953C Track-Type Loader Hydrostatic Drive 2ZN00001-01749 (MACHINE) POWERED BY 3116 Engine(SEBP2434 - 72) - Documentation

Tuesday, January 26, 2016

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| C:\05919485\1230A30F-5878-4C6A-82B6-D0998BBA7ACC_files\image002.gif | Product:  TRACK LOADER |
|  | Model:  953C TRACK LOADER 2ZN |
|  | Configuration: 953C Track-Type Loader Hydrostatic Drive 2ZN00001-01749 (MACHINE) POWERED BY 3116 Engine |

**Testing and Adjusting**

**953C Track-Type Loader**

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| --- | --- | --- |
| **Media Number -SENR8405-04** | **Publication Date -01/07/2002** | **Date Updated -19/11/2001** |

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**Troubleshooting**

**SMCS -** 3030

**Power Train and Hydraulic Diagnostic Symptoms**

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| Illustration 1 | g00605090 |
| Symbols that are shown in the display area  (1) The Accepted Symbol is displayed when the calibrate switch is depressed in the "INCR" direction (increase).  (2) The Accepted Symbol is displayed when the calibrate switch is depressed in the "DECR" direction (decrease).  (3) The Not Accepted Symbol is displayed when the calibrate switch is depressed in the "INCR" direction (increase).  (4) The Not Accepted Symbol is displayed when the calibrate switch is depressed in the "DECR" direction (decrease). |  |

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| Illustration 2 | g00605605 |
| This display area shows the information inputs for the following calibration submodes: 15, 16 and 17.  (5) Submode identifier  (6) Speed range identifier  (7) Accept status identifier  (8) Machine speed identifier |  |

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| Illustration 3 | g00749016 |
| (9) Submode identifier  (10) Signal out of range  (11) Signal out of range HIGH symbol  (12) Signal out of range LOW symbol  (13) Accept status identifier  (14) Percentage value of duty cycle |  |

The preceding symbols are used in conjunction with the calibration chart.

**Calibration Chart**

Read the information and understand the information that is contained in Systems Operation/Testing and Adjusting, SENR8314, "953C, 963C and 973C Track-Type Loaders Hydrostatic Transmission Electronic Control System". The table should be used for reference only.

|  |  |  |  |
| --- | --- | --- | --- |
| **CALIBRATION SUBMODES**  **When you access the Caterpillar Monitoring System in No. 5 Mode, perform the procedure for the Calibration Submode.** |  |  |  |
| **Submode No. (1)** | **Engine Status** | **Submode Description** | **Calibration Procedure** |
| 01 | OFF | Left Pedal (Full Up) | Use the Service switch and the Clear switch in order to scroll to Mode -5- on the monitor display. You will start at submode 01. This is the Left Pedal Full Up Calibration. Push down on the calibrate switch in order to move to the store position. If the signal that is received by the ECM is within the allowable tolerances, you should get the symbol for acceptance (Accepted Symbol). If the calibration is Not Accepted Symbol, check the pedal position and the linkages that are associated with the sensor. Press the service switch in order to scroll to the next submode. You must place the sensor in the maximum position. Depress the calibrate switch in order to move to the store position. Verify that you see the Accepted Symbol for each submode.  Move the pedals three times from the calibrate positions in submodes 1 through 6. Move the speed/direction control lever from the calibrate position in submodes 7 through 9. Return each pedal and return the speed/direction control lever to the calibrate position. The percent duty cycle signal must display the same reading when the component returns to the calibrate position. When any of the pedals or the lever do not display a constant percent duty cycle signal in the calibrate position, depress the calibrate switch again in order to recalibrate that position. |
| 02 | OFF | Left Pedal (Full Down) |  |
| 03 | OFF | Center Pedal (Full Up) |  |
| 04 | OFF | Center Pedal (Full Down) |  |
| 05 | OFF | Right Pedal (Full Up) |  |
| 06 | OFF | Right Pedal (Full Down) |  |
| 07 | OFF | Speed/Direction Control Lever (Forward) |  |
| 08 (2) | OFF | Speed/Direction Control Lever (Park) |  |
| 09 | OFF | Speed/Direction Control Lever (Reverse) |  |
| 10 | OFF | Check of Throttle Lever Position Switch | Select submode 10 and move the governor control lever to the HIGH IDLE position. The status indicator should read 00. The indicator should change to 11 when the governor control lever is moved out of the HIGH IDLE position. The switch should activate  3.0 mm (0.12 inch) before the governor control lever engages the HIGH IDLE notch. If the switch does not activate at this point, adjust the position of the switch. |
| 11 | OFF | Check of Tilt Lever Switch | Move the tilt lever from the hold position to the tilt back position. Repeat this movement several times. The status identifier should change from "11" to "00". The status identifier should show "00" when the lever is first moved to the tilt back position. If this does not happen, you must make an adjustment to the mechanical switch or to the linkage. Make the adjustment in order to cause the status identifier to change when the lever is just moved to the tilt back position. |
| 12 | OFF | Check of the Position Switch for the Parking Brake | Move the speed/direction control lever out of the PARK position. The status indicator should change from 00 to 11 when the lever is moved out of the PARK position. If this does not occur, adjust the position switch for the parking brake. This will cause the change in the switch when the lever is just moved out of the PARK position. |
| 13 | OFF | Part Number for Application Software, and Reset of Calibration | This submode allows you to retrieve the part number for the current configuration software that is installed on your machine. The display will scroll through three lines of information. The first two lines will be the actual part number. The third line will be the change level. Depress the calibrate switch in the "decrease" direction and the clear switch in the "clear" position at the same time. Hold both switches until the Accepted Symbol is showing. The Accepted Symbol (upward arrow) means that the calibration submodes (engine off and engine on) have been reset to default values. **After resetting the calibration in submode 13, you must perform Engine OFF submodes 1 through 9 and Engine ON submodes 15 through 17.** |
| 14 | OFF | "--" |  |
| 15 (3) | ON | Minimum Track Speed Calibration | Complete the calibration procedures for calibration submodes 15, 16, and 17, as described below. Perform this calibration for both FORWARD and REVERSE. Move the speed/direction control lever into position 1. The speed range identifier should show "1" when the lever is in the correct position. If the previous calibration was correct, the machine should not be moving at this time. You must increase speed in order to ensure machine movement for synchronization in position 1. Move the calibrate switch to the increase position until the Accepted Symbol is showing. You may need to click the switch a few times in order to get the machine moving. The machine must be moving in order to verify track speed synchronization. Proceed to submode 16. |
| 16 (3) (4) | ON | Track Speed Synchronization Calibration (Right Track Speed Adjustment) | Complete the calibration procedures for calibration submodes 15, 16, and 17, as described below. Perform this calibration for both FORWARD and REVERSE. While the speed/direction control lever is in position 1, check the tracking of the machine. If the tracking is correct, you must move the calibrate switch to the increase position or to the decrease position in order to make the tracking incorrect. Now, adjust the speed of the right track in order to match the speed of the left track. The machine should be tracking straight. **Now go back to submode 15. Calibrate position 1 of the speed/direction control lever again by moving the calibrate switch to the decrease position. There must be no movement while the lever is in position 1.** Remember that the calibrate switch changes both sides equally in submode 15. Proceed to submode 17 and perform that procedure. Remember that submode 16 should be performed for both FORWARD and REVERSE in positions 2 through 6, after you perform submode 17. |
| 17 (3) | ON | Maximum Track Speed Calibration | Complete the calibration procedures for calibration submodes 15, 16, and 17, as described below. Perform this calibration for both FORWARD and REVERSE. Use the calibrate switch in order to increase or decrease the setting. Raise the speed setting and verify that the mechanical stops are correct. If there is a problem with the mechanical stops, adjustment may be necessary. Refer to Drive Motor Minimum Displacement Stop Setting in this publication for the correct procedure. Then, reduce the speed setting to a maximum speed of  9.7 km/h (6.0 mph) for 953C (S/N: 2ZN) Track-Type Loaders. You must obtain the Accepted Symbol in order to verify the speed setting. Now return to submode 16 and complete the rest of that calibration by moving the lever to positions 2 through 6. |
| 18 | ON | Display for Engine Speed (RPM) | Submode 18 shows the present value for the engine RPM. The number 18 and a four digit number should be showing. The four digit number represents the engine speed. |
| 19 | ON | Display of the Override Pressure | A four digit number should be showing. The four digit number represents the override pressure in kPa. The override pressure will be zero when the speed/direction control lever is in the PARK position or in the BRAKES OFF position. |
| 20 | ON | Transmission Stall Test | In submode 20, the display scrolls through engine RPM, override pressure, and oil temperature of the hydraulic tank. Submode 20 is used to set the parking brakes when you perform a transmission stall test. Depress the calibrate switch in the "decrease" direction and the clear switch to the "clear" position at the same time. Hold both switches until the "accepted symbol" is showing. The downward facing "accepted symbol" means that the brakes can be released. The upward facing "accepted symbol" means that the brakes remain on. The brakes remain in the current state until submode 20 is entered again and the state is changed. The state does not change even if the engine or the battery disconnect switch is turned off. After you have set the brakes for a stall test, be careful when you move the speed/direction control lever. The machine will move if the brakes are worn excessively or if the brake system is not functioning properly. |
| 21 | ON | Parking Brake Solenoid Check | 00 will be showing when the parking brake solenoid is not energized. 11 will be showing when the parking brake solenoid is energized. Move the speed/direction control lever out of the notch in order to energize the solenoid and release the brakes. Pressing the speed override and brake control (center pedal) at this time should change the display back to 00. If the response is not correct, adjust the parking brake switch and/or recalibrate the center pedal by using submodes 3 and 4. It is also possible that the solenoid is still set not to release in submode 20. |
| 22 | ON | Left Track Speed Display | Submode 22 displays the actual value for the left track speed in km/h. Typically, the speed needs to be above  3.0 km/h (1.9 mph) in order to be accurate. |
| 23 | ON | Right Track Speed Display | Submode 23 displays the actual value for the right track speed in km/h. Typically, the speed needs to be above  3.0 km/h (1.9 mph) in order to be accurate. |
| 24 | ON | Measurement of Fuel Flow | Refer to the procedure for the measurement of fuel flow in this publication for more information on submode 24. |
| 25 | ON | "--" |  |
| 26 | ON | Signal Pressure for the Left Motor | A four digit number should be showing. The four digit number represents the approximate signal pressure in kPa for the left drive motor. |
| 27 | ON | Signal Pressure for the Right Motor | A four digit number should be showing. The four digit number represents the approximate signal pressure in kPa for the right drive motor. |
| 28 | ON | Sensitivity of the Steering Pedals | Submode 28 adjusts the rate of response of the machine to the input of the steering pedals. Press the calibrate switch in order to select "HI" or "LO". The machine operates normally in Submode 28 so you can compare the two settings. Press the "SERVICE" switch and the "CLEAR" switch simultaneously in order to exit the calibration mode. |

Table 1

|  |  |
| --- | --- |
| ( 1 ) | Only the submodes for the current engine status (ON or OFF) are accessible: Engine OFF = submodes 01 - 14, Engine ON = submodes 15 - 27. |
| ( 2 ) | Submode 08 calibrates the NEUTRAL position of the Speed/Direction Control Lever. It is important to place the Speed/Direction Control Lever in the notch for the PARK position in order to properly calibrate Submode 08. |
| ( 3 ) | The hydraulic oil must be warmed to a temperature of 50 °C (122 °F) to 60 °C (140 °F) in order to perform Submodes 15, 16, and 17. Stall the transmission in five second intervals in order to warm the oil. Wait for ten seconds after each stall of the transmission. **This temperature must be maintained throughout the calibration procedure.** |
| ( 4 ) | **After application software has been flashed or the calibration has been reset in Submode 13, an adjustment must be made to each of the speed ranges in Submode 16. This is required to properly calibrate each two-stage TEHC valve (steering valve). This adjustment must be made, even if the default setting for the direction of tracking of the machine is correct. If the original direction of tracking is correct, move the calibrate switch to the increase position or to the decrease position in order to make the tracking incorrect. Now, move the calibrate switch in order to make the tracking correct. This must be done for each of the speed ranges.** |

**Troubleshooting Symptom Table**

|  |  |
| --- | --- |
| **Symptom** | **Title of the Symptom** |
| 1 | Warnings From the Caterpillar Monitoring System |
| 2 | Low Transmission Charge Pressure at NEUTRAL |
| 3 | Hydraulic Tank Over Temperature |
| 4 | Low Override Pressure During Travel |
| 5 | Machine That Does Not Move During a Demand for Travel |
| 6 | Low Top Speed |
| 7 | One Track That Does Not Move |
| 8 | Jerky Start at Low Speed Input of the Speed/direction Control Lever |
| 9 | Unwanted Turn During A Demand For Straight Travel |
| 10 | Machine That Creeps in NEUTRAL On Level Ground |
| 11 | Machine That Creeps Down a Grade in PARK |
| 12 | Positioning the Machine on Slopes Is Difficult. |
| 13 | Power Train That Lacks Power Under Load |
| 14 | Power Train That Lacks Power (Machine That Slows During A Turn) |
| 15 | Machine That Stops Suddenly During Travel |

Table 2

**Note:** Determine any fault codes and repair all problems that are displayed by fault codes before proceeding.

The following symptoms are arranged in a logical sequence from beginning to end. The procedures are intended to be followed from the start to the finish. You should proceed from Symptom 1 to Symptom 15. Identify the symptom that is present on your machine. Perform the entire procedure for that symptom and continue with any further troubleshooting.

**Symptom 1**

**Warnings From the Caterpillar Monitoring System**

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| Illustration 4 | g00738663 |
| Caterpillar Monitoring System display  Alert indicator lights  (1) Coolant temperature  (2) Engine oil pressure  (3) Air inlet heater  (4) Override pressure  (5) Oil temperature in pump drive gear box  (6) Hydraulic oil temperature  (7) Alternator  (8) Hydrostatic transmission  (9) Fuel level  (10) Display area |  |

**Problem 1**

**Low engine oil pressure**

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| --- | --- |
| C:\05919485\1230A30F-5878-4C6A-82B6-D0998BBA7ACC_files\image007.gif | **Engine Oil Pressure (2)** - This indicator indicates low oil pressure in the engine. |

Alert indicator light (2) flashes on and off.

* Turn the engine OFF within 15 seconds.
* Perform an engine diagnosis.
* Refer to Systems Operation/Testing and Adjusting, SENR3583, "Basic Engine Components 3114, 3116, & 3126 Engines" for additional information.

**Problem 2**

**Engine over temperature**

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| --- | --- |
| C:\05919485\1230A30F-5878-4C6A-82B6-D0998BBA7ACC_files\image008.gif | **Engine Coolant Temperature (1)** - This indicator indicates excessive engine coolant temperature. |

Alert indicator light (1) flashes on and off.

* Turn the engine OFF within 15 seconds.
* Perform an engine diagnosis.
* Refer to Systems Operation/Testing and Adjusting, SENR3583, "Basic Engine Components 3114, 3116, & 3126 Engines" for additional information.

**Problem 3**

**Fault in hydrostatic transmission electronic control system**

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| --- | --- |
| C:\05919485\1230A30F-5878-4C6A-82B6-D0998BBA7ACC_files\image009.gif | **Hydrostatic Transmission (8)** - This indicator indicates that a problem exists in the hydrostatic transmission system. |

Alert indicator light (8) flashes on and off.

* Refer to Systems Operation/Testing and Adjusting, SENR8314, "953C, 963C and 973C Track-Type Loaders Hydrostatic Transmission Electronic Control System" for more information.

**Problem 4**

**Gear box over temperature**

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| C:\05919485\1230A30F-5878-4C6A-82B6-D0998BBA7ACC_files\image010.gif | **Oil Temperature in Pump Drive Gear Box (5)** - This indicator indicates excessive oil temperature in the pump drive gear box. |

Alert indicator light (5) flashes on and off.

* Check for correct oil level and signs of worn gears and/or bearings

**Problem 5**

**Hydraulic tank over temperature**

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| --- | --- |
| C:\05919485\1230A30F-5878-4C6A-82B6-D0998BBA7ACC_files\image011.gif | **Hydraulic Oil Temperature (6)** - This indicator indicates excessive hydraulic oil temperature. |

Alert indicator light (6) flashes on and off.

* Turn the engine OFF in order to cool the system.
* Continue to check for initial symptoms.
* See Symptom 3.

**Problem 6**

**Low override pressure during travel**

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| --- | --- |
| C:\05919485\1230A30F-5878-4C6A-82B6-D0998BBA7ACC_files\image012.gif | **Override Pressure (4)** - This indicator indicates low override pressure in the transmission during travel. |

Alert indicator light (4) flashes on and off during travel.

* Return the speed/direction control lever to the BRAKES OFF position.
* See Symptom 4.

**Note:** If override pressure is low, alert indicator light (4) will come on when the machine is brought out of NEUTRAL. Low override pressure may be an indication of low charge pressure. Also, low override pressure may be an indication of a stuck override valve. See Symptom 4 in order to troubleshoot this condition. The indicator light may come on while the machine is in NEUTRAL. This indicates that the override valve is stuck in the OPEN position. Proceed to Problem 7 for additional information.

**Problem 7**

**High override pressure in NEUTRAL**

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| --- | --- |
| C:\05919485\1230A30F-5878-4C6A-82B6-D0998BBA7ACC_files\image012.gif | **Override Oil Pressure (4)** - This indicator indicates high override pressure in NEUTRAL. |

Alert indicator light (4) flashes on and off in NEUTRAL.

* Check the function of the override solenoid.
* Check the function of the override valve.
* Replace the override valve, if necessary.

**Note:** The override valve should be closed when the machine is in NEUTRAL. If the valve is stuck open, alert indicator light (4) will flash when the machine is in NEUTRAL.

**Problem 8**

**Alternator (fault)**

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| C:\05919485\1230A30F-5878-4C6A-82B6-D0998BBA7ACC_files\image013.gif | **Alternator (7)** - This indicator indicates a malfunction in the alternator. |

Alert indicator light (7) flashes on and off.

* Refer to Systems Operation/Testing and Adjusting, SENR3583, "Basic Engine Components 3114, 3116, & 3126 Engines" for additional information.

**Problem 9**

**A fault code is displayed on the Caterpillar Monitoring System**

The display area (10) provides specific machine information to the operator and the service technician.

* Refer to Systems Operation/Testing and Adjusting, SENR8314, "953C, 963C and 973C Track-Type Loaders Hydrostatic Transmission Electronic Control System" for additional information.

**Symptom 2**

**Low Transmission Charge Pressure at NEUTRAL**

Check the oil level in the hydraulic oil tank.

**Problem 1**

**Charge pressure is still low when the oil level is within specifications**

* Install pressure gauges on the charge pressure tap and on the tap for the charge pressure upstream of the filter.
* Start the engine and run the engine at HIGH IDLE. Do not run the engine for more than 15 seconds.
* Record the following pressures:

Charge pressure\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Charge pressure upstream of the filter\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Problem 2**

**The difference between the charge pressure and the charge pressure upstream of the filter is more than 275 kPa (40.0 psi)**

* Check and/or replace the charge filter.
* Check the spool and check the spring in the filter bypass valve.
* Recheck the charge pressure.

**Problem 3**

**There is no charge pressure upstream of the filter**

* Remove the charge pump from the drive pump and observe the mating parts.
* Crank the engine in order to verify that the shaft rotates.

**Problem 4**

**The charge pressure is between 0 kPa (0 psi) and 2344 kPa (340 psi).**

* Reset the relief valve.
* Replace the charge relief valve if the valve is sticking.
* Replace the charge pump if the pump is worn.
* Test the efficiency of the drive pumps and motors.

**Symptom 3**

**Hydraulic Tank Over Temperature**

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| --- | --- |
| C:\05919485\1230A30F-5878-4C6A-82B6-D0998BBA7ACC_files\image006.jpg |  |
| Illustration 5 | g00738663 |
| Caterpillar Monitoring System display  Alert indicator lights |  |

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| --- | --- |
| C:\05919485\1230A30F-5878-4C6A-82B6-D0998BBA7ACC_files\image011.gif | **Hydraulic Oil Temperature (6)** - This indicator indicates excessive hydraulic oil temperature. |

Alert indicator light (6) flashes on and off.

* Turn the engine OFF. This will allow the sump to cool.
* Open the doors beneath the cab and over the hydraulic oil tank in order to ventilate the area.
* Ventilate the area until the temperature drops below the alarm level.

**Problem 1**

**Unusually long durations of stalling the work tools**

* Slow down or alter the work cycle.

**Problem 2**

**Oil cooler core that is externally plugged**

* Clean the cooler core.

**Problem 3**

**The power train is below performance specifications**

* See Symptom 13 and Symptom 14.

**Problem 4**

**The work tools operate below performance specifications**

* Perform hydraulic Operational Checks. Refer to Hydraulic Systems Operation, Testing and Adjusting, SENR1768.

**Problem 5**

**Oil cooler that is not hot to the touch**

* Verify that the power train oil tank is hot to the touch. If the tank is not hot, check the sensor in the tank. Replace the sensor, if necessary.
* Verify that the hoses to the oil cooler are in good condition.
* Open the hydraulic tank and observe the return lines and the cooler bypass valve for problems.
* Perform the Check of the Bypass Pressure for the Oil Cooler.

**Symptom 4**

**Low Override Pressure During Travel**

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| Illustration 6 | g00738663 |
| Caterpillar Monitoring System display  Alert indicator lights |  |

|  |  |
| --- | --- |
| C:\05919485\1230A30F-5878-4C6A-82B6-D0998BBA7ACC_files\image012.gif | **Override Pressure (4)** - This indicator indicates low charge oil pressure in the transmission during travel. |

Alert indicator light (4) flashes on and off.

**Problem 1**

**Charge pressure that is not set correctly in NEUTRAL at HIGH IDLE**

* Charge pressure must be 2850 ± 40 kPa (415 ± 7 psi).
* If charge pressure is below the specification, see Symptom 2.

**Problem 2**

**Bad override valve**

* Read the charge pressure with a gauge. Compare the reading to the override pressure that is displayed on the Caterpillar Monitoring System. If the difference exceeds 500 kPa (73 psi), exchange the override valve with a steering valve. Recheck for the problem.
* If the exchange of valves did not solve the problem, see Problem 5.

**Problem 3**

**Fault that only occurs during high loading of the transmission**

* Perform the Test Procedure for the Efficiency of the Drive Pumps and Motors.

**Problem 4**

**Damaged charge pump or broken charge pump**

* Remove the charge pump from the drive pump and observe the mating parts.

**Problem 5**

**High Leakage at the Drive Pump Pilot Spool or Servo Valve or Pilot Spool for the Motor**

* Cap each line for the signal to the pump. Cap each line for the signal to the motor. Do this one at a time. Recheck the difference between charge pressure and override pressure as each one is capped or plugged. If the differential exceeds 500 kPa (73 psi), you may have located the problem. Examine the corresponding pilot spool. Examine the clearance of the corresponding servo valve in the pump or motor.

**Symptom 5**

**Machine That Does Not Move During a Demand for Travel**

**Note:** If the stuck valve detection indicates a fault, see Symptom 15.

**Problem 1**

**The engine lugs when you attempt to move the machine**

* Perform the Engine OFF calibration submode 12. Recheck for the problem.
* Perform the Engine ON calibration submode 20 for the brake release.
* Perform the Engine ON calibration submode 21 in order to verify the brake release.

Install gauge and verify that the brake pressure is above 1400 kPa (205 psi) when the brakes should be released.

YES

* Inspect the brakes.

NO

* Check the charge pressure while the brakes should be released. The charge pressure must be 2850 ± 40 kPa (415 ± 7 psi). If the pressure is low, see Symptom 4.
* If the charge pressure is correct, check the current to the brake solenoid. Also, check the operation of the brake solenoid valve.

**Problem 2**

**The engine does not lug when you attempt to move the machine in one direction or in both directions, and the override pressure is above 800 kPa (117 psi)**

Verify that the signal pressure to the drive pumps is above 800 kPa (117 psi) when the speed/direction control lever is at the maximum position.

YES

* Inspect the controls of the drive pumps.

NO

* Check the current to the solenoids of the steering valves.
* Check the operation of the steering valves.

**Problem 3**

**The override pressure is below 800 kPa (117 psi) in Problem 2.**

* Check the current to the solenoid of the override valve when the speed/direction control lever is at the maximum position.
* Check the operation of the override valve.
* If the current is greater than 700 mA, replace the override valve. If the current is below 700 mA, replace the ECM.

**Symptom 6**

**Low Top Speed**

* Perform the Engine OFF calibration.
* Verify that the track adjustment is not too tight.

**Problem 1**

**Engine speed is above 2200 rpm during a demand for top travel speed**

* Verify that the charge pressure is above 1800 kPa (260 psi) while the machine is at full speed.
* Verify that the towing valves are closed.
* Perform the Engine ON calibration submode 17.
* Refer to Systems Operation/Testing and Adjusting, SENR8314, "953C, 963C and 973C Track-Type Loaders Hydrostatic Transmission Electronic Control System" for additional information.

Check the signal pressure that is output by the override valve and the steering valves. The pressure should be greater than 1600 kPa (230 psi) in FULL FORWARD and in FULL REVERSE.

YES

* Test the range of stroking of the drive pump and motor.

NO

* Measure the electrical current that is sent to the solenoid of the steering valve. If the current is greater than 700 mA, replace the steering valve. If the current is below 700 mA, replace the ECM.

**Problem 2**

**Engine speed is below 2200 rpm at top travel speed**

* Check the adjustment of the control linkage of the governor lever.
* Check that the implement hydraulic pressure is below 1000 kPa (145 psi) at HIGH IDLE while the lever is in the HOLD position.
* Check the adjustment of the engine speed sensor.
* Check and/or correct engine HIGH IDLE.
* Check and/or correct engine power.
* Refer to Systems Operation/Testing and Adjusting, SENR3583, "Basic Engine Components 3114, 3116, & 3126 Engines" for additional information.

**Problem 3**

**High final drive oil level**

* Drain the final drives to the full mark.
* Determine the reason for the high oil level.
* Check the final drives for damage.
* Perform the stall test of the brakes in submode 20.

**Symptom 7**

**One Track That Does Not Move**

**Note:** To diagnose this symptom without undesired turning, disable the side that is functioning by removing the solenoid coil from the steering valve. Do not disconnect the electrical connection from the coil. Also, disconnect the electrical connection from one of the sensors for the signal pressure to the motors. This will prevent the stuck valve detection from closing the override valve. A fault will be logged for the disconnected sensor, but you may proceed with the diagnosis.

**Problem 1**

**The engine lugs during a demand for travel**

* Check that the drive pressure is increasing toward the maximum setting of the relief valve. The drive pressure should nearly reach this maximum setting.
* Verify that the brake pressure is above 1400 kPa (205 psi).

Remove the drive motor and verify that the output shaft can be turned with normal torque.

YES

* The parking brake is faulty. Repair the brake.

NO

* The drive motor is jammed. Repair the motor.

**Note:** If the motor turns with normal torque and the parking brake is not faulty, the final drive is jammed.

**Problem 2**

**The engine does not lug during a demand for travel**

**Note:** The track may not move in only one direction or the track may not move in both directions.

Check that signal pressure is being sent to the side that will not move. Perform this check at full input of the speed/direction control lever. The pressure should be greater than 800 kPa (116 psi).

YES

* Verify that the pump servo valve is not stuck.

NO

* Verify that the steering valve is not stuck in the closed position.
* Verify that the electrical current that is sent to the steering solenoid is greater than 500 mA.

**Symptom 8**

**Jerky Start at Low Speed Input of Speed/direction Control Lever**

**Problem 1**

**Faulty calibration of the control system**

* Perform Engine OFF calibration submodes 7 through 9.
* Perform Engine ON calibration submode 15 and 16. If you are unable to adjust the submodes to settings that are low enough, replace the ECM with an ECM that is known to work correctly.
* Refer to Systems Operation/Testing and Adjusting, SENR8314, "953C, 963C and 973C Track-Type Loaders Hydrostatic Transmission Electronic Control System" for more information.

**Problem 2**

**The speed/direction control lever, the linkage, or the sensor are malfunctioning**

* Inspect the speed/direction control lever, the linkage, and the sensor. None of the components should be loose. None of the components should be binding. If necessary, adjust the components.

**Problem 3**

**The steering valves are sticking**

Note the side and/or direction that exhibits jerky response.

* Remove the steering valve and inspect the steering valve for contamination.
* Switch the steering valve with a steering valve that is known to work properly at low speed. If the new valve solves the problem, permanently replace the old valve.
* Perform Engine ON calibration submode 15 and 16 again.

**Problem 4**

**Pump controls are sticking**

* Open the pump controls and inspect the pump controls for obstructed movement.

**Symptom 9**

**Unwanted Turn During a Demand for Straight Travel**

**Problem 1**

**Incorrect calibration of the control system**

* Perform Engine ON calibration submodes 15, 16, and 17 for speed positions 1 through 6.
* Refer to Systems Operation/Testing and Adjusting, SENR8314, "953C, 963C and 973C Track-Type Loaders Hydrostatic Transmission Electronic Control System" for more information.

**Problem 2**

**The slow side does not move in one direction or in both directions**

* See Symptom 7.

**Problem 3**

**The problem occurs at maximum speed only**

* Verify that the setting for the minimum displacement of the motor is correct.
* Perform Engine ON calibration submode 16 and 17 for speed position 6.

**Problem 4**

**The problem occurs only in the upper 66% of the speed range**

* The drive motor is not stroking.
* Check the signal pressure and check the line.
* Check the servo valve on the drive motor and check the actuator.

**Problem 5**

**The problem is more obvious near 33% of the speed range, but the problem does not exist at higher speeds or at lower speeds**

* Test the range of stroking of the drive pump and motor.

**Problem 6**

**The problem is more obvious only in the lower 33% of the speed range**

* There is a sticking servo valve on the drive pump.

**Problem 7**

**The problem is evident throughout the entire speed range in one direction**

* There is a sticking steering valve.

**Problem 8**

**The machine will not maintain track speed synchronization only at very low speed**

* Perform the Hydraulic Neutral Adjustment of the Drive Pump in this manual.

**Symptom 10**

**Machine That Creeps in NEUTRAL on Level Ground**

* Check the linkage for looseness, wear, and adjustment.
* Perform Engine OFF calibration submode 08.
* Perform Engine ON calibration submodes 15 and 16.
* Refer to Systems Operation/Testing and Adjusting, SENR8314, "953C, 963C and 973C Track-Type Loaders Hydrostatic Transmission Electronic Control System" for more information.

**Problem 1**

**Signal pressure from any of the steering valves to the pump is greater than 200 kPa (29 psi) while the speed/direction control is in the BRAKES OFF position**

* Disconnect the electrical connector from the corresponding steering valve. Fault detection will stop the machine.

Signal pressure remains greater than 200 kPa (29 psi).

YES

* Remove the steering valve and the override valve in order to inspect the components for damage and contamination.

NO

* Replace the ECM with an ECM that is known to work correctly.

**Problem 2**

**The machine creeps in NEUTRAL and the signal pressure from the steering valves to the pump is below 200 kPa (29 psi)**

* Adjust the hydraulic neutral setting on the affected drive pump.

**Note:** See the Hydraulic Neutral Adjustment of the Drive Pump in this manual.

**Symptom 11**

**Machine That Creeps Down a Grade in PARK**

**Problem 1**

**Machine stops when the center pedal is fully applied**

* Check the function of the parking brake switch. Perform the Engine OFF calibration submode 12.

**Problem 2**

**The machine does not stop when the center pedal is fully applied**

Check the brake pressure while in PARK. The brake pressure is less than 200 kPa (29 psi).

YES

* The brakes are faulty.

NO

* The solenoid control valve for the brakes is stuck open.
* Check the ECM by disconnecting the electrical connection from the solenoid for the brake valve and checking the brake pressure while in PARK. If the brake pressure drops to 0 kPa (0 psi), the ECM is faulty.

**Symptom 12**

**Positioning the Machine on Slopes Is Difficult**

**Note:** If this symptom is intermittent, see Symptom 8.

**Problem 1**

**Incorrect calibration of the control system**

* Perform calibrations for Engine OFF submodes 1 through 9. Perform calibrations for Engine ON submodes 15 and 16 for speed position 1.
* Refer to Systems Operation/Testing and Adjusting, SENR8314, "953C, 963C and 973C Track-Type Loaders Hydrostatic Transmission Electronic Control System" for additional information.

**Problem 2**

**Normal calibration does not suit the machine application on the slope**

* Install pressure gauges on the taps for the drive pressure for right FORWARD, right REVERSE, left FORWARD, and left REVERSE.
* Verify that the power train oil is at normal operating temperature. Go to calibration submode 15. Fully depress the center pedal. The drive pump pressure at full speed of the engine with the speed/direction control lever at full speed should be 12000 ± 2500 kPa (1740 ± 363 psi). The pressure should be within tolerance on both sides of the machine in FORWARD and in REVERSE.
* If the left side is out of tolerance in either FORWARD or REVERSE, set the speed/direction control lever to speed position 1. Click the calibrate switch in the upward direction or in the downward direction in order to achieve the proper setting. You must move the speed/direction control lever to full speed in order to check the new setting. If the right side is now out of tolerance, proceed to submode 16 in order to adjust the right side in the same manner.
* If only the right side is out of tolerance, go directly to submode 16. Set the speed/direction control lever to speed position 1. Click the calibrate switch in the upward direction or in the downward direction in order to achieve the proper setting.

**Note:** The readings of the drive pressure must be made while the speed/direction control lever is in the maximum position. Adjustments to the calibration must only be made in speed position 1. The center pedal must be depressed during the entire process. The power train oil must be at normal operating temperature.

**Note:** This may result in jerky response at low speeds on level ground. The setting of submode 15 and submode 16 in position 1 should be optimized in order to meet operational requirements for both level ground and slopes.

**Note:** Pressures that are outside of this range may provide satisfactory operation in certain applications.

**Symptom 13**

**Power Train That Lacks Power Under Load**

**Problem 1**

**Warning of low override pressure under a load**

* See Symptom 4.

**Problem 2**

**HIGH IDLE setting is too high or too low**

**Note:** Verify that there is a consistent signal from the speed sensor on the flywheel.

Check for binding or sticking within the governor control cable. Adjust the HIGH IDLE setting, if necessary.

**Problem 3**

**The engine lugs to approximately 1500 rpm during the transmission stall test**

* Perform Engine OFF calibration submode 10.
* If the problem persists, proceed to Problem 7.

**Problem 4**

**Incorrect calibration of the control system**

**Note:** A machine operator may complain of low power when the machine is operating properly. In order to overcome a perception of low power, you may wish to calibrate a lower top speed. Set the top speed to 9.2 km/h (5.7 mph) in submode 17 in order to improve the perception of the operator. If necessary, continue lowering the top speed in increments of 0.5 km/h (0.3 mph) until lack of top speed becomes a problem.

* Perform submodes 1 through 10 while the engine is off.
* Perform submodes 15, 16, and 17 while the engine is running.

**Problem 5**

**The relief valve of the drive pump is set incorrectly**

* Verify the relief valve setting for each of the drive pumps. Adjust the setting, if necessary.

**Problem 6**

**Towing valves are leaking**

* Disassemble the towing valves and check the condition of the seats. Repair the valves or replace the valves, if necessary.

**Problem 7**

**Low engine power**

* Perform the stall test of only the implements in the rackback position in order to verify that the engine power is low.
* Refer to Systems Operation/Testing and Adjusting, SENR3583, "Basic Engine Components 3114, 3116, & 3126 Engines" for additional information.

**Problem 8**

**Worn drive pump or motor**

* Perform a stall test of the transmission.
* Perform a test of the efficiency of the pumps and of the motors.

**Symptom 14**

**Power Train That Lacks Power (Machine That Slows During a Turn)**

**Note:** A machine operator may complain of low power when the machine is operating properly. In order to overcome a perception of low power, you may wish to calibrate a lower top speed. Set the top speed to 9.2 km/h (5.7 mph) in submode 17 in order to improve the perception of the operator. If necessary, continue lowering the top speed in increments of 0.5 km/h (0.3 mph) until lack of top speed becomes a problem.

* Perform calibrations for Engine OFF submodes 1 through 10. Perform calibrations for Engine ON submodes 15, 16, and 17.
* Refer to Systems Operation/Testing and Adjusting, SENR8314, "953C, 963C and 973C Track-Type Loaders Hydrostatic Transmission Electronic Control System" for additional information.

**Problem 1**

**The power train still lacks power (machine that slows during a turn)**

* Check the drive pressure with test gauges during a turn.

The drive pressure is 42000 kPa (6100 psi) or more.

YES

* Perform the Adjustment of the Pressure Override Valve for the Drive Motor in this manual.

NO

* Perform the stall test of only the implements in the rackback position in order to determine if the engine power is low.
* Refer to Systems Operation/Testing and Adjusting, SENR3583, "Basic Engine Components 3114, 3116, & 3126 Engines" for additional information.

**Symptom 15**

**Machine That Stops Suddenly During Travel**

**Problem 1**

**The machine stops at a particular position of the speed/direction control lever.**

* Reset the calibration of the machine to default values in submode 13.
* Perform calibration submodes 1 through 9 with the engine off.
* Perform calibration submodes 15 through 17 with the engine on.

**Note:** You must calibrate each of the speed ranges in submode 16.

**Problem 2**

**The machine stops only during a turn.**

* Check signal pressures to the motors in submodes 26 and 27 during a turn.

The signal pressures correspond to the steering inputs when the steering pedals are pressed. The signal pressure on the left side decreases as the left pedal is pressed. The signal pressure on the right side decreases as the right pedal is pressed.

YES

* Recalibrate the machine in submodes 15 through 17.

**Note:** You must calibrate each of the speed ranges in submode 16.

NO

* The sensors for the signal pressure to the left motor and to the right motor may be installed in the wrong ports of the ECM manifold. Also, the wiring harness may be incorrectly interchanged between these sensors. Correct the problem with the installation and recalibrate the machine.

**Problem 3**

**The machine stops intermittently.**

* Check for diagnostic codes that correspond to the signal pressure for the motors. A list of diagnostic codes appears under problem 4.
* Attach gauges to the forward and reverse signal pressure taps for the right side and for the left side. Run the machine. Compare the readings of the gauges to the display in submodes 26 and 27.

The signal pressure that is displayed in submodes 26 and 27 corresponds to the readings of the pressure gauges.

YES

* Recalibrate submodes 15 through 17.

**Note:** You must calibrate each of the speed ranges in submode 16.

NO

* Replace the faulty sensor for the signal pressure to the motor and recalibrate the machine.

**Note:** If the problem persists, case pressure that is intermittently high may be the source of the problem. Also, override pressure that is intermittently low may be the source of the problem.

**Problem 4**

**The machine stops and the machine will not move.**

* Check for diagnostic codes. If a diagnostic code is not listed in the following table, refer to Systems Operation/Testing and Adjusting, SENR8314, "953C, 963C and 973C Track-Type Loaders Hydrostatic Transmission Electronic Control System" for additional information. You must refer to revision 03 or you must refer to a newer revision.

|  |  |
| --- | --- |
| **Diagnostic Code** | **Description** |
| 079\_133\_12 | Override valve that is stuck in high pressure |
| 079\_133\_07 | No pressure output from the override valve |
| 079\_134\_07 | Right forward or right reverse steering valve that is stuck in high pressure |
| 079\_135\_07 | Left forward or left reverse steering valve that is stuck in high pressure |
| 079\_469\_12 | Left forward steering valve that is stuck in low pressure |
| 079\_470\_12 | Left reverse steering valve that is stuck in low pressure |
| 079\_471\_12 | Right forward steering valve that is stuck in low pressure |
| 079\_472\_12 | Right reverse steering valve that is stuck in low pressure |

Table 3

Diagnostic codes 079\_133\_12, 079\_469\_12, 079\_470\_12, 079\_471\_12, or 079\_472\_12 are displayed.

YES

* Replace the faulty valve and recalibrate the machine.

Diagnostic code 079\_133\_07 is displayed.

YES

* See Symptom 4 in order to diagnose low override pressure.

Diagnostic codes 079\_134\_07 or 079\_135\_07 are displayed.

YES

* The faulty valve must be determined.
* Attach test gauges to the forward and reverse signal pressure taps for the left side and for the right side.
* Enter submode 20 and lock the brakes.
* With the governor control lever in high idle, slowly move the speed/direction control lever in the forward direction. Then, slowly move the speed/direction control lever in the reverse direction.
* A sudden increase in control pressure will be displayed on the gauge that corresponds to the faulty steering valve when the speed/direction control lever is brought out of the BRAKES OFF position.
* Replace the faulty valve and recalibrate the machine.

**Note:** The stuck valve detection may close the override valve during troubleshooting. Also, a diagnostic code will be displayed. Return the machine to NEUTRAL for 5 seconds in order to clear the stuck valve detection. Then, continue diagnosing the problem.

**Note:** If a sticking valve is replaced under Symptom 15, check the pumps and motors for failure. Check the charge pressure with the machine in low idle. Charge pressure that is lower than 2000 kPa (290 psi) may be an indication of a failed charge pump. Check for a failure of the seal on the charge relief valve. Perform an efficiency test of the drive pumps and motors in order to diagnose failure of these components.

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