200C II BRAKE SYSTEM

The braking system on the 200C II Kress Coal Hauler uses hydraulic oil pressure from both the System and Steering accumulator circuits. Using oil from both circuits provides braking power in case a line or component fails in either accumulator circuit, the front braking system, the rear braking system or even an engine failure. The front brakes use oil supplied by the System accumulators while the rear brakes use oil supplied by the Steering accumulators. The rear brake oil supply is also supplemented by the torque converter lockup circuit pump.

The energy stored in the accumulators permits full hydraulic braking, even when the main hydraulic pump is not functioning. The number of brake applications, after the engine is stopped, is limited only by the accumulator size as a function of the volume and pressure required per brake application.

The rear service brake system has a relay valve to regulate the oil pressure to the two Caterpillar wet disc brake assemblies on the rear axle. This valve provides the necessary pressure for proper braking power while protecting the internal components from damage due to excessive oil pressure.

Both the front and rear service brakes are controlled by the MICO Tandem Modulating valve. The internal circuits from the accumulator systems through the pedal valve to the front and rear brake systems are closed center. This valve controls the brakes with power stored in and furnished by both the Steering and System accumulators.

FRONT SERVICE BRAKE SYSTEM

The front service brakes use System accumulator hydraulic oil pressure to apply the disc brakes on the front wheels.

The oil pressure to the brake caliper is 1500 psi (10343 kPa) when the pedal is fully depressed. This oil pressure pushes the six pistons (three on each side of each disc) toward the brake disc that is mounted on the wheel. The pistons push the brake pads against each side of the disc to provide the friction for stopping the disc rotation.

When the brake pedal valve is released, the oil from the calipers is returned through the pedal valve to the hydraulic tank.

The brake calipers have self retractors. The retractors are a spring whose function is to ensure the pads are not being pressed against the rotor by back-pressure in the return-to-tank line which may be present in the brake hoses. (Troubleshooting information is contained later in this section.)

BRAKE PAD WEAR INDICATOR

The optional wear indicator pin should be checked during Walk Around Check to see how far it is protruding out of the nut. When new pads and a new disc are present, this pin will stick out approximately .87 inch (22 mm) past the nut. Measure from the edge of the nut closest to the end of the pin, not the caliper mounting plate. When this pin is only protruding .12 inch (3 mm), the pads should be checked and replaced to ensure proper braking performance and prevent serious disc damage.
REAR SERVICE BRAKE CIRCUIT
**REAR SERVICE BRAKE CIRCUIT**

The rear service brakes use Steering Accumulator Circuit hydraulic oil pressure to apply the wet type Caterpillar disc brakes on the rear axle. Additional oil pressure supply for the rear brake circuit comes from the Torque Converter Lockup Circuit which not only supplies more available fluid, but also provides an additional assurance of rear brake functionality. An additional hydraulic accumulator (shown at right) mounted inboard from hydraulic tank above the left rear tires is connected into the supply line to the Rear Brake Relay Valve. This small accumulator is used to provide a constant oil supply with a minimum of pressure spikes. When the Accumulator System Blowdown is actuated, the small bypass orifice at the check valve in the small Brake Accumulator line allows the Brake Accumulator fluid to return to the System Accumulator circuit and then to the hydraulic tank through the Blowdown valve. This brake accumulator is to have a 200 psi dry nitrogen (N₂) precharge.

When the brake pedal in the cab is fully depressed, 1500 PSI (10343 kPa) oil pressure (brake signal) flows to the relay valve that is mounted on the Hydraulic Module. The relay valve regulates (proportional to amount of brake pedal depression) this oil pressure to a maximum of 750 ± .25 PSI (5172 ± 172 kPa). When the brake pedal is released, the pressurized oil in the line between the pedal valve and the relay valve is returned to the hydraulic tank through the tank port in the pedal valve. The pressurized oil in the lines between the disc brakes and the relay valve is returned to the hydraulic tank through the tank port of the relay valve.

**Service Brake Warming Circuit**

In cold weather situations, the oil in the lines between the pedal valve in the cab and the relay valve on the hydraulic module in the rear can become cold and stiff between brake applications. The vehicle can be fitted with an optional check valve and orifice to allow warm oil from the brake cooling circuit to flow backward through the rear brake signal line, through the valves at the cab and then to the hydraulic tank through the tank line. To keep this oil warm, a small hose fitted with a check valve and .060 inch orifice is teed into the signal hose at the relay valve. The small hose receives low pressure oil from the rear brake cooling circuit. This low pressure oil passes through the check valve, the orifice, the tee and then to the front of the truck. When the brake pedal is released, the port for the signal line to the rear brakes is open to the tank port which allows the oil to be returned to the hydraulic tank.

This constant flow of oil keeps the cold oil flushed from the lines. The pressure of this oil is low and will not activate the rear brakes. When the pedal valve is depressed, the oil flow through the check valve stops because the oil pressure seats the valve to prevent flow back toward the brake cooling circuit.
HYDRAULIC MODULE ASSEMBLY
Hydraulic Module Assembly

The hydraulic module assembly, located in front of the left rear tires, receives the oil from the steering pump, filters the contaminants from that oil, and then routes the oil to the various hydraulic components of the vehicle. Test ports and components in this assembly are shown on the following page.

Hydraulic System

There are two parts to the main hydraulic system on this vehicle called the System accumulator and the Steering accumulator circuits. The oil supply for both of these circuits comes from the constant pressure pump which is set at 2900 psi (19995 kPa). A sequence valve (Fig 1) in the hydraulic module ensures the pressurized oil enters Steering accumulator circuit prior to entering the System accumulator circuit. The sequence valve does not allow flow to the System accumulator circuit until the Steering accumulator circuit is at 2600 psi (17926 kPa).

**NOTE!!** The two separate, but associated, accumulator systems allow fluid under pressure to be available to safely steer and stop the vehicle in the event of engine and/or hydraulic pump failure.

Manual Park Brake Shutoff Valve

This manually operated valve is to be in the “Open” position (screwed out counter-clockwise & locked) for normal operation of the park brake system. If a leak is suspected in the Park Brake seals in the rear axle, then close this valve. If the flow stops, then check the Park Brake assemblies for seal failures. The park brake Reducing Valve (located beside Park Brake Valve) output pressure can be accurately checked by closing the Manual Shutoff Valve.

If a Park Brake Valve failure is suspected, close the Manual Shutoff Valve, shut down the engine, turn the ignition “On” and place the Park Brake Switch (in dash) in the “Off” or “Released” position. If flow is heard at the Park Brake Valve on the hydraulic module, then it has failed and is flowing oil to the return to tank circuit.
Braking System - Test

⚠️ **WARNING** Personal injury can result if the machine moves while testing. If the machine begins to move during test, reduce the engine speed immediately and engage the parking brake.

The following tests are used to determine if the parking brake, the secondary brake, and the service brake are functional. These tests are not intended to measure the maximum brake holding effort. The brake holding effort that is required to sustain a machine at a specific engine rpm varies depending on the machine. The variations are the differences in the engine setting, in the power train efficiency, and in the brake holding ability, etc.

**NOTE!!** Service personnel should perform this test monthly. Document the results of each monthly test. Compare the engine rpm from the previous month to the current engine rpm. This will determine the system deterioration.

**Parking Brake Holding Ability Test**

1. Fasten the seat belt before you test the brakes.
2. Check the area around the machine. Make sure that the machine is clear of personnel and clear of obstacles.
3. Test the brakes on a dry, level surface.
4. Start the engine.
5. Engage parking brake.
6. Move the transmission range selector lever to the FIRST SPEED FORWARD position.
7. Gradually increase the engine speed to 1300 rpm. The machine should not move.
8. Reduce the engine speed to low idle. Move the transmission range selector lever to the NEUTRAL position. Leave parking brake engaged. Stop the engine.

**NOTE!!** If the machine moved while testing the brakes, contact your Kress/Caterpillar dealer. Have the dealer inspect and, if necessary, repair the parking brakes before returning the machine to operation.

**Retarder Holding Ability Test**

1. Fasten the seat belt before you test the brakes.
2. Check the area around the machine. Make sure that the machine is clear of personnel and clear of obstacles.
3. Test the brakes on a dry, level surface.
4. Start the engine.
5. Apply Retarder control pedal.
6. Release parking brake.
7. Move the transmission range selector lever to the FIRST SPEED FORWARD position.
8. Gradually increase the engine speed to 1300 rpm. The machine should not move.
9. Reduce the engine speed to low idle. Move the transmission range selector lever to the NEUTRAL position. Engage parking brake.
10. Stop the engine.

**NOTE!!** If the machine moved while testing the brakes, contact your Kress/Caterpillar dealer. Have the dealer inspect and, if necessary, repair the brakes before returning the machine to operation.
Service Brake Holding Ability Test

1. Fasten the seat belt before you test the brakes.
2. Check the area around the machine. Make sure that the machine is clear of personnel and clear of obstacles.
3. Test the brakes on a dry, level surface.
4. Start the engine.
5. Apply service brake control.
6. Release parking brake.
7. Move the transmission range selector lever to the FIRST SPEED FORWARD position.
8. Gradually increase the engine speed to 1300 rpm. The machine should not move.
9. Reduce the engine speed to low idle. Move the transmission range selector lever to the NEUTRAL position. Engage parking brake.
10. Stop the engine.

**NOTE!!** If the machine moved while testing the brakes, contact your Kress/Caterpillar dealer. Have the dealer inspect and, if necessary, repair the brakes before returning the machine to operation.

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**TROUBLESHOOTING - BRAKES**

The following chart will provide troubleshooting information for the 200C II Service Brake hydraulic circuits by giving symptoms, areas to check and possible solutions to the problems.

**NOTE!!** The numbers found in parenthesis in this chart relate to the numbers in the fold-out Brake System Schematic located in this section just behind this chart.

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>DIAGNOSTIC CHECK</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear Brakes Dragging</td>
<td>A. Is approximately 680 psi present in the Park Brake circuit when Park brakes are in the “released” or “off”? [use Park Brake Test Port (19) on Hydraulic Module]</td>
<td>If yes, go to next check. If no, then repair the Park brake circuit so that the brakes are fully releasing.</td>
</tr>
<tr>
<td></td>
<td>B. Is there pressure in the Service brake application line? [use Service Brake Test Port (21) on Hydraulic Module]</td>
<td>If yes, determine if pressure in signal line from front is actuating the relay valve, or, if the relay valve is malfunctioning and allowing pressure to the brakes. If no, then inspect the service brakes for a mechanical failure.</td>
</tr>
</tbody>
</table>

4/5/07 7 fs 200C II Brake System
**Rear Service Brakes Will Not Apply**

A. Are the Steering circuit accumulators fully charged?

If yes, go to next check.  
If no, then repair the accumulator system and test the brakes.

B. Is there approximately 1500 psi in the signal line at the Brake Relay Valve when the brake pedal is fully depressed? [use test port at pedal valve]

If yes, go to next check.  
If no, then check the service brake pedal for proper functioning or possible blockage in the signal line to the relay valve.

C. Is there approximately 750 psi in the lines from the Brake Relay Valve to the rear brakes? [Use Service Brake test port (21) on Hydraulic Module.]

If yes, then check the brake assemblies for mechanical failure and repair as necessary.  
If no, then check the Relay Valve for proper functioning and check to ensure one of the brake assemblies is not leaking and bypassing the fluid.

**Service Brakes Slow To Apply**

A. Are all of the accumulators fully charged?

If yes, go to next check.  
If no, repair accumulator system and retest the brakes.

B. Bleed the front brake system to purge any air that might be present in the circuit.  Do the brakes apply normally now?

If no, go to next check.  
If yes, place vehicle back in service.

C. Bleed the rear brake system to purge any air that might be present in the circuit.  Do the brakes apply normally now?

If no, go to next check.  
If yes, place the vehicle back in service.

D. Bleed the service brake pilot line at the brake relay valve to purge any air that might be trapped in the line.  Do the brakes apply normally now?

If yes, place the vehicle in service.  
If no, check the brake treadle valve (2) and relay valve (27) for proper functioning.

**Front Brakes Will Not Apply**

A. Are the System circuit accumulators fully charged?

If yes, go to next check.  
If no, then repair the accumulator system and test the brakes.

B. Is there approximately 1500 psi in the brake line to the brake calipers when the brake pedal is fully depressed? [use test port at brake pedal]

If yes, go to next check.  
If no, then check the service brake pedal for proper functioning or possible blockage in the line to the front brakes.

C. Is there approximately 1500 psi in the lines at the front brakes?

If yes, then check the brake assemblies for mechanical failure and repair as necessary.  
If no, then check lines to the brakes for blockage.
<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>DIAGNOSTIC CHECK</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual Retarder Does Not Work</td>
<td>A. Do the rear brakes function correctly using the service brake pedal?</td>
<td>If yes, go to next check.</td>
</tr>
<tr>
<td></td>
<td>B. Is approximately 800 psi present at the “A” port of the Retarder pedal valve when the Retarder pedal is fully depressed?</td>
<td>If no, repair service brakes and then recheck retarder.</td>
</tr>
<tr>
<td></td>
<td>C. Is there approximately 800 psi present at the outlet port of the shuttle valve (4) when the Retarder pedal is fully depressed?</td>
<td>If yes, go to next check.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If no, repair the Retarder valve.</td>
</tr>
<tr>
<td>Park Brake Will Not Release</td>
<td>A. Is the Manual Park Brake Shutoff valve closed (screwed in clockwise)? (Note: This valve is to be open for normal operation. It can be closed for testing and and checking the pressure regulator setting.)</td>
<td>If yes, go to next check.</td>
</tr>
<tr>
<td></td>
<td>B. Is approximately 680 psi present in the Park Brake circuit when Park brakes are in the “released” or “off”? [use Park Brake Test Port (19) on Hydraulic Module]</td>
<td>If no, go to next check.</td>
</tr>
<tr>
<td></td>
<td>C. Is fluid passing through solenoid valve 4b (16) when trying to release the Park Brake?</td>
<td>If yes, fully open the valve by turning counter-clockwise and then recheck the brake.</td>
</tr>
<tr>
<td></td>
<td>D. Is fluid continuously passing through solenoid valve 4a (15) when trying to release the Park Brake?</td>
<td>If no, go to next check.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If yes, then repair the Park brake circuit so that the brakes are fully releasing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If no, go to next check.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If yes, determine why this valve is not closing and repair as necessary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If fluid is passing through valve 4a and not 4b, then there is a leak in one of the Park Brake assemblies. Determine which one and repair as necessary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If fluid is not passing through continuously and there is approximately 680 psi in the lines, then check the Park Brake assemblies for mechanical failure.</td>
</tr>
</tbody>
</table>
**BRAKE ELECTRONICS**

**Brake Electronics System Inputs**

- Auto Retarder Pressure Switch
- Service/Retarder Pressure Switch
- Engine Output Speed Sensor
- ARC on/off Switch
- TCS Test Switch
- Left Wheel Speed Sensor
- Right Wheel Speed Sensor
- RHS Steer Switch
- LHS Steer Switch
- Rear Diff Oil Temperature
- Rear Diff Oil Filter Bypass
- Rear Diff Oil Pressure
Service/Retarder Switch

- Signals the Transmission/Chassis ECM to use elevated shift points, which provide increase engine speed during downhill retarding for increase oil flow to the brake cooling circuit.
- Signals the Transmission/Chassis ECM to allow rapid shifting during braking by overriding the anti-hunt timer.

Park/Secondary Switch

- Signals the Transmission/Chassis ECM to allow rapid shifting when the park or secondary brake are applied by overriding the anti-hunt timer.

MANUAL RETARDER

The retarder pedal is located on the cab floor to the left of the steering column. The retarder may be applied at any time and the response is immediate with no built in time delays. The retarder application is proportional to the amount the pedal is depressed to a maximum of 53% of full rear service brake application. Although downshifts can be made while retarder is in operation, for good control and safe operation, the operator should always anticipate grade, and downshift to a proper gear range for effective retarding before applying the retarder. The retarder applies the rear wheel brakes, and provides a finer control than the service brake pedal. Try to maintain a steady pressure on the pedal to maintain vehicle speed, rather than pumping the pedal. If a skid is encountered while applying the retarder, ease off the pedal immediately.

**NOTE!!** Depress the retarder pedal gradually on slippery roads to prevent locking wheels and causing a transmission downshift.

AUTOMATIC RETARDER

To activate the Automatic Retarder Control (ARC) move the control switch to the ON position. This will allow the transmission to upshift to the gear selected by the transmission selector lever.

**NOTE!!** For proper operation of the ARC, the switch should remain ON during all normal operation. Select the proper gear for the grade, load and ground condition.

ENGINE OVERSPEED PROTECTION

The Automatic Retarder Control will control the engine speed to the preset rpm in the selected gear. The engine overspeed protection feature of the ARC will function even if the accelerator is depressed and/or ARC is turned off. Additional details are shown on the following pages.

**NOTE!!** Placing the Automatic Retarder Control Switch in the OFF position will disable the retarding portion of the system, but not the engine overspeed protection.
Kress Coal Hauler 200C II utilizing the Cat 785C Braking Control System

The Kress Coal Hauler braking system is similar to the braking system used on the Cat 785C truck. The exception to this is that the Kress Coal Hauler has no air system which affects the Auto Retarder Control system inputs and solenoids. The following chart lists the changes to the Cat 785C braking system that have been modified for the Kress 200C II Coal Hauler.

Differences between 785C OHT & Kress 200C II Systems

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Auto Retarder Control (ARC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The Brake Cylinder overstroke limit switch input has been eliminated.</td>
</tr>
<tr>
<td>2.</td>
<td>The Brake air pressure sensor input has been eliminated.</td>
</tr>
<tr>
<td>3.</td>
<td>Secondary Brake/Parking pressure switch works with the same logic, Kress replaced the switch with a N.O. hydraulic switch that will operate when parking brakes are released. (Cat DataLink- Mac 14)</td>
</tr>
<tr>
<td>4.</td>
<td>Service Brake/Retarder Pressure switch works with the same logic, Kress replaced the switch with a N.C. hydraulic switch that operates when service or retarder brakes are applied. Switch Cat P/N: 128-5091</td>
</tr>
<tr>
<td>5.</td>
<td>Automatic Retarder Control pressure switch works with the same logic, Kress replaced the switch with a N.C. hydraulic switch that switches when Automatic Retarder Control is operated. Switch Cat P/N: 128-5091</td>
</tr>
<tr>
<td>6.</td>
<td>Manual/Auto Retarder Pressure switch works with the same logic, Kress replaced the switch with a N.O. hydraulic switch that operates when the retarder control valve is applied. (Cat DataLink- Mac 14)</td>
</tr>
<tr>
<td>/</td>
<td>Parking Brake Filter Switch works with the same logic.</td>
</tr>
<tr>
<td>8.</td>
<td>Differential Oil Temperature Sensor works with the same logic.</td>
</tr>
<tr>
<td>9.</td>
<td>Differential Oil Pump Outlet Pressure Sensor works with the same logic.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Auto Retarder Control (ARC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ARC supply solenoid. Kress utilizes the ARC ON/OFF hydraulic valve from the Cat 797C truck, Cat P/N:122-1134</td>
</tr>
<tr>
<td>2</td>
<td>ARC proportional valve. Kress utilizes the ARC proportional valve from the Cat 797C truck, Cat P/N: 155-5989.</td>
</tr>
<tr>
<td>3</td>
<td>Retarder engaged indicator lamp has stayed the same.</td>
</tr>
</tbody>
</table>

ARC SUPPLY SOLENOID

The counts for the supply solenoid is triggered by the actual supply solenoid being cycled on. The solenoid is activated/turned on when one of the following conditions is met:
1) ARC in Retard mode
2) ARC in Protect mode
3) ARC in Test mode
4) Manual retarder pedal is depressed
5) Neutral Coast brake command is non-zero

ARC CONTROL SOLENOID

The ARC control solenoid counter currently unavailable to count with current software so it should read zero.
CAUTION

DO NOT DESCEND GRADES AT SPEEDS GREATER THAN LISTED WHEN VEHICLE IS MAX LOADED:
G.V.W. 766,000 lbs (347,000 kg)
ASSUMING 485,000 lbs (220,000 kg) LOAD
MAXIMUM GRADE AT MAX SPEED UNLOADED: 5%**

<table>
<thead>
<tr>
<th>EFF GRADE</th>
<th>SPEED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MPH</td>
</tr>
<tr>
<td>(PRE-SELECT 1st GEAR)</td>
<td>9</td>
</tr>
<tr>
<td>(PRE-SELECT 2nd GEAR)</td>
<td>7</td>
</tr>
<tr>
<td>(PRE-SELECT 3rd GEAR)</td>
<td>5</td>
</tr>
<tr>
<td>(PRE-SELECT 4th GEAR)</td>
<td>3</td>
</tr>
<tr>
<td>(PRE-SELECT 5th GEAR)</td>
<td>2</td>
</tr>
</tbody>
</table>

** ASSUMES NO ROLLING RESISTANCE

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