maintain the oil to the correct level at all times.

i02477418

Transmission Oil Level - Check

SMCS Code: 3030-535-FLV

Check the oil level of the transmission under the following conditions:

- The transmission oil is warmed to operating temperature.
- The engine is at LOW IDLE.
- The transmission is in NEUTRAL.
- The vehicle is on level ground.

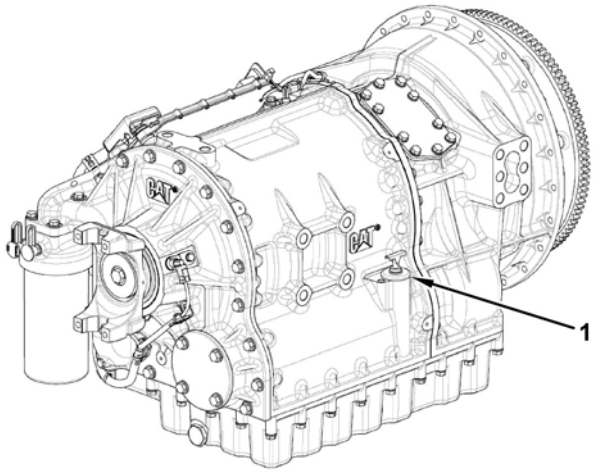

Illustration 37 g01241170

(1) Filler tube

1. Maintain the proper oil level on the oil fill tube (1).

2. Add oil, if necessary.

i02595360

Transmission Oil Sample - Obtain

SMCS Code: 3030-008; 3080-008; 7542-008

WARNING

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

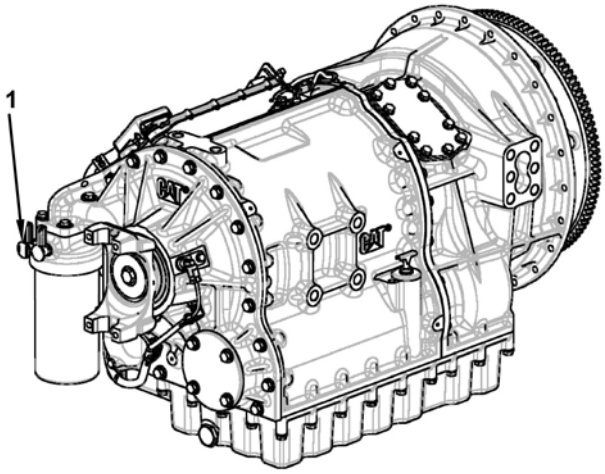

Illustration 38 g01299039

(1) Oil sampling valve

Oil sampling valve (1) for the transmission oil is located on the transmission oil filter.

SOS oil samples need to be taken when the engine is running and the oil is at operating temperature. The SOS oil analysis can be used two ways. (1) Before the oils is drained for an oil change the analysis indicates past transmission wear on contamination issues. (2) If the SOS sample is taken at 15,000 miles and the oil is not changed, it can be used as an indicator of the need for future oil and/or filter changes.

Refer to Special Publication, PEHP6001, “How To Take A Good Oil Sample”. Also, refer to Operation and Maintenance Manual, “S·O·S Information” and Special Publication, SEBU6250, “S·O·S Oil Analysis” for additional information about obtaining an oil sample.

Warranty Section

Warranty Information

i02610700

Warranty Information

SMCS Code: 7000

Limited Warranty

CX31 Transmissions Powering Vehicles

Caterpillar Inc. or any of its subsidiaries (Caterpillar) warrants new CX31 transmissions, attached to 10.3 liter up to and including 15.2 liter engines, sold by it for use in on-highway vehicles to be free from defects in material and workmanship.

This warranty is subject to the following:

Warranty Period

The warranty period for new CX31 transmissions attached to 10.3 liter up to and including 15.2 liter engines used in on-highway vehicles, except recreational vehicles, fire trucks, emergency service vehicles and ambulances, is 24 months after date of delivery to the first user.

The warranty period for new CX31 transmissions, attached to 10.3 liter up to and including 15.2 liter engines, used in recreational vehicles, fire trucks, emergency service vehicles and ambulances, is 60 months or 200,000 miles (321,869 kilometers), which ever occurs first after date of delivery to the first user.

Caterpillar Responsibilities

If a defect in material or workmanship is found during the warranty period, Caterpillar will, during normal working hours and at a place of business of a Caterpillar dealer or source approved by Caterpillar:

- Provide (at Caterpillar's choice) new, remanufactured or Caterpillar approved repaired parts or assembled components needed to correct the defect.
- Replace transmission oil, filters, and other service items made unusable by the defect.
- If the defective part or assembled component was installed by Caterpillar, a Caterpillar dealer, or other authorized source, provide reasonable or customary labor needed to correct the defect, including labor for removal and installation when necessary to make the repair.
- Provide reasonable or customary towing to the nearest authorized repair facility or reasonable travel expenses from the nearest authorized repair facility if the vehicle is inoperable or continued operation would result in additional transmission damage.

Note: Items replaced under this warranty become the property of Caterpillar.

User Responsibilities

During the warranty period the user is responsible for:

- Providing proof of the delivery date to the first user.
- Labor costs, except as stated under "Caterpillar Responsibilities".
- Travel or transporting costs, except as stated under "Caterpillar Responsibilities and Limitations".
- Premium or overtime labor costs.
- Parts shipping charges in excess of those which are usual and customary.
- Local taxes, if applicable.
- Cost to investigate complaints, unless the problem is caused by a defect in Caterpillar material or workmanship.
- Giving timely notice of a warrantable failure and promptly making the product available for repair.
- Performance of required maintenance (including use of proper transmission oil, filters, and lubricants) and items replaced due to normal wear and tear.
- Allowing Caterpillar access to all electronically stored data.

Limitations

Caterpillar is not responsible for:

- Failure resulting from any use or installation which Caterpillar judges improper.
- Failures resulting from attachments, accessory items and parts not sold or approved by Caterpillar.

- Failures resulting from abuse, neglect and/or improper repair.
- Failures resulting from user's delay in making the product available after being notified of a potential product problem.
- Failures resulting from unauthorized repair or adjustments.

For products operating in the Middle East, Africa, and within the territories administered by Caterpillar S. A .R. L., Singapore Branch, certain limitations may apply to towing and/or travel expenses based on geographic location and proximity to the nearest authorized repair facility. Contact your local dealer to determine if these limitations apply.

For products operating outside of Australia, Fiji, Nauru, New Caledonia, New Zealand, Papua New Guinea, the Solomon Islands and Tahiti, the following is applicable:

NEITHER THE FOREGOING EXPRESS WARRANTY NOR ANY OTHER WARRANTY BY CATERPILLAR, EXPRESS OR IMPLIED, IS APPLICABLE TO ANY ITEM CATERPILLAR SELLS, WHICH IS WARRANTED DIRECTLY TO THE USER BY ITS MANUFACTURER.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. REMEDIES UNDER THIS WARRANTY ARE LIMITED TO THE PROVISIONS OF MATERIAL AND SERVICES, AS SPECIFIED HEREIN. CATERPILLAR IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

CATERPILLAR EXCLUDES ALL LIABILITY FOR OR ARISING FROM ANY NEGLIGENCE ON ITS PART OR ON THE PART OF ANY OF ITS EMPLOYEES, AGENTS OR REPRESENTATIVES IN RESPECT OF THE MANUFACTURE OR SUPPLY OF GOODS OR THE PROVISION OF SERVICES RELATING TO THE GOODS.

IF OTHERWISE APPLICABLE, THE VIENNA CONVENTION (CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS) IS EXCLUDED IN ITS ENTIRETY.

For personal or family use transmissions operation in the USA, its territories and possessions, some states do not allow limitations on how long an implied warranty may last nor allow the exclusion or limitation of incidental or consequential damages. Therefore, the previously expressed exclusion may not apply to you.

This warranty gives you specific legal rights and you may also have other rights, which vary by jurisdiction. To find the location of the nearest Caterpillar dealer or other authorized repair facility call (800) 447-4986. If you have questions concerning this warranty or its applications, call or write:

In the USA and Canada:

Caterpillar Inc.
Engine Division
Warranty Administration
P.O. Box 610, Mossville, IL USA 61552-0610
Attn: Customer Service Manager
1-800-447-4986

Outside the USA and Canada: Contact your Caterpillar dealer.

For products operating in Australia, Fiji, Nauru, New Caledonia, New Zealand, Papua New Guinea, the Solomon Islands and Tahiti, the following is applicable:

THIS WARRANTY IS IN ADDITION TO WARRANTIES AND CONDITIONS IMPLIED BY STATUTE AND OTHER STATUTORY RIGHTS AND OBLIGATIONS THAT BY ANY APPLICABLE LAW CANNOT BE EXCLUDED, RESTRICTED OR MODIFIED ("MANDATORY RIGHTS"). ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED (BY STATUTE OR OTHERWISE), ARE EXCLUDED.

NEITHER THIS WARRANTY NOR ANY OTHER CONDITION OR WARRANTY BY CATERPILLAR, EXPRESS OR IMPLIED (SUBJECT ONLY TO THE MANDATORY RIGHTS), IS APPLICABLE TO ANY ITEM CATERPILLAR SELLS WHICH IS WARRANTED DIRECTLY TO THE USER BY ITS MANUFACTURER.

TO THE EXTENT PERMITTED UNDER MANDATORY RIGHTS, IF CATERPILLAR IS THE SUPPLIER TO THE USER, CATERPILLAR'S LIABILITY SHALL BE LIMITED AT ITS OPTION TO (a) IN THE CASE OF SERVICES, THE SUPPLY OF THE SERVICES AGAIN OR THE PAYMENT OF THE COST OF HAVING THE SERVICES SUPPLIED AGAIN, AND (b) IN THE CASE OF GOODS, THE REPAIR OR REPLACEMENT OF THE GOODS, THE SUPPLY OF EQUIVALENT GOODS, THE PAYMENT OF THE COST OF SUCH REPAIR OR REPLACEMENT OR THE ACQUISITION OF EQUIVALENT GOODS.

CATERPILLAR EXCLUDES ALL LIABILITY FOR OR ARISING FROM ANY NEGLIGENCE ON ITS PART OR ON THE PART OF ANY OF ITS EMPLOYEES, AGENTS OR REPRESENTATIVES IN RESPECT OF THE MANUFACTURE OR SUPPLY OF GOODS OR THE PROVISION OF SERVICE RELATING TO THE GOODS.

CATERPILLAR IS NOT LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES UNLESS IMPOSED UNDER MANDATORY RIGHTS.

IF OTHERWISE APPLICABLE, THE VIENNA CONVENTION (CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS) IS EXCLUDED IN ITS ENTIRETY.

Claims under this warranty should be limited to a place of business of a Caterpillar dealer or other source approved by Caterpillar. For further information concerning either the location to submit claims or Caterpillar as the issuer of this warranty, write

Caterpillar Inc.
100 N.E. Adams St
Peoria, IL USA 61629

Note: CX31 Transmission Warranty Information is available in the Caterpillar Limited Warranty Policy letter SELF5402 dated August 1, 2006

Maintenance Recommendations

Efficiency and transmission performance depends on adherence to proper operation and maintenance recommendations and the use of recommended oils, filters and parts. Caterpillar recommends major adjustments and repairs be made by your authorized Caterpillar dealer.

Various transmission oil additives which claim to reduce wear, stop leaks or improve efficiency are available commercially. Although additives have been used to solve some isolated field problems, additives are not recommended for general use. The recommended transmission lubricants and replaceable service parts are listed under **Lubricant Viscosities** and **Oil Filter Replace** in this manual.

Take corrective steps immediately if worn parts which may affect performance are discovered in order to ensure the proper operation of the transmission and its control systems. The use of genuine Caterpillar parts is recommended. Suppliers of non-Caterpillar parts must ensure the owner that the use of such parts will not adversely affect the performance, reliability or durability level of the transmission. Regular maintenance intervals with a special emphasis on the following items are necessary in order to maintain the reliability and durability of the transmission. Refer to the Operation and Maintenance Manual, SEBU8192-01, to determine the appropriate application factor for your transmission. See the **General Applications** and **Severe Application** for limits and definitions. See your authorized Caterpillar dealer in order to help analyze your specific application, operating environment and maintenance intervals.

DAILY INSPECTIONS – The oil level of the transmission needs to be checked daily. Do not operate a transmission with a low oil level. Check for mud and debris buildup around the controls. Observe that the oil and electrical lines are unobstructed.

OIL AND SERVICE INTERVALS – Do not exceed the recommended service intervals. Extended transmission oil and filter usage depends upon acceptable SOS analysis. DO not go to extended oil and filter changes without SOS data.

ELECTRONIC CONTROL UNIT – This component is a device that is designed to control transmission operation with respect to the engine, ground speed and operator input. Any erratic transmission behavior may indicate a need for replacement or repair. Your Caterpillar dealer is equipped with the necessary tools, personnel and procedures in order to perform this service. The owner is encouraged to keep adequate maintenance records. However, the absence of such records will not invalidate the warranty. Refer to the Maintenance Records and Maintenance Log sections of this manual.

The vehicle owner may perform routine maintenance, repairs and other work that is outside of the warranty. The work may be done at any repair facility. Such work does not need to be performed at a designated station that is determined by the warranty in order for the warranty to remain in force.

Customer Assistance

Caterpillar Inc. intends to ensure that the Warranty is properly administered. If you do not receive adequate warranty service, call or write to the following address:

Caterpillar Inc.
Manager, Transmission Business
Warranty Administration
Peoria, IL 61629
1-800-261-5221

Authorized dealers are recommended for major maintenance and for repair work. Caterpillar dealers are staffed with trained personnel and proper tools. Authorized dealers are aware of the latest maintenance methods and procedures. If owners or other persons desire to perform the work, a Service Manuals should be purchased and current service information should be obtained from a Caterpillar dealer.

Refer to the TEPS Directory for information regarding an authorized dealer or call the following toll free number:

1-800-261-5221

Reference Information Section

Reference Materials

i02649570

Maintenance Records

SMCS Code: 3030

Caterpillar Inc. recommends the retention of accurate maintenance records. Accurate maintenance records can be used for the following purposes:

- Determine operating costs.
- Establish maintenance schedules for other transmissions that are operated in the same environment.
- Show compliance with the required maintenance practices and maintenance intervals.

Maintenance records can be used for a variety of other business decisions that are related to transmission maintenance.

Maintenance records are a key element of a maintenance program that is well managed. Accurate maintenance records can help your Caterpillar dealer to fine tune the recommended maintenance intervals in order to meet the specific operating situation. This should result in a lower transmission operating cost.

Records should be kept for the following items:

Service Hours – A record of service hours is essential to determine when the load sensitive components should be inspected or repaired.

Fuel Consumption – Engine fuel consumption records are often used to determine engine overhaul intervals. If the fuel consumption records for the engine powering the transmission are available, they can be used as an indication of the transmission load factor. The load factor can be used to schedule transmission inspections, maintenance and service intervals.

Documents – These items should be easy to obtain, and these items should be kept in the vehicle history file. All of the documents should show the date, service hours, and transmission serial number. The following types of documents should be kept as proof of maintenance or repair for warranty:

Keep the following types of documents as proof of maintenance for warranty. Also, keep these types of documents as proof of repair for warranty:

- Dealer work orders and itemized bills
- Owner’s repair costs
- Owner’s receipts
- Maintenance log

i02798416

Maintenance Log

SMCS Code: 3030

Table 16

Transmission Model	**Customer Identifier**
Serial Number	**Arrangement Number**

Table 17

Service Hours	Miles/Km	Serviced Item	Date	Authorization

i02795056

Reference Material

SMCS Code: 1000; 7000

CX31 Transmission References

NOTICE
The Operations and Maintenance Manual and Installation Guides are stored and printed from an electronic file. These files are revised periodically. To ensure that your hard copy of the document is the current version, consult your Caterpillar Representative. All paper copies are uncontrolled.

Special Instructions, REHS2790, "Application and Installation CX31 Transmission (Mechanical)"

Special Instructions, REHS2884, "Application and Installation CX31 Transmission (Electrical)"

Parts Manual, SEBP4927, "CX31 On-Highway Transmission"

Disassembly and Assembly, KENR5091, "CX31 Transmission"

Systems Operation, Troubleshooting, Testing and Adjusting, KENR5099, "CX31 Transmission"

Specifications, System Operation, Testing and Adjusting, KENR5090, "CX31 Transmission"

Caterpillar Reference Material

Special Publication, PECP9067, "One Safe Source"

Special Publication, SEBU6250, "Caterpillar Machine Fluids Recommendations"

Special Publication, SEBU5898, "Cold Weather Recommendations"

Special Instruction, SEHS9031, "Storage Procedure for Caterpillar Products"

Special Publication, NENG2500, "Caterpillar Tools and Shop Products Guide"

Service Manual, SENR3130, "Torque Specification Module"

Special Publication, PEHP7076, "Understanding S·O·S Services Tests"

Special Publication, PEHP6001, "How to Take a Good Oil Sample"

Additional Reference Material

SAE J754, "Nomenclature" This can normally be found in the SAE handbook.

SAE J183, "Classification" This can normally be found in the SAE handbook.

Description of Applications

On-Highway vehicles operate exlusively on roads that are improved or normally paved. Typical vocations are: pickup and delivery, beverage delivery, public service dump trucks, utility trucks, tank trucks, and tour coaches.

Severe Duty

On/Off Highway: Vehicles that operate both on and off highway. Typical vocations: dump, transit mixers, all wheel drive, utility, snow removal, yard spotter, concrete pumper, and other vocations with severe PTO applications.

Refuse: Refuse and garbage disposal applications.

HET: Heavy equipment transport.

Emergency Vehicles: Fire trucks that are typically designed to NFPA guidelines.

Motorhomes: Recreational vehicles with living accomodations.

CX31 Ratings

Transmission Applications

Table 18

Item Description		CX31				
		On-Highway	Refuse	HET	Emergency Vehicles	Motorhomes
Maximum Gross Input Power	hp (kW)	550 (410)	500 (373)	600 (447)	600 (447)	625 (466)
Maximum Gross Input Torque	lb-ft (N.m)	1770 (2400)	1650 (2237)	1850 (2510)	1850 (2510)	1900 (2576)
Maximum Turbine Torque (forward)	lb-ft (N.m)	2450 (3322)	2450 (3322)	2600 (3525)	2600 (3525)	2600 (3525)
Maximum Turbine Torque (reverse)	lb-ft (N.m)	2200 (2983)				
Rated Input Speed	rpm	2100				
Minimum Input Speed	rpm	600				
Maximum Input Speed	rpm	2500				
Dry Weight Without Retarder[1]	lb (kg)	906 (411)				
Dry Weight With Retarder[1]	lb (kg)	1088 (494)				
Dry Weight Without PTO	lb (kg)	-				
Dry Weight With PTO	lb (kg)	-				
Forward Reverse Gears		6F/1R				
Planetary Gear Ratios						
1F		4.40				
2F		2.33				
3F		1.53				
4F		1.00				
5F		0.72				
6F		0.61				
7F		-				
8F		-				
1R		3.97				
Overall		7.21				
Torque Converters						
TC42531		STR 2.7				
TC42731		STR 2.3				
TC42833		STR 1.9				

(1) This transmission does not include the following components: crankshaft adapter, flex plates, starter ring gear, bolts, output yoke, and ECU. (29 kg (64 lb))

Acronyms

Table 19

Acronyms	Description
A and I	Application and Installation
A/C	Air Conditioner
ABS	Anti-lock Braking System
CID	Component Identifier Diagnostic (code that informs the service personnel of specific component or system failure)
CTS	Controlled Throttle Shifting (significantly reduces power train stress and clutch wear by controlling engine speed, torque converter lockup, and transmission clutch engagement)
ECM	Engine Control Module (controls all aspects of an engine's emissions compliance, performance, operator/chassis interaction and diagnostics)
ECU	Electronic Control Unit (electronic device used to control transmission functions)
ECPC	Electronic Clutch Pressure Control (design senses input from the transmission and the operator controls in order to modulate each individual clutch through a proportional electro-hydraulic valve)
FWH	Flywheel Wheel Housing
HET	Heavy Equipment Transport
LUC	Lockup Clutch
OEM	Original Equipment Manufacturer
PT	Power Train (transmission and auxiliary components)
PTO	Power Take-Off (referred to in this manual is engine rpm control initiated through a dedicated PTO ON/OFF switch circuit connected to the ECM Input No. 1)
SAE	Society of Automotive Engineers (standards)
STR	Stall Torque Ratio (torque converter stall torque ratio)
OMM	Operation and Maintenance Manual
kPa	x 0.145 = pressure (PSI)
bar	x 14.5 = pressure (PSI)
kW	x 1.34 = horsepower
L/min	x 0.26 = gallons/min
N·m	x 0.74 = ft × lb
S·O·S	Scheduled Oil Sampling

Index

W

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: _____

_____

_____

	Dealer Contact	Phone Number	Hours
Sales:	_____	_____	_____
Parts:	_____	_____	_____
Service:	_____	_____	_____

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