135D
Excavator
Operation and Test

TECHNICAL MANUAL
135D Excavator Operation and Test

TM10742 05DEC08 (ENGLISH)

For complete service information also see:

135D Excavator Repair	**TM10743**
135D Excavator Operator's Manual	**OMT239673**
Undercarriage Appraisal Manual	**SP326**
Super Caddy Oil Cleanup Procedure	**CTM310**

Worldwide Construction
And Forestry Division
LITHO IN U.S.A.

Recognize Safety Information

This is the safety alert symbol. When this symbol is noticed on the machine or in this manual, be alert for the potential of personal injury.

Follow the precautions and safe operating practices highlighted by this symbol.

A signal word — DANGER, WARNING, or CAUTION — is used with the safety alert symbol. DANGER identifies the most serious hazards.

On the machine, DANGER signs are red in color, WARNING signs are orange, and CAUTION signs are yellow. DANGER and WARNING signs are located near specific hazards. General precautions are on CAUTION labels.

T133555 –UN–28AUG00

T133588 –19–28AUG00

TX03679,00016CC –19–03JAN07–1/1

Follow Safety Instructions

Read the safety messages in this manual and on the machine. Follow these warnings and instructions carefully. Review them frequently.

Keep safety signs in good condition.

Be sure new equipment components and repair parts include the current safety signs.

Be sure all operators of this machine understand every safety message. Replace operator's manual and safety signs immediately if missing or damaged. Replacement safety signs are available from your authorized dealer.

TX14740,0000019 –19–10JAN07–1/1

Operate Only If Qualified

Do not operate this machine unless the operator's manual has been read carefully, and you have been qualified by supervised training and instruction.

Operator should be familiar with the job site and surroundings before operating. Try all controls and machine functions with the machine in an open area before starting to work.

Know and observe all safety rules that may apply to every work situation and work site.

TX03679,00016FA –19–03JAN07–1/1

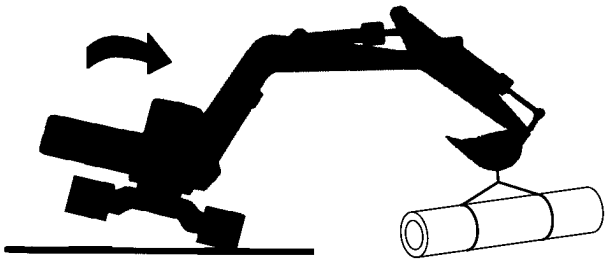
Use Special Care When Lifting Objects

Never use this machine to lift people.

Never lift a load above another person. Keep bystanders clear of all areas where a load might fall if it breaks free. Do not leave the seat when there is a raised load.

Do not exceed lift capacity limits posted on machine and in this manual. Extending heavy loads too far or swinging over undercarriage side may cause machine to tip over.

Use proper rigging to attach and stabilize loads. Be sure slings or chains have adequate capacity and are in good condition. Use tether lines to guide loads and prearranged hand signals to communicate with co-workers.



T133839 –UN–27SEP00

TX03679,00016E1 –19–03JAN07–1/1

Add and Operate Attachments Safely

Always verify compatibility of attachments by contacting your authorized dealer. Adding unapproved attachments may affect machine stability or reliability and may create a hazard for others near the machine.

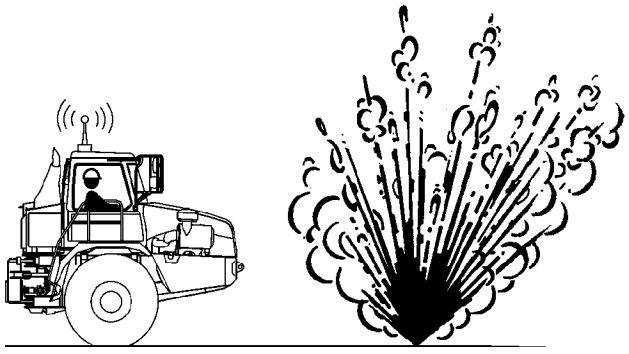
Ensure that a qualified person is involved in attachment installation. Add guards to machine if operator protection is required or recommended. Verify that all connections are secure and attachment responds properly to controls.

Carefully read attachment manual and follow all instructions and warnings. In an area free of bystanders and obstructions, carefully operate attachment to learn its characteristics and range of motion.

TX03679,00016F0 –19–12FEB07–1/1

Prevent Unintended Detonation of Explosive Devices

Avoid serious injury or death from an explosion hazard. Deactivate all cellular or radio frequency devices on equipment stored or operating in an area, such as a blasting zone, where the use of radio transmitting devices are prohibited.



TX1023216 –UN–07MAY07

VD76477,0001543 –19–08JAN08–1/1

Main Controller (MCF) Diagnostic Trouble Codes

For additional information on the main controller circuit.See Main Controller (MCF) Circuit Theory of Operation. (Group 9015-15.)

Main controller diagnostic trouble codes (DTCs) can be displayed on the monitor, connection with Service Advisor, or by connection with Dr. ZX.

- See Reading Diagnostic Trouble Codes With Monitor Display (Group 9015-20.)
- See Reading Diagnostic Trouble Codes With SERVICE ADVISOR Diagnostic Application (Group 9015-20.)
- See Reading Diagnostic Trouble Codes with Dr. ZX. (Group 9015-20.)

TP97644,00005DE –19–12NOV07–1/1

11000.02 — Abnormal EEPROM

TP97644,00005DF –19–12NOV07–1/1

Controller Hardware Diagnostics

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14 ECM Short to Key Switch Signal Check	Disconnect all connectors to main controller (MCF), information controller (ICF), engine control module (ECM), and monitor controller. Check for continuity between engine control module (ECM) pin 18 and pin 24. Check for continuity between engine control module (ECM) pin 37 and pin 24. Is there continuity between CAN circuit and key switch signal circuit? *NOTE: Key Switch: Off*	**YES:** CAN circuit short to key switch signal. Repair or replace harness. See Cab Harness (W1) Wiring Diagram, See Machine Harness (W2) Wiring Diagram and See Monitor Harness (W3) Wiring Diagram. (Group 9015-10.) **NO:** Go to ICF Short to Key Switch Signal Check. – – –1/1

15 ICF Short to Key Switch Signal Check	Disconnect all connectors to main controller (MCF), information controller (ICF), engine control module (ECM), and monitor controller. Check for continuity between information controller (ICF) pin C5 and C7. Check for continuity between information controller (ICF) pin C11 and C7. Is there continuity between CAN circuit and key switch signal circuit? *NOTE: Key Switch: Off*	**YES:** CAN circuit short to key switch signal. Repair or replace harness. See Cab Harness (W1) Wiring Diagram, See Machine Harness (W2) Wiring Diagram and See Monitor Harness (W3) Wiring Diagram. (Group 9015-10.) **NO:** Go to Monitor Controller Short to Key Switch Signal Check. – – –1/1

Pump 1 Delivery Pressure Sensor Diagnostics

Pump 1 delivery pressure sensor voltage 4.5 volts or higher.

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❶ **Sensor Check**	Switch pump 1 delivery pressure sensor with pump 2 delivery pressure sensor. Clear DTCs and re-check DTCs. Does DTC follow delivery pressure sensor?	**YES:** Faulty pump 1 delivery pressure sensor. **NO:** Go to Sensor Circuit Check. – – –1/1

❷ **Sensor Circuit Check**	Disconnect connector to pump 1 delivery pressure sensor. Check voltage between terminals 1 and 3 of harness. Is voltage between 4.5—5.5 volts? *NOTE: Key Switch: On*	**YES:** Go to Open Circuit Check. **NO:** Go to Harness Voltage Check. – – –1/1

❸ **Open Circuit Check**	Disconnect connector to pump 1 delivery pressure sensor. Check continuity between main controller (MCF) connector D (X31) pin D10 and pump 1 delivery pressure sensor pin 2. Is there continuity between the pins?	**YES:** Go to Short Circuit Check. **NO:** Open in harness. Repair or replace harness. See Machine Harness (W2) Wiring Diagram and See Pump Harness (W8) Wiring Diagram. (Group 9015-10.) – – –1/1

11208.03 — Pump 2 Control Pressure Sensor Voltage High

TP97644,00005ED –19–12NOV07–1/1

Pump 2 Control Pressure Sensor Diagnostics

Pump 2 control pressure sensor voltage 4.75 volts or higher.

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❶ **Sensor Check**	Switch pump 2 control pressure sensor with pump 1 control pressure sensor. Clear DTCs and re-check DTCs. Does DTC follow control pressure sensor?	**YES:** Faulty pump 2 control pressure sensor. **NO:** Go to Sensor Circuit Check. – – –1/1
❷ **Sensor Circuit Check**	Disconnect connector to pump 2 control pressure sensor. Check voltage between terminals 1 and 3 of harness. Is voltage between 4.5—5.5 volts? *NOTE: Key Switch: On*	**YES:** Go to Open Circuit Check. **NO:** Go to Harness Voltage Check. – – –1/1
❸ **Open Circuit Check**	Disconnect connector to pump 2 control pressure sensor. Check continuity between main controller (MCF) connector D (X31) pin D14 and pump 2 control pressure sensor pin 2. Is there continuity between the pins?	**YES:** Go to Short Circuit Check. **NO:** Open in harness. Repair or replace harness. See Machine Harness (W2) Wiring Diagram and See Pump Harness (W8) Wiring Diagram. (Group 9015-10.) – – –1/1

❷ **Sensor Circuit Check**	Disconnect connector of boom up pilot pressure sensor. Check voltage between terminals 1 and 3 of harness. Is voltage between 4.5—5.5 volts? *NOTE: Key Switch: On*	**YES:** Go to Open Circuit Check. **NO:** Go to Harness Voltage Check. – – –1/1

❸ **Open Circuit Check**	Disconnect harness from boom up pilot pressure sensor and main controller (MCF). Check continuity between boom up pilot pressure sensor connector pin 2 and main controller (MCF) connector D (X31) pin D15. Is there continuity between the pins?	**YES:** Go to Short Circuit Check. **NO:** Open circuit in harness. Repair or replace harness. See Machine Harness (W2) Wiring Diagram. (Group 9015-10.) – – –1/1

❹ **Short Circuit Check**	Disconnect harness from boom up pilot pressure sensor and main controller (MCF). Check continuity between boom up pilot pressure sensor connector pin 2 and power and ground. Is there continuity to power or ground?	**YES:** Short circuit in harness. Repair or replace harness. See Machine Harness (W2) Wiring Diagram. (Group 9015-10.) **NO:** Main controller (MCF) malfunction. Replace main controller (MCF). See Main Controller (MCF) Remove and Install. (Group 9015-20.) – – –1/1

❷ **Sensor Circuit Check**	Disconnect connector of front attachment pilot pressure sensor. Check voltage between terminals 1 and 3 of harness. Is voltage between 4.5—5.5 volts? *NOTE: Key Switch: On*	**YES:** Go to Open Circuit Check. **NO:** Go to Harness Voltage Check. – – –1/1

❸ **Open Circuit Check**	Disconnect harness from front attachment pilot pressure sensor and main controller (MCF). Check continuity between front attachment pilot pressure sensor connector pin 2 and main controller (MCF) connector C (X30) pin C12. Is there continuity between the pins?	**YES:** Go to Short Circuit Check. **NO:** Open circuit in harness. Repair or replace harness. See Machine Harness (W2) Wiring Diagram. (Group 9015-10.) – – –1/1

❹ **Short Circuit Check**	Disconnect harness from front attachment pilot pressure sensor and main controller (MCF). Check continuity between front attachment pilot pressure sensor connector pin 2 and power and ground. Is there continuity to power or ground?	**YES:** Short circuit in harness. Repair or replace harness. See Machine Harness (W2) Wiring Diagram. (Group 9015-10.) **NO:** Main controller (MCF) malfunction. Replace main controller (MCF). See Main Controller (MCF) Remove and Install. (Group 9015-20.) – – –1/1

❷ **DTC Check**	Switch connectors of arm regenerative solenoid (SC) with another solenoid in solenoid valve manifold. Clear and re-check DTCs. Does DTC 11403.04-Arm regenerative solenoid feedback current low still display?	**YES:** Main controller (MCF) malfunction. Replace main controller (MCF). See Main Controller (MCF) Remove and Install. (Group 9015-20.) **NO:** Arm regenerative solenoid malfunction. Replace solenoid. – – –1/1

11405.02 — Travel Speed Solenoid Feedback Current Abnormal

TP97644,0000608 –19–12NOV07–1/1

Power Dig Solenoid Diagnostics

Travel speed solenoid feedback current above 920 mA or below 60 mA.

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❶ **Continuity Check**	Disconnect harness from travel speed solenoid and main controller (MCF). Check continuity between travel speed solenoid connector pin 1 and main controller (MCF) connector A (X28) pin A31. Check continuity between travel speed solenoid connector pin 2 and main controller (MCF) connector A (X28) pin A5. Is there continuity between solenoid and main controller (MCF)?	**YES:** Go to DTC Check. **NO:** Open circuit in harness. Repair or replace harness. See Machine Harness (W2) Wiring Diagram. (Group 9015-10.) – – –1/1

❷ **DTC Check**	Switch connectors of travel speed (SI) solenoid with another solenoid in solenoid valve manifold. Clear and re-check DTCs. Does DTC 11405.02-Travel speed solenoid current feedback abnormal still display?	**YES:** main controller (MCF) malfunction. Replace main controller (MCF). See Main Controller (MCF) Remove and Install. (Group 9015-20.) **NO:** Travel speed solenoid malfunction. Replace solenoid. – – –1/1

12 Monitor Controller Short to Power Check	Disconnect all connectors to main controller (MCF), information controller (ICF), engine control module (ECM), and monitor controller. Check for continuity between monitor controller pin B7 and A16. Check for continuity between monitor controller pin B6 and A16. Is there continuity between CAN circuit and power circuit?	**YES:** CAN circuit short to power. Repair or replace harness. See Cab Harness (W1) Wiring Diagram, See Machine Harness (W2) Wiring Diagram and See Monitor Harness (W3) Wiring Diagram. (Group 9015-10.) **NO:** Go to MCF Short to Key Switch Signal Check. – – –1/1

13 MCF Short to Key Switch Signal Check	Disconnect all connectors to main controller (MCF), information controller (ICF), engine control module (ECM), and monitor controller. Check for continuity between main controller (MCF) pin C4 and B16. Check for continuity between main controller (MCF) pin C15 and B16. Is there continuity between CAN circuit and key switch signal circuit? *NOTE: Key Switch: Off*	**YES:** CAN circuit short to key switch signal. Repair or replace harness. See Cab Harness (W1) Wiring Diagram, See Machine Harness (W2) Wiring Diagram and See Monitor Harness (W3) Wiring Diagram. (Group 9015-10.) **NO:** Go to ECM Short to Key Switch Signal Check. – – –1/1

11 ICF Short to Power Check	Disconnect all connectors to main controller (MCF), information controller (ICF), engine control module (ECM), and monitor controller. Check for continuity between information controller (ICF) pin C5 and pins C1 and C2. Check for continuity between information controller (ICF) pin C11 and pins C1 and C2. Is there continuity between CAN circuit and power circuit?	**YES:** CAN circuit short to power. Repair or replace harness. See Cab Harness (W1) Wiring Diagram, See Machine Harness (W2) Wiring Diagram and See Monitor Harness (W3) Wiring Diagram. (Group 9015-10.) **NO:** Go to Monitor Controller Short to Power Check. – – –1/1

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12 Monitor Controller Short to Power Check	Disconnect all connectors to main controller (MCF), information controller (ICF), engine control module (ECM), and monitor controller. Check for continuity between monitor controller pin B7 and A16. Check for continuity between monitor controller pin B6 and A16. Is there continuity between CAN circuit and power circuit?	**YES:** CAN circuit short to power. Repair or replace harness. See Cab Harness (W1) Wiring Diagram, See Machine Harness (W2) Wiring Diagram and See Monitor Harness (W3) Wiring Diagram. (Group 9015-10.) **NO:** Go to MCF Short to Key Switch Signal Check. – – –1/1

❽ **Monitor Controller Short to Ground Check**	Disconnect all connectors to main controller (MCF), information controller (ICF), engine control module (ECM), and monitor controller. Check for continuity between monitor controller pin B7 and pin B11. Check for continuity between monitor controller pin B6 and pin B11. Is there continuity between CAN circuit and ground circuit?	**YES:** CAN circuit short to ground. Repair or replace harness. See Cab Harness (W1) Wiring Diagram, See Machine Harness (W2) Wiring Diagram and See Monitor Harness (W3) Wiring Diagram. (Group 9015-10.) **NO:** Go to MCF Short to Power Check. – – –1/1
❾ **MCF Short to Power Check**	Disconnect all connectors to main controller (MCF), information controller (ICF), engine control module (ECM), and monitor controller. Check for continuity between main controller (MCF) pin C4 and pins A1, A12, B7, and B17. Check for continuity between main controller (MCF) pin C15 and pins A1, A12, B7, and B17. Is there continuity between CAN circuit and power circuit?	**YES:** CAN circuit short to power. Repair or replace harness. See Cab Harness (W1) Wiring Diagram, See Machine Harness (W2) Wiring Diagram and See Monitor Harness (W3) Wiring Diagram. (Group 9015-10.) **NO:** Go to ECM Short to Power Check. – – –1/1
❿ **ECM Short to Power Check**	Disconnect all connectors to main controller (MCF), information controller (ICF), engine control module (ECM), and monitor controller. Check for continuity between engine control module (ECM) pin 18 and pins 2 and 5. Check for continuity between engine control module (ECM) pin 37 and pins 2 and 5. Is there continuity between CAN circuit and power circuit?	**YES:** CAN circuit short to power. Repair or replace harness. See Cab Harness (W1) Wiring Diagram and See Machine Harness (W2) Wiring Diagram. (Group 9015-10.) **NO:** Go to ICF Short to Power Check. – – –1/1

❻ **ECM Short to Ground Check**	Disconnect all connectors to main controller (MCF), information controller (ICF), engine control module (ECM), and monitor controller. Check for continuity between engine control module (ECM) pin 18 and pins 1, 3, 4, 43, and 62. Check for continuity between engine control module (ECM) pin 37 and pins 1, 3, 4, 43, and 62. Is there continuity between CAN circuit and ground circuit?	**YES:** CAN circuit short to ground. Repair or replace harness. See Cab Harness (W1) Wiring Diagram, See Machine Harness (W2) Wiring Diagram and See Monitor Harness (W3) Wiring Diagram. (Group 9015-10.) **NO:** Go to ICF Short to Ground Check. – – –1/1

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❼ **ICF Short to Ground Check**	Disconnect all connectors to main controller (MCF), information controller (ICF), engine control module (ECM), and monitor controller. Check for continuity between information controller (ICF) pin C5 and pins C14 and C15. Check for continuity between information controller (ICF) pin C11 and pins C14 and C15. Is there continuity between CAN circuit and ground circuit?	**YES:** CAN circuit short to ground. Repair or replace harness. See Cab Harness (W1) Wiring Diagram, See Machine Harness (W2) Wiring Diagram and See Monitor Harness (W3) Wiring Diagram. (Group 9015-10.) **NO:** Go to Monitor Controller Short to Ground Check. – – –1/1

❹ **Continuity Check MCF and Monitor Unit**	Check for continuity between main controller (MCF) pin C4 and monitor controller pin B7. Check for continuity between main controller (MCF) pin C15 and monitor controller pin B6. Is there continuity between the connectors? *NOTE: Key Switch: Off*	**YES:** Go to MCF Short to Ground Check. **NO:** Open circuit in CAN between main controller (MCF) and monitor controller. Repair or replace harnesses. See Cab Harness (W1) Wiring Diagram, See Machine Harness (W2) Wiring Diagram and See Monitor Harness (W3) Wiring Diagram. (Group 9015-10.) – – –1/1

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❺ **MCF Short to Ground Check**	Disconnect all connectors to main controller (MCF), information controller (ICF), engine control module (ECM) and monitor controller. Check for continuity between main controller (MCF) pin C4 and main controller (MCF) pins A2, A13, B8, and B18. Check for continuity between main controller (MCF) pin C15 an main controller (MCF) pins A2, A13, B8, and B18. Is there continuity between the CAN circuit and ground circuit? *NOTE: Key Switch: Off*	**YES:** CAN circuit short to ground. Repair or replace harness. See Cab Harness (W1) Wiring Diagram, See Machine Harness (W2) Wiring Diagram and See Monitor Harness (W3) Wiring Diagram. (Group 9015-10.) **NO:** Go to ECM Short to Ground Check. – – –1/1

Engine Control Module (ECM) Diagnostic Trouble Codes

Engine control module (ECM) diagnostic trouble codes may be viewed on the monitor, by using Dr. ZX, , or by using SERVICE ADVISOR™. See the following procedures for viewing the engine control module diagnostic trouble codes.

- See Reading Diagnostic Trouble Codes With Monitor Display. (Group 9015-20.)
- See Reading Diagnostic Trouble Codes With Service ADVISOR™ Diagnostic Application. (Group 9015-20.)
- See Reading Diagnostic Trouble Codes With Dr. ZX. (Group 9015-20.)

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JW00603,0000153 –19–20AUG08–1/1

100.03 — Engine Oil Pressure Sensor Voltage Low (P0522)

Voltage less than 0.1 Volts for 4 seconds or more.

See Tech 2 Diagnostic Trouble Code P0522 in Isuzu Engine Trouble Shooting Manual. (1E-470.)

- Machine Symptom: None
- Machine Operation: Operable
- ECM Assumed Parameters: None
- Engine Malfunction Indicator: ON
- DTC/Malfunction Condition Resets: After malfunction is corrected, key OFF, key START

JW00603,0000154 –19–20AUG08–1/1

172.04 — Intake Air Temperature Sensor Voltage Low (P0112)

Voltage less than 0.1 Volts for 4 seconds or more.

See Tech 2 Diagnostic Trouble Code P0112 in Isuzu Engine Trouble Shooting Manual. (1E-335.)

- Machine Symptom: None
- Machine Operation: Operable
- ECM Assumed Parameters: Intake air temperature defaults to -10°C when starting, 25°C when operating; EGR cannot start
- Engine Malfunction Indicator: ON
- DTC/Malfunction Condition Resets: After malfunction is corrected, key OFF, key START

JW00603,0000165 –19–20AUG08–1/1

174.03 — Fuel Temperature Sensor Voltage High (P0183)

Voltage more than 4.85 Volts for 4 seconds or more.

See Tech 2 Diagnostic Trouble Code P0183 in Isuzu Engine Trouble Shooting Manual. (1E-368.)

- Machine Symptom: Hard starting
- Machine Operation: Operable
- ECM Assumed Parameters: Fuel temperature defaults to -20°C when starting, 70°C when operating
- Engine Malfunction Indicator: ON
- DTC/Malfunction Condition Resets: After malfunction is corrected, key OFF, key START

JW00603,0000166 –19–20AUG08–1/1

1080.02 — 5 Volt Power Supply #2 Malfunction (P1632)

5 Volt Power Supply #2 is more than 5.5 Volts or less than 4.5 Volts.

See Tech 2 Diagnostic Trouble Code P1632 in Isuzu Engine Trouble Shooting Manual. (1E-610.)

- Machine Symptom: Dark smoke at high altitude, low power at low altitude
- Machine Operation: Operable
- ECM Assumed Parameters: Barometric pressure defaults to 80 kPa, intake air temperature defaults to -10°C during start up and 25°C during operation, EGR cannot start
- Engine Malfunction Indicator: ON
- DTC/Malfunction Condition Resets: After malfunction is corrected, key OFF, key START

JW00603,0000179 –19–20AUG08–1/1

1239.01 — No Pump Pressure—First Stage (P0087)

Rail Pressure is less than 15 MPa for 3 seconds or more.

See Tech 2 Diagnostic Trouble Code P0087 in Isuzu Engine Trouble Shooting Manual. (1E-296.)

- Machine Symptom: Engine vibration, rough idle, dark smoke, low power, increasing engine speed may be difficult
- Machine Operation: Operable but steering is not possible
- ECM Assumed Parameters: Fuel injection is limited, no pilot injection, target fuel rail pressure is limited to 80 MPa
- Engine Malfunction Indicator: ON
- DTC/Malfunction Condition Resets: After malfunction is corrected, key OFF, key START, key OFF (for 10 seconds), key START

JW00603,000017A –19–20AUG08–1/1

Information Controller (ICF) Diagnostic Trouble Codes

For additional information on the information controller circuit. See Information Controller (ICF) Circuit Theory of Operation. (Group 9015-15.)

Information controller diagnostic trouble codes (DTCs) can be displayed on the monitor, connection with Service ADVISOR, or by connection with Dr. ZX.

- See Reading Diagnostic Trouble Codes With SERVICE ADVISOR Diagnostic Application (Group 9015-20.)
- See Reading Diagnostic Trouble Codes with Dr. ZX. (Group 9015-20.)
- See Reading Diagnostic Trouble Codes With Monitor Display. (Group 9015-20.)

TP97644,0000649 –19–12NOV07–1/1

14000.02 — Abnormal CAN Communication

NOT APPLICABLE TO THIS MACHINE

TP97644,000064A –19–12NOV07–1/1

14001.02 — ICF: Flash Memory: Read / Write Error

NOT APPLICABLE TO THIS MACHINE

TP97644,000064B –19–12NOV07–1/1

Harness Diagnostics

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❶ **Connector Check**	Check harness connection to coolant temperature sensor and heater and air conditioner controller. Are connectors clean and free of debris? Are pins straight and do they make a good connection?	**YES:** Go to Open Circuit Check. **NO:** Repair or replace connector or pins. – – –1/1

❷ **Open Circuit Check**	Disconnect harness from coolant temperature sensor and heater and air conditioner controller. Check for continuity between pins on controller and coolant temperature sensor connector. See Heater and Air Conditioner Harness (W6) Wiring Diagram. (Group 9015-10.) Is there continuity on the appropriate pins?	**YES:** Coolant temperature sensor malfunction. Replace sensor. **NO:** Repair or replace wiring harness. – – –1/1

-25 — Coolant Temperature Sensor Short Circuit

Coolant temperature sensor has a short circuit.

TP97644,0000660 –19–12NOV07–1/1

Harness Diagnostics

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❶ **Connector Check**	Check harness connection to coolant temperature sensor and heater and air conditioner controller. Are connectors clean and free of debris? Are pins straight and do they make a good connection?	**YES:** Go to Short Circuit Check. **NO:** Repair or replace connector or pins. – – –1/1

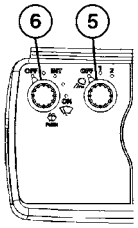
❶ Resistance Check	Disconnect fuel level sensor and check sensor resistance. Is sensor resistance within specifications?	**YES:** Go to Continuity Check. **NO:** Fuel level sensor malfunction. Replace sensor. – – –1/1

Fuel Level Sensor

Float Position	Resistance (Ohms)
Upper Limit (FULL)	6-10
3 / 4	26
1 / 2	33-43
1 / 4	53
Alarm Level	82-88
Lower Limit (EMPTY)	90-100

❷ Continuity Check	Disconnect fuel level sensor from harness. Connect pin 1 of fuel level sensor harness connector to ground. Check for continuity between monitor controller pin C2 and machine ground. Is there continuity between monitor and machine ground?	**YES:** Monitor controller malfunction. Replace monitor. See Monitor Controller Remove and Install. (Group 9015-20.) **NO:** Open circuit in harness between monitor controller and sensor. Check wires. See Short circuit in harness between monitor controller and sensor. Check wiring. See Cab Harness (W1) Wiring Diagram, See Machine Harness (W2) Wiring Diagram, and See Monitor Harness (W3) Wiring Diagram. (Group 9015-10.) – – –1/1

Windshield Wiper Controls Check



TX1000880 –UN–01DEC05
Switch Panel

5—Work Light Switch
6—Windshield Wiper and Washer Switch

NOTE: Front window must be fully closed and latched for this check.

Turn wiper switch (6) to first INT position.

LOOK: Does wiper operate intermittently?

Turn wiper switch to second INT position.

LOOK: Does wiper operate intermittently, but faster than when in first position?

Turn wiper switch to third INT position.

LOOK: Does wiper operate intermittently, but faster than when in second position?

Turn wiper switch to ON position.

LOOK: Does wiper operate continuously?

Move wiper switch to OFF position.

LOOK: Does wiper arm stop in park position at left side of windshield?

YES: Go to next check.

NO: Check that front window is fully latched and switch contacts make good connection.

NO: Check windshield wiper and washer 10 A fuse (F2) (marked WIPER). See Fuse and Relay Specifications. (Group 9015-10.)

NO: Check windshield wiper motor assembly circuit breaker F62. See Fuse and Relay Specifications. (Group 9015-10.)

NO: Check Wiring. See Cab Harness (W1) Wiring Diagram. (Group 9015-10.)

NO: See Windshield Wiper and Washer Circuit Theory of Operation for additional information. (Group 9015-15.)

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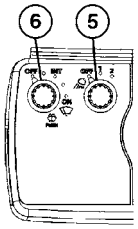
Windshield Washer Circuit Check

IMPORTANT: Washer motor may be damaged if washer switch is held for more than 20 seconds, or continually operated with no fluid in the washer fluid tank.

NOTE: The wiper cannot operate with the upper front window open. The washer can operate with the upper front window open. When closing window, check that window upper left corner makes good contact with the cab.



TX1000880 –UN–01DEC05
Switch Panel

5—Work Light Switch
6—Windshield Wiper and Washer Switch

NOTE: Front window should be fully closed and latched for this check.

Push washer switch (6).

LOOK: Is washer fluid supplied to windshield?

Turn windshield wiper (6) ON.

LISTEN: Does wiper circuit click?

LOOK: Does windshield wiper operate?

YES: Go to next check.

NO: Check washer fluid level. See Check Windshield Washer Fluid Level. (Operator's Manual.)

NO: Check that the window upper left corner is making good contact with the cab.

NO: Check windshield wiper and washer 10 A fuse (F2) (marked WIPER). See Fuse and Relay Specifications. (Group 9015-10.)

NO: Check wiring harness. See Cab Harness (W1) Wiring Diagram. (Group 9015-10.)

NO: Check washer pump. See Windshield Wiper and Washer Circuit Theory of Operation for additional information. (Group 9015-15.)

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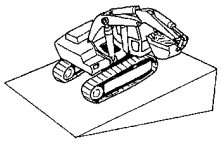
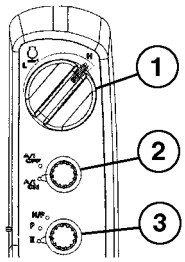
Swing Power Check



T140540

T140540 –UN–17MAY01

Machine Position



TX1000170 –UN–10NOV05

Switch Panel

1—Engine Speed Dial
2—Auto-Idle Switch
3—Power Mode Switch

Fill the bucket with dirt.

Position machine on a hillside with a slope of approximately 25%. If a hill is not available, raise one side of machine approximately 300 mm (1 ft) with the boom and then put a block under the track.

Move arm to the fully extended position. Raise boom so arm-to-bucket pivot pin is the same height as boom-to-frame pivot pin.

Swing upperstructure right so it is 90 degrees to the slope.

Turn engine speed dial (1) to H (fast idle) position.

Turn power mode switch (3) to HP (high power) mode.

Actuate the swing function to swing uphill.

LOOK: Does upperstructure swing uphill?

Swing upperstructure 180 degrees left and repeat procedure.

Turn engine speed dial (1) to H (fast idle) position.

Power mode switch (3) in HP (high power) mode.

Actuate the swing function to swing uphill.

LOOK: Does upperstructure swing uphill?

YES: Go to next check.

NO: See Swing Motor Crossover Relief Valve Test and Adjustment. (Group 9025-25.)

NO: Check swing motor leakage. See Swing Motor Leakage Test. (Group 9025-25.)

NO: See Diagnose Swing Circuit Malfunctions. (Group 9025-15.)

NO: Check swing spool in control valve. See Control Valve Remove and Install. (Group 3360.)

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	FEEL/LISTEN: Does vent position change? *LOOK: Does fan speed change to maximum and temperature setting decrease?* *LOOK: Does full cool (FC) appear in the temperature setting area?* *FEEL: Does cool air come from the vents?* Press A/C switch. *LISTEN: Does air conditioner compressor clutch solenoid "click"? (Heater is ON in manual mode.)* *LOOK: Do indicator lights above A/C and AUTO switches go OFF?* Press temperature control switch to maximum heat position. *FEEL/LISTEN: Does vent position change?* *LOOK: Does fan speed change to maximum and temperature setting increase?* *LOOK: Does full heat (FH) appear in the temperature setting area?* *FEEL: Does warm air come from the vents?* Press A/C switch. *LISTEN: Does air conditioner compressor clutch solenoid "click"? (Air conditioner and heater are ON in manual mode.)* Press temperature control switch to maximum cold position. *FEEL/LISTEN: Does vent position change?* *LOOK: Does fan speed change to maximum and temperature setting decrease?* *LOOK: Does full cool (FC) appear in the temperature setting area?* *FEEL: Does cool air come from the vents?* Press OFF switch. *LOOK: Are air conditioner and heater OFF? (Push AUTO to start A/C and heater).* Press AUTO switch.	**YES:** Check complete. **NO:** Heater fan does not blow air. Check air conditioner and heater 20 A fuse (F3) (marked HEATER). See Fuse and Relay Specifications. (Group 9015-10.) **NO:** Check system operation. See Heater and Air Conditioner Operational Checks. (Group 9031-25.) **NO:** Check wiring harness. See Cab Harness (W1) Wiring Diagram. (Group 9015-10.) –19– –2/2

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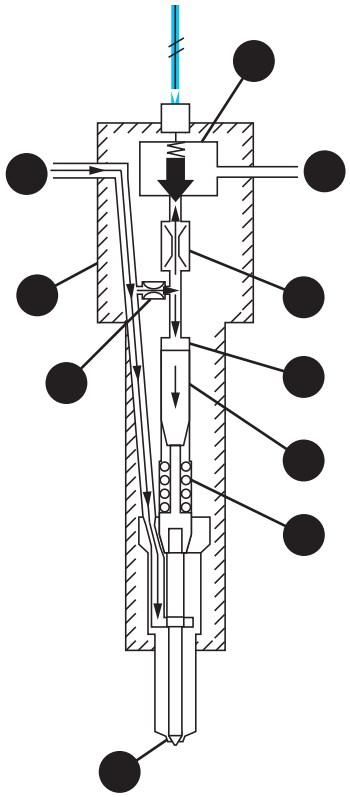
No Injection

Fuel from the high pressure common rail enters the electronic injector at the fuel inlet (11). When no current is supplied to the two-way valve (10), the valve spring (16) and hydraulic pressure of the fuel in the control chamber (14) cause the hydraulic piston (15) to push down and close the nozzle (17). High pressure fuel is held inside the nozzle until injection.

3—Electronic Injector
10—Two-Way Valve
11—Fuel Inlet
12—Orifice 1
13—Orifice 2
14—Control Chamber
15—Hydraulic Piston
16—Valve Spring
17—Nozzle
18—Fuel Leak-Off Line



TX1003033 –UN–25JAN06

No Injection

JL45346,0000007 –19–31JAN08–5/7

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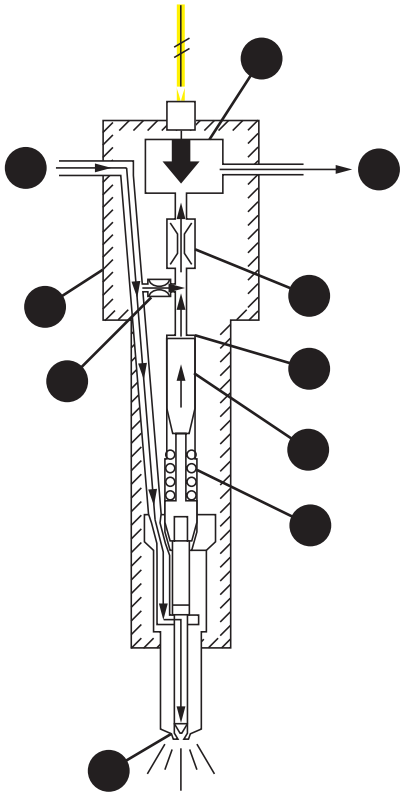
Begin Injection

Injection begins when current is applied from the ECM to open the two-way valve (10). With valve open, fuel from the control chamber (14) flows through orifice 1 (12) out of the injector to the fuel leak-off line (18). The fuel is then routed back to the fuel tank. As the fuel from the control chamber exits the injector, the force is removed from the hydraulic piston (15), allowing fuel through the nozzle (17) to start the injection process.

3—Electronic Injector
10—Two-Way Valve
11—Fuel Inlet
12—Orifice 1
13—Orifice 2
14—Control Chamber
15—Hydraulic Piston
16—Valve Spring
17—Nozzle
18—Fuel Leak-Off Line



TX1003034 –UN–25JAN06

Begin Injection

Continued on next page

JL45346,0000007 –19–31JAN08–6/7

1—Exhaust Gas Recirculation (EGR) Valve
2—Exhaust Manifold
3—Intake Manifold
4—Exhaust Gas Recirculation (EGR) Cooler
6—Engine
7—Intake Air from Intercooler
8—From Air Cleaner
9—To Intercooler
10—Exhaust
11—Engine Coolant In
12—Engine Coolant Out
A1—Engine Control Module (ECM)
B1—Crankshaft Position Sensor
B2—Camshaft Position Sensor
B3—Barometric Pressure Sensor
B4—Engine Coolant Temperature Sensor
B7—Intake Air Temperature Sensor
B12—Fuel Rail Temperature Sensor
B60—Exhaust Gas Recirculation (EGR) Position Sensor
M3—Exhaust Gas Recirculation (EGR) Valve Actuator
Blue—Cooled Gas
Red—Hot Gas
Yellow—Sensor Signal Wire
Brown—Exhaust Gas Recirculation (EGR) Valve Actuator Wire

Exhaust Gas Recirculation (EGR) valve (1) recirculates a portion of the engine exhaust gas into the intake manifold to mix with intake air. The recirculation of exhaust gas helps lower the combustion temperature, which limits emissions of nitrogen oxide (NOx).

The amount of EGR gas is controlled by opening and closing the EGR valve (1). EGR valve (1) is installed between the exhaust manifold (2) and intake manifold (3). The engine control module (ECM) (A1) operates the EGR valve based on engine speed, engine coolant temperature, intake air temperature, fuel injection amount, and barometric pressure. The ECM uses the EGR position sensor (B60) to detect the EGR valve position. The ECM supplies power to the EGR valve actuator (M3) to open and close the EGR valve.

The EGR cooler (4), through which EGR gas passes, cools down high temperature EGR gas. The cooled EGR gas mixes with intake air in the intake manifold to lower the combustion temperature, which limits NOx emissions.

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JL45346,0000005 –19–23JAN08–2/2

❹ **Starting System Check**	Check the starting system. 1. Check fuses. See Fuse Test. (Group 9015-20.) 2. ECM Relay (K14) check. See Relay Test. (Group 9015-20.) 3. Battery voltage check. See Component Checks. (Group 9015-20.) 4. Starter protection relay (K18) check. See Component Checks. (Group 9015-20.) 5. Glow plug relay (K16) check (colder temperatures). See Component Checks. (Group 9015-20.) For more information on starting system: See Starting and Charging Circuit Theory of Operation. (Group 9015-15.) See Electrical Component Checks. (Group 9015-20.) Is starting system ok?	**YES:** Go to Fuel System Test. **NO:** Repair starting system and test again. – – –1/1

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❺ **Fuel System Test**	Check fuel system in the following procedure. 1. Check the high pressure line and low pressure line for leaks, kinks, or obstructions. Check in the following order. • Fuel filters (water separator and fuel filter). • Fuel tank (pump strainer). • Fuel system lines. 2. Check fuel lines, fuel filter, and inside of the fuel tank for freezing or waxing (cold temperatures). 3. Check the supply line inside the fuel tank for debris. Are any fuel system problems present?	**YES:** Repair and test again. **NO:** Go to Electrical Interference Check. – – –1/1

❻ **Electrical Interference Check**	Check the condition of accessory electrical equipment such as radio and lights. Does the engine start when the accessory electrical equipment is powered off?	**YES:** Repair electrical equipment. **NO:** Go to Mechanical Engine Check. – – –1/1

❹ **Cooling Fan System Check**	• Check fan drive system for operating speed. • Check cooling belt tension. See Serpentine Belt Check and Adjust. (Group 9010-25.) Is cooling fan operating at proper speeds?	**NO:** Adjust and repair or replace parts as necessary and check again. – – –1/1

Auto-Idle Does Not Work

TP97644,000067B –19–01FEB08–1/1

Auto-Idle Does Not Work Diagnostics Procedure

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❶ **Check Engine Speed**	Check that engine speed is set higher than 1200 rpm (auto-idle speed).	**YES:** Engine speed is above Auto-Idle Speed: Go to Active DTC Test. **NO:** Set engine speed above 1200 rpm. – – –1/1
❷ **Active DTC Test**	To access active DTCs see the following: See Reading Diagnostic Trouble Codes With Monitor Display. (Group 9015-20.) See Reading Diagnostic Trouble Codes With Dr. ZX. (Group 9015-20) See Reading Diagnostic Trouble Codes With Service ADVISOR™ Diagnostic Application. (Group 9015-20) Are any DTCs detected?	**NO:** No active DTCs present: Go to Travel Pressure Sensor Check. **YES:** Diagnose active DTCs. – – –1/1
❸ **Travel Pressure Sensor Check**	Check for travel pilot pressure. Using monitor, check travel pressure sensor. See Monitor Data Items. (Group 9015-20.) Does monitor display pressure?	**YES:** Travel pressure is displayed: Go to Attachment Pressure Sensor Check. **NO:** Check travel pressure sensor circuit. See System Functional Schematic. (Group 9015-10.) – – –1/1

❹ **Fuel System Test**	Check fuel system in the following procedure. 1. Check the high pressure line and low pressure line for leaks, kinks, or obstructions. Check in the following order. • Fuel filters water separator and final filters. • Fuel tank pump strainer. • Fuel system lines. 2. Check fuel lines, fuel filter, and inside of the fuel tank for freezing or waxing (cold temperatures). 3. Check the supply line inside the fuel tank for debris. 4. Supply fresh fuel from a container other than the fuel tank. a. Make sure fresh fuel is being delivered to engine. b. Replace the fuel in the fuel tank and lines. c. Start the engine, bleed air from fuel, operate the machine, and check for trouble symptoms. Are any fuel system problems present?	**YES:** Repair and replace necessary parts or fuel and test again. **NO:** Go to Exhaust System Check. – – –1/1
❺ **Exhaust System Check**	Check for crush, breakage, or exhaust leakage in the exhaust pipe. Is exhaust in good condition?	**YES:** Go to Mechanical Engine Check. **NO:** Repair or replace parts as necessary and test again. – – –1/1
❻ **Mechanical Engine Check**	Check the mechanical parts of the engine, and repair if needed. • Compression pressure See Engine Compression Pressure Test. (Group 9010-25.) • Valves See Engine Valve Lash (Clearance) Check and Adjust. (Group 9010-25.) • Injector Perform Injector Balance Test (Injector Misfire Test): See Engine Control Module (ECM) Special Function Using Dr. ZX. (Group 9015-20.) Are mechanical parts of engine OK?	**YES:** Go to Engine Control Module (ECM) Check. **NO:** Repair or replace parts as necessary and test again. – – –1/1

- Damaged valves
- Blown head gasket

JL45346,0000003 –19–31JAN08–3/3

Air Filter Restriction Indicator Switch Test

SPECIFICATIONS	
Air Filter Restriction Indicator Must Come On At Vacuum	5.0 kPa 50 mbar 20 in. water

SERVICE EQUIPMENT AND TOOLS
1/8 F NPT x 1/8 F NPT x 1/8 M NPT Male Run Tee Fitting
0—15 kPa (0—150 mbar) (0—60 in. water) Vacuum Gauge

Continued on next page

JL45346,0000004 –19–31JAN08–1/2

Electrical Diagram Information

NOTE: All System Functional Schematics, Circuit Schematics, and Wiring Diagrams are shown with key switch in the OFF position.

Explanation of Wire Markings

Continued on next page

TP97644,0000696 –19–12NOV07–1/9

Explanation of Wire Markings

Electrical harness wires are identified by color, with no number stamped on wire. Wire numbers are used on some connector drawings simply as reference numbers, useful in tracing wires through the harness.

Some wires are solid wire colors. These would be identified by one color name such as RED or BLK or GRN.

Other wire colors are identified with two color names. These are solid wires with a narrow stripe. For example, a wire identified as RED/WHT would be a primarily RED wire, with a WHT stripe. A wire identified as WHT/RED would be a primarily WHT wire with a RED stripe.

Following is a listing of wire color abbreviations used on drawings.

- BLK—Black
- BLU—Blue
- BRN—Brown
- GRN—Green
- GRY—Grey
- LTGRN—Light Green
- ORG—Orange
- PNK—Pink
- PUR—Purple
- RED—Red
- VLT—Violet
- WHT—White
- YEL—Yellow

Not all wire colors are not available at time of first production. In those cases the wire is identified by a number only. Wire color will be added as soon as it is available.

TP97644,000069F –19–13NOV07–1/1

- S9—Windshield Wiper and Washer Switch (SE6)(W7)
- S10—Work Light Switch (SE6)(W7)
- S11—Travel Speed Switch (SE6)(W7)
- S12—Power Mode Switch (SE6)(W7)
- S13—Travel Alarm Cancel Switch (SE9)(W15)
- S14—Engine Stop Switch (SE1)(W1)
- S23—Seat Heater Switch (SE20)(W13)
- S24—Seat Compressor Switch (SE20)
- S30—Right Switch A (SE15)(W14)
- S31—Right Switch B (SE15)(W14)
- S32—Left Switch A (SE15)(W14)
- S33—Left Switch B (SE15)(W14)
- S34—Right Enable Switch (SE15)(W14)
- S35—Left Enable Switch (SE15)(W14)
- V1—Battery Relay Diode (SE1)(W1)
- V3—Load Dump Relay Diode (SE2)(W1)
- V4—Security Relay Diode (SE2)(W1)
- V5—Starter Relay Diode (SE2)(W1)
- V6—Auxiliary Power Connector Diode (SE16)(W1)
- V7—Starter Cut Relay Diode (SE1)(W1)
- V8—Pilot Shutoff Diode (SE2)(W11)
- V30—Right Solenoid Diode B (SE15)
- V31—Right Solenoid Diode A (SE15)
- V32—Left Solenoid Diode B (SE15)
- V33—Left Solenoid A (SE15)
- V40—Selector Valve Solenoid Valve Diode (SE8)(W20)
- V41—Secondary Relief Solenoid Valve Diode (SE9)(W20)
- V42—Accumulator Solenoid Valve Diode (Not Used) (SE9)
- V43—2-Speed Activation Solenoid Valve Diode (SE9)(W21)
- W1—Cab Harness (W1)
- W2—Machine Harness (W2)
- W3—Monitor Harness (W3)
- W4—Engine Harness (W4)
- W6—Heater and Air Conditioner Harness (W6)
- W7—Right Console Harness (W7)
- W8—Pump Harness (W8)
- W9—Auxiliary Fuse Box Harness (W9)
- W10—Travel Alarm Cancel Switch Sub Harness (W10)
- W11—Pilot Shutoff Switch Harness (W11)
- W12—Air Suspension Seat Harness (W12)
- W13—Seat Heater Switch Harness (W13)
- W14—Multi-Function Pilot Control Lever Harness (W14)
- W15—Travel Alarm Cancel Switch Harness (W15)

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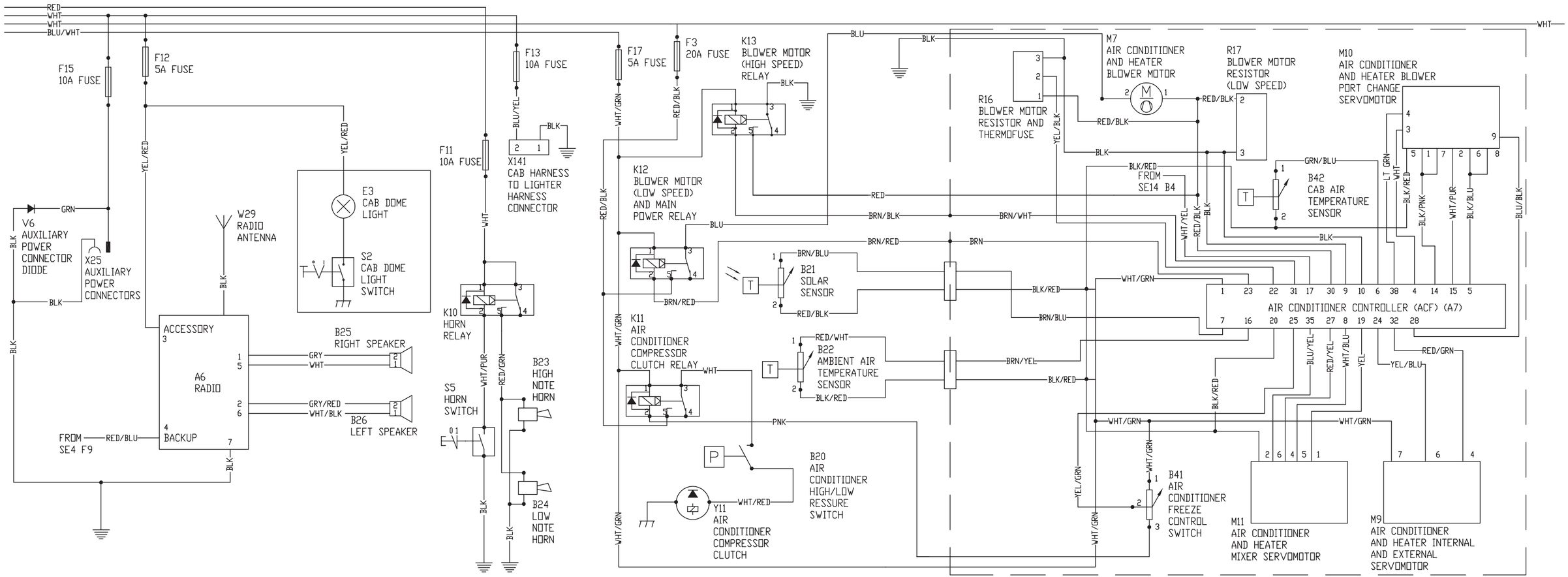
TX1034411 –19–29JAN08



System Functional Schematic (6 of 7) (SE16, SE17, SE18)

B25—Right Speaker
B26—Left Speaker
E3—Cab Dome Light
H2—Security Alarm
H3—Monitor Warning Alarm
K1—Load Dump Relay
K2—Pilot Shutoff Solenoid Relay
K3—Security Alarm Relay
K4—Starter Relay
K5—Security Relay
K6—Windshield Wiper Relay
K7—Drive Light Relay
K8—Boom Work Light Relay
K9—Windshield Washer Relay
K10—Horn Relay
K11—Air Conditioner Compressor Clutch Relay
K12—Blower Motor (Low Speed) and Main Power Relay
K13—Blower Motor (High Speed) Relay
K14—Engine Control Module (ECM) Relay
M5—Windshield Wiper Motor
S2—Cab Dome Light Switch
S5—Horn Switch
S14—Engine Stop Switch
V4—Security Relay Diode
V5—Starter Relay Diode
W38—Cab Harness Ground 4
X2—Dr. ZX 6-Pin Connector
X11—Cab Harness-to-Pilot Shutoff Solenoid Valve Harness Connector
X25—Auxiliary Power Connectors
X26—Optional Connector
X32—Cab Harness-to-Information Controller 31-Pin Connector
X34—CAb Harness-to-Information Controller 17-Pin Connector
X45—Option 2 12-Pin Connector
X70—Cab Harness 3-Pin Connector (Not Used)
X72—Cab Harness-to-Pilot Shutoff Switch Harness Connector
X80—Engine Speed Dial Main Controller Side Connector (S1)
X81—Engine Speed Dial Switch Panel Side Connector (1)
X82—Engine Speed Dial Ground Main Controller Side Connector (S2)
X83—Engine Speed Dial Ground Switch Panel Side Connector (2)
X84—Engine Control Module (ECM) Power and Signal Connector (E1)
X85—Engine Control Module (ECM) Return Connector (E2)
X98—Cab Harness ML Connector (Not Used)

TP97644,00006A5 –19–07JAN08–5/5

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B41—Air Conditioner Freeze Control Switch
B42—Cab Air Temperature Sensor
M7—Air Conditioner and Heater Blower Motor
M9—Air Conditioner and Heater Internal and External Servomotor
M10—Air Conditioner and Heater Blower Port Change Servomotor
M11—Air Conditioner and Heater Mixer Servomotor
R16—Blower Motor Resistor and Thermofuse
R17—Blower Motor Resistor (Low Speed)
X38—Cab Harness-to-Heater and Air Conditioner Harness 16-Pin Connector
X39—Cab Harness-to-Heater and Air Conditioner Harness 4-Pin Connector
X48—Heater and Air Conditioner Harness-to-Air Conditioner and Heater Controller 20-Pin Connnector
X49—Heater and Air Conditioner Harness-to-Air Conditioner and Heater Controller 16-Pin Connnector

TP97644,00006AD –19–13NOV07–2/2

A8—12-Volt Power Converter
F—Fuse Box
G5—12-Volt Power Outlet
W9—Auxiliary Fuse Box Harness
W23—12-Volt Power Converter Harness
X26—Optional Connector
X43—Auxiliary Fuse Box Connector
X44—Optional Light Connector
X60—Air Suspension Seat Harness Power Connector
X61—Rear Cab Light Connector
X62—12 Volt Power Unit Connector
X63—IMOBI Connector
X64—Quick Hitch Connector
X65—Cab Auxiliary Power Connector 3
X66—Front Cab Light 2 Connector
X67—Warning Lamp Connector
X68—Cab Auxiliary Power Connector 2
X69—Front Cab Light 1 Connector

TP97644,00006B2 –19–30JAN08–2/2

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K20—Seat Heater Relay
M12—Seat Air Compressor motor
R18—Seat Heater
X60—Air Suspension Seat Harness Power Connector
X76—Air Suspension Seat Harness-to-Heated Seat Switch Harness 3-Pin Connector

TP97644,00006B9 –19–13NOV07–2/2

Seat Heater Switch Harness (W13) Component Location

For Seat Heater Switch Harness (W13) Component Location, See Air Suspension Seat Harness (W12) Component Location. (Group 9015-10.)

TP97644,00006BA –19–13NOV07–1/1

X11—Cab Harness-to-Pilot Shutoff Solenoid Valve Harness Connector

Y10—Pilot Shutoff Solenoid

MT89988,000041A –19–11JAN08–2/2

Lighter Harness (W19) Component Location

For Lighter Harness (W19) Component Location, See Cab Harness (W1) Component Location. (Group 9015-10.)

MT89988,0000416 –19–15JAN08–1/1

B46—Arm Out Pressure Sensor
V43—2-Speed Activation Solenoid Valve Diode
X87—Attachment Harness-to-Two Speed Harness Connector
Y43—2-Speed Activation Solenoid Valve
Y44—Flow Rate Adjustment Solenoid Valve (Not Used)

TP97644,00006C5 –19–25JAN08–2/2

Starting Circuit—The starting circuit consists of the following components:

- Engine control module (ECM) (A1)
- Main controller (MCF) (A3)
- Monitor controller (MON) (A4)
- Information controller (ICF) (A6)
- Batteries (G1 and G2)
- Starter relay (K4)
- Security relay (K5)
- Engine control module (ECM) relay (K14)
- Starter protection relay (K18)
- Battery relay (K19)
- Starter motor (M1)
- Key switch (S1)
- Pilot shutoff switches (S3 and S4)
- Engine stop switch (S14)
- Security diode (V4)
- Starter Cut Relay Diode (V7)
- Starter relay diode (V5)
- Pilot shutoff diode (V8)

When key switch (S1) is moved to the START (ST) position, power is applied from key switch terminal ST to starter relay (K4) terminals 1 and 3. Power from Key switch terminal M energizes battery relay (K19). The energized battery relay supplies power to starter motor (M1) terminal B and starter protection relay (K18) terminal B.

Power from de-energized starter relay (K4) terminal 4 is applied to starter protection relay (K18) terminal S, and engine control module (ECM) terminal 46. The starter protection relay (K18) is energized. Once relay (K18) is energized, terminals B and C are internally connected, which supplies power from terminal C to starter motor (M1) terminal S. Starter motor (M1) then cranks the engine.

Power from key switch terminal M is also supplied through controller key switch signal 5 A fuse (F18) to main controller (MCF) (A3) terminal B16, monitor controller (MON) (A4) terminal A7, information controller (ICF) (A5) terminal C7, and engine control module (ECM) (A1) terminal 24. When engine control module terminal 24 receives power, engine control module terminals 21 and 40 apply power to engine control module (ECM) relay (K14) terminal 1, energizing the relay. Power from engine control module (ECM) 30 A fuse (F8) is applied through energized relay (K14) to engine control module terminals 2 and 5, and also to engine stop switch (S14) terminal 1.

When engine stop switch (S14) is in the RUN position, power from energized engine control module relay (K14) terminal 5 is removed from engine control module (ECM) terminal 47. When engine stop switch (S14) is in the STOP position, power from energized control module relay (K14) terminal 5 is present at engine control module terminal 47. When power is present at engine control module terminal 47, starter relay (K4) terminal 2 is connected to ground at engine control module terminal 14, energizing the relay. Energized relay (K4) removes power from starter protection relay (K18) terminal S, and engine control module terminal 46. With starter protection relay de-energized, power is then removed from starter motor (M1) terminal S, thus preventing the starter from cranking the engine.

Once the engine is running, engine control module (ECM) terminal 14 applies ground to starter relay (K4) terminal 2, energizing the relay. The energized relay (K4) then removes power from starter protection relay (K18) terminal S. Starter motor (M1) terminal S is then removed from power, preventing starter from engaging while engine is running.

When a or security code error is detected, the monitor controller (MON) (A4) terminal A4 is connected to ground, energizing starter relay (K4). Energizing starter relay removes power from starter protection relay (K18) terminal S. With starter protection relay de-energized, current is not supplied to starter motor (M1) terminal S, preventing engine from starting.

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Temperature Sensors—Intake Air temperature sensor (B7) and manifold air temperature sensor (B9) provide signals to the engine control module (ECM) for fuel injection control. The intake air temperature sensor sends a varying signal to engine control module terminal 72. Engine control module terminal 60 provides ground for the intake air temperature sensor. The manifold air temperature sensor sends a varying signal to engine control module terminal 74. Engine control module terminal 109 provides ground for the manifold air temperature sensor.

Engine coolant temperature sensor (B4) detects engine coolant temperature. The sensor sends a varying signal to the engine control module (ECM) terminal 84. The sensor resistance is low when coolant temperature is high and resistance is high when coolant temperature is low. Engine control module terminal 79 provides ground for the engine coolant temperature sensor. The engine coolant temperature sensor also sends the signal to monitor controller (MON) (A4) terminal C8 and Air Conditioner Controller (ACF) terminal 17.

Fuel Injection Pressure—The engine control module (ECM) determines the appropriate fuel injection pressure based on engine speed, fuel injection amount, and common rail pressure. The engine control module controls fuel injection pressure by activating and deactivating fuel pump control valve solenoid (Y7). When the fuel pump control valve solenoid is deactivated, fuel is allowed to flow into the pumping chambers. When the engine control module activates the fuel pump control valve solenoid, the valve to the pumping chamber is closed. This prevents any fuel from flowing into the pumping chambers. The high pressure fuel pump raises the pressure of the fuel in the chamber to the required pressure for injection. When the fuel pressure exceeds the delivery valve opening pressure, the fuel is routed to the common rail, distributing fuel to electronic injectors 1—4 (Y1—Y4).

Fuel Injection Amount—The engine control module (ECM) controls the fuel injection amount based on inputs form the sensors on the engine and from messages sent over the controller area network (CAN). Main controller (A3) determines target engine speed using signals received from engine speed dial (R15) and various pressure sensors and switches on the machine. The main controller uses the controller area network (CAN) to send an engine speed request to the engine control module based on the target engine speed.

NOTE: For additional information on engine speed control, see Main Controller (MCF) Circuit Theory of Operation. (Group 9015-15.)

After receiving the requested engine speed information from the main controller, the engine control module (ECM) compares the requested speed with the actual engine. The engine control module varies the fuel injection amount by controlling how long electronic injectors 1—4 (Y1—Y4) are activated and deactivated.

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Fuel Injection Timing—The engine control module (ECM) controls fuel injection timing based on inputs from the sensors on the engine and from messages sent over the controller area network (CAN). The camshaft and crankshaft position sensors allow the engine control module to precisely determine piston position in relation to TDC so that the engine control module can activate the correct electronic injector at the correct time.

Fuel Injection Rate—To improve combustion in the cylinders, the engine control module (ECM) may inject a small amount of fuel (pilot injection) into the cylinder prior to the main injection event. After this pilot injection ignites, the engine control module injects the main supply of fuel.

Fuel Injection Amount Correction—The engine control module (ECM) adjusts the fuel injection amount based on starting engine speed and atmospheric conditions. The engine control module adjusts the fuel injection amount during starting until the engine speed reaches a predetermined threshold. The engine control module adjusts the fuel injection amount to aid in starting.

Continued on next page

The travel alarm circuit consists of a travel pressure sensor (B34), main controller (A3), travel alarm (H4), and a travel alarm cancel switch (S13).

The circuit is designed to warn bystanders of machine movement by signaling with an audible alarm any time the travel levers are moved.

When the travel levers are moved, travel pressure sensor (B34) senses pilot pressure and sends a signal to the main controller (A3) terminal C2. The main controller then sends a signal from terminal A28 to the travel alarm (H4) terminal 2 to activating the alarm.

Power to the travel alarm terminal 1 comes from travel alarm 5 A fuse (F5).

When pressed, the travel alarm cancel switch (S13) applies ground to terminal 4 of the travel alarm (H4). The travel alarm cancel switch (S13) must be pressed and released in order to cancel the alarm. The travel alarm must sound for 10 seconds before the travel alarm cancel switch will deactivate it. The travel alarm (H4) is reset when the control levers are returned to the neutral position. The travel alarm cancel switch (S13) must be pressed and released again to cancel the alarm.

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The accumulator solenoid valve diode (V42) suppresses voltage spikes created when the solenoid valve is activated or deactivated.

NOTE: Accumulator control will not work properly unless appropriate kits are installed on machine.

2-Speed Selector—The 2-Speed selector icon on the monitor controls the 2-speed activation solenoid valve (Y43) and the flow rate adjustment solenoid valve (Y44). The 2-speed activation solenoid valve is powered by travel alarm 5 A fuse (F5) and grounded by the main controller (MCF) pin B23. The flow rate adjustment solenoid valve is powered by main controller (MCF) pin A7 and grounded on pin A23. When activated, the 2-speed activation solenoid valve sends pilot oil to the bypass shutoff valve blocking hydraulic oil from pump 1 from returning to the hydraulic oil tank. The activated 2-speed activation solenoid valve also sends pilot oil to the auxiliary flow combiner valve to combine oil flow from pump 1 with that of pump 2. This allows for combined oil flow from pump 1 and pump 2 to operate the attachment.

When 2-Speed is activated, the flow rate adjustment solenoid valve can also be activated. When an arm-out, boom-up, swing or travel function is actuated in combination with the attachment function, the flow rate adjustment solenoid valve is activated. When the flow rate adjustment solenoid valve is activated, pilot oil is routed to the auxiliary flow rate control valve. This adjusts the auxiliary flow rate control valve to provide more or less priority to the arm-out, boom-up, swing and travel functions over the attachment function. The main controller (MCF) can vary the signal to the flow rate adjustment solenoid valve to vary the pilot oil pressure at the auxiliary flow rate control valve. This allows for adjustment of the priority of the attachment function over arm-out, boom-up, swing and travel. The 2-speed selector status can be adjusted for each attachment using Dr. ZX. See Main Controller (MCF) Setup Using Dr. ZX (Group 90-20.) Adjustments to the priority level can be made in the monitor in the attachment adjustment menu. See Monitor Menu Operation. (Group 9015-16.)

Continued on next page

NOTE: The monitor can display up to 20 diagnostic trouble codes for each controller. The Main Fault Code screen can display 10 diagnostic trouble codes at one time. If the Main Fault Code screen displays 10 codes, use the buttons (1) and (2) to view any additional codes on the next screen.

7. View the diagnostic trouble codes for the selected controller.

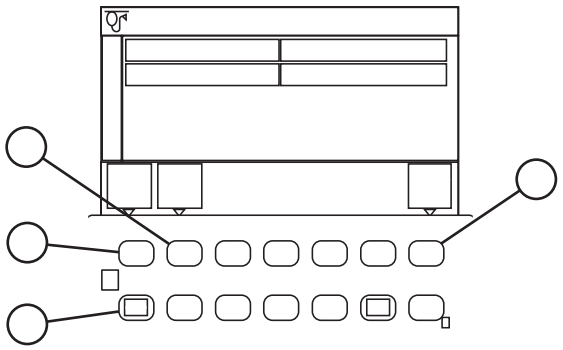
   See Main Controller (MCF) Diagnostic Trouble Codes. (Group 9001-10.)

   See Engine Control Module (ECM) Diagnostic Trouble Codes. (Group 9001-20.)

   See Information Controller (ICF) Diagnostic Trouble Codes. (Group 9001-30.)

   See Monitor Controller (MON) Diagnostic Trouble Codes. (Group 9001-50.)

8. Press the back button (12) to return to the Troubleshooting screen and select another controller, or push the Return to Default Screen button (6) to display the default screen.



TX1002679 –19–20JAN06

Main Fault Code Screen

1—Button 1
2—Button 2
6—Return to Default Screen Button
12—Back Button

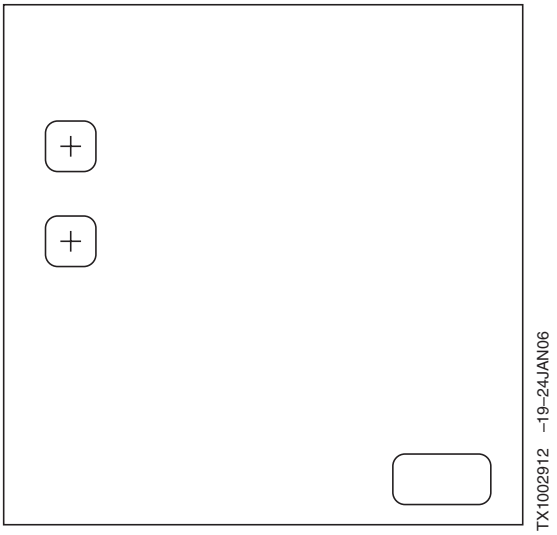
MR24579,000033A –19–23APR08–5/5

Reading Diagnostic Trouble Codes With Dr. ZX

1. After connecting with Dr. ZX, select Self-Diagnostic Results.

   For connection procedure to machine, See Personal Digital Assistant (PDA) Connection to Excavator Using DR. ZX Application. (Group 9015-20.)

NOTE: Screen will display "Communicating" while sending and receiving data.



Function Selection Screen

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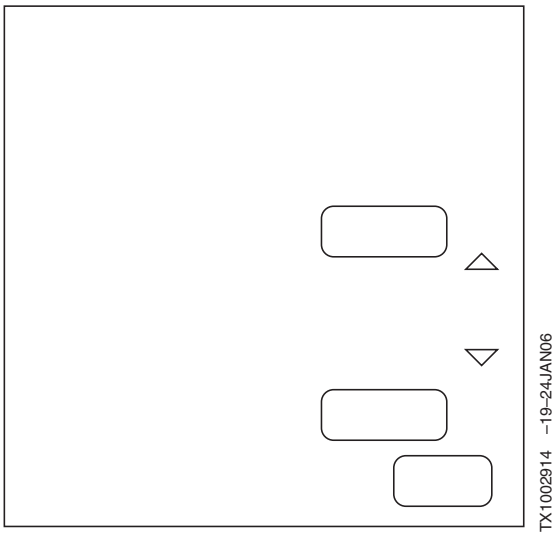
2. PDA will display all controllers on the machine. Any controller with a diagnostic trouble code will have a fault button after its name.

   Select Fault button to display diagnostic trouble codes.

   ESC will return to Function Selection screen.



Controller Self Diagnostic Screen

Continued on next page

MR24579,0000323 –19–16JAN08–2/5

Main Controller Data Items			
Selecting	**Monitoring**	**Data**	**Unit**
ATT. Proportional Valve Output	ATT P/S Valve Output	Control instruction signal to ATT. proportional valve output	MPa
Pump 1 Flow Rate Limit Proportional Valve Output (Optional) FB	Pump 1 Flow Rate Limit P/S/V Out FB	Feedback of pump 1 flow rate limit proportional valve output	mA
Pump 2 Flow Rate Limit Proportional Valve Output FB	Pump 2 Flow Rate Limit P/S/V Out FB	Feedback of pump 2 flow rate limit proportional valve output	mA
Pump Torque Proportional Valve Output FB	Pump Torque P/S Valve Output FB	Feedback of pump torque proportional valve output	mA
ATT Proportional Valve Output (Optional) FB	ATT P/S Valve Output FB	Feedback of ATT proportional valve output	mA
Arm Regenerative Proportional Valve Output FB	Arm Regenerative P/S/V Output FB	Feedback of arm regenerative proportional valve output	mA
Travel Mode Control Pressure FB	Travel 2-Speed Chg. Ovr. Pressure FB	Feedback of travel mode control pressure	mA
Travel Alarm (Optional)	Travel Alarm	Travel alarm action/no action status	Action/No Action
Swing Alarm (Optional)	Swing Alarm	Swing alarm action/no action status	Action/No Action
Load Alarm (Optional)	Load Alarm	Load alarm action/no action status	Action/No Action
Hydraulic Oil Temperature	Hydraulic Oil Temperature (HOT)	Input signal from hydraulic oil temperature sensor	°C
Overload Alarm ON/OFF Switch	Load Alarm ON/OFF Switch	Overload alarm switch ON/OFF status	ON, OFF

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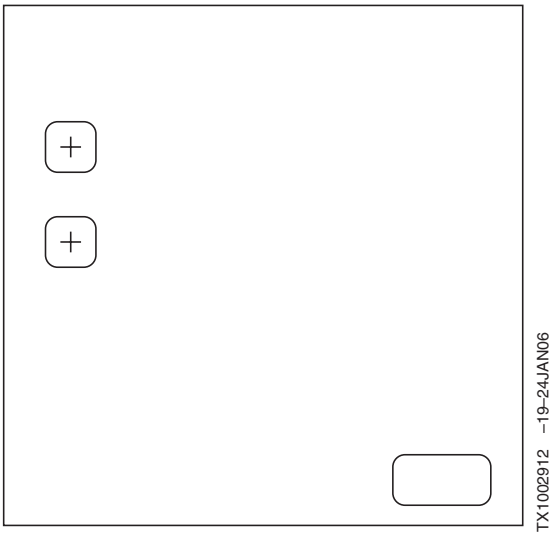
Main Controller (MCF) Special Function Using Dr. ZX

1. Start Dr. ZX and select Select Controller.

   For connection procedure to machine, See Personal Digital Assistant (PDA) Connection to Excavator Using DR. ZX Application. (Group 9015-20.)

NOTE: Screen will display "Communicating" while sending and receiving data.



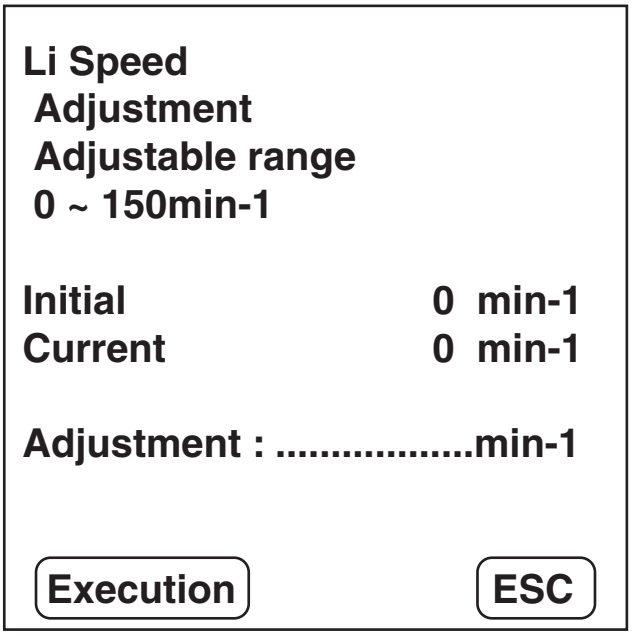
Function Selection Screen

Continued on next page

MR24579,0000325 –19–16JAN08–1/8

b. Each parameter will list a range in which the parameter can be adjusted, an initial setting and a current setting. Enter a number to change the current setting and select Execution to advance to the confirmation screen.

   ESC will return to List of Main Controller Parameters screen.



Main Controller Parameter Adjustment Range

9015
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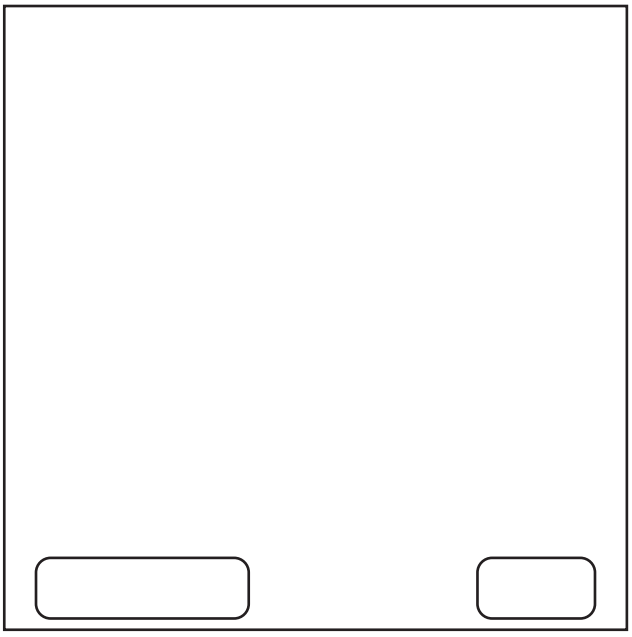
35

MR24579,0000326 –19–16JAN08–10/20

c. Dr. ZX will confirm the data entered in the previous screen. Select Execute to change the parameter.

   ESC will return to List of Main Controller Parameters screen.



Main Controller Parameter Adjustment Confirmation

Continued on next page

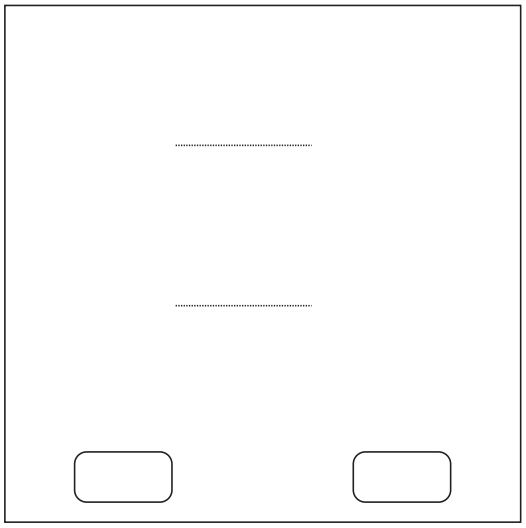
MR24579,0000326 –19–16JAN08–11/20

6. After selecting Monitor Display, enter the model and serial number of the machine.

   Select OK to continue after entering model and serial number.

   ESC will return to Engine Select Function Screen.

NOTE: Model and serial numbers are not necessary to proceed. Model and serial numbers will be necessary if a recording is to be taken.



Enter Model and Serial Number Screen

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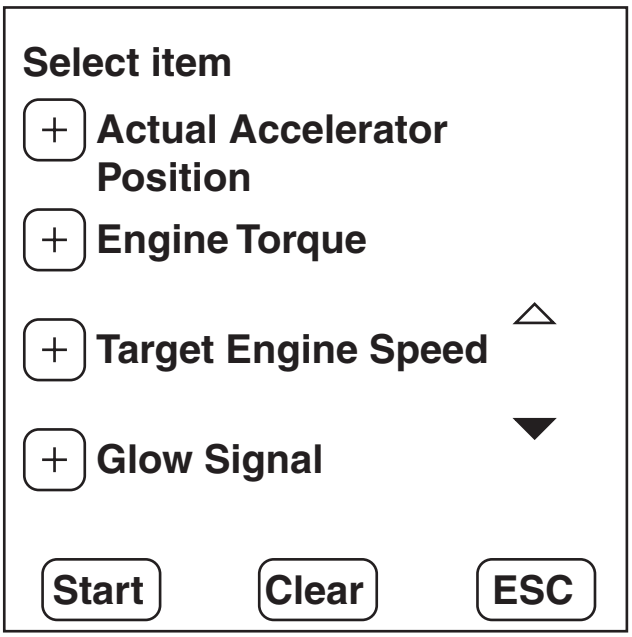
7. The Monitoring Select Item Screen displays a list of items that may be monitored. Select up to four items to display.

   A number to the upper right of the Clear button will indicate the number of items selected.

   Start will display the selected items.

   Clear will clear all selected items.

   ESC will return to Main Controller Select Function Screen.



Monitoring Select Item Screen

Continued on next page

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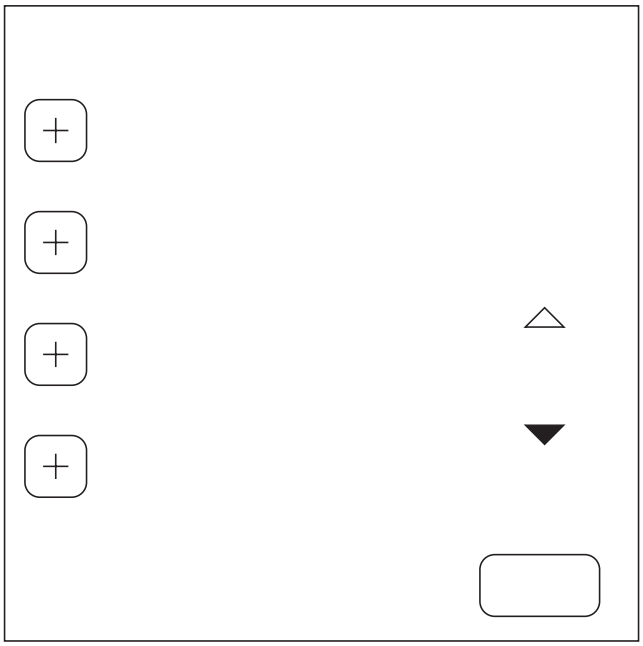
6. Data Download To ECM will download (previously uploaded data) from the palm to the ECM. Select Data Download To ECM.

   Data Upload From ECM will up data from ECM to the palm.

   Write Injector ID Code allows user to input individual injector identification codes.

   ECM Data Display shows the injector identification codes for all the injectors.

   Actuator Test allows user to slow down the engine and deactivate individual injectors.



Special Function Setup Screen

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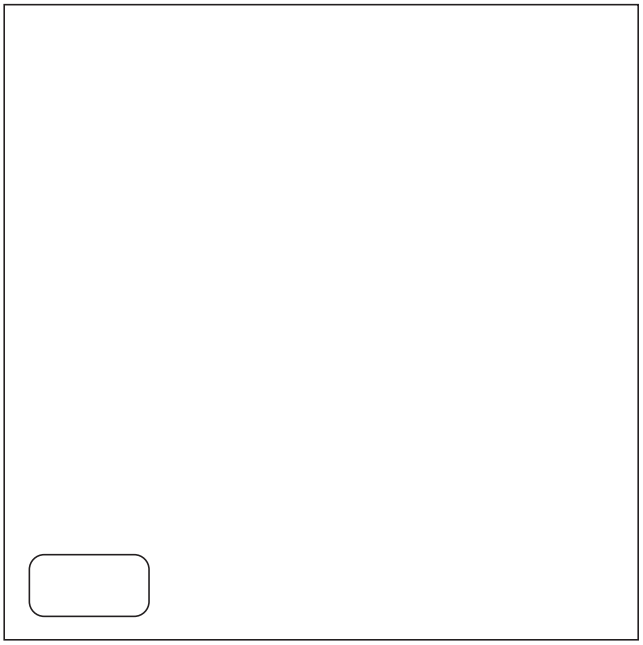
MR24579,0000328 –19–22APR08–13/44

7. Dr. ZX will prompt to check that the key switch is ON and the engine is OFF. Select Next to continue.



Key On Engine Off Verification Screen

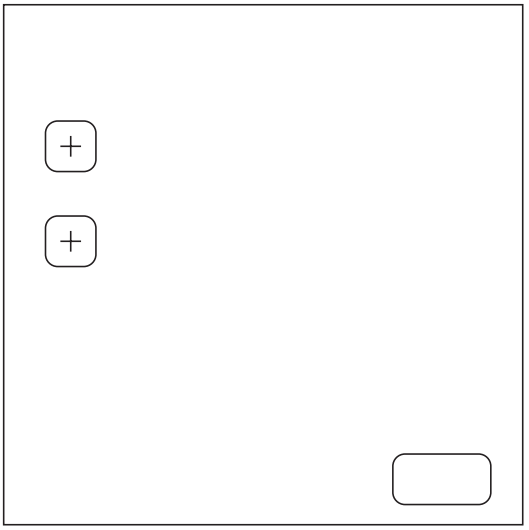
Continued on next page

MR24579,0000328 –19–22APR08–14/44

1. **ECM Data Display—**Start Dr. ZX and select Select Controller.

   For connection procedure to machine, See Personal Digital Assistant (PDA) Connection to Excavator Using DR. ZX Application. (Group 9015-20.)

NOTE: Screen will display "Communicating" while sending and receiving data.

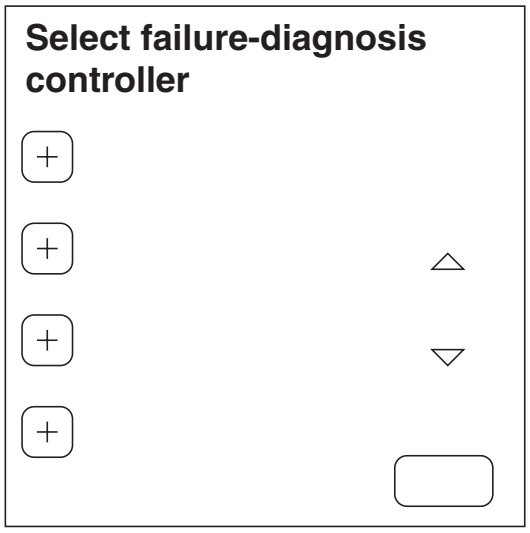


Function Selection Screen

MR24579,0000328 –19–22APR08–28/44

2. Select Engine C/U for engine control module (ECM) diagnostics.

   ESC will return to Function Selection Screen.



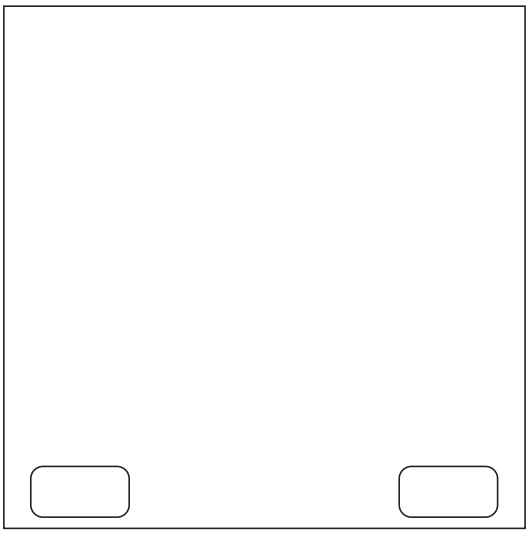
Controller Selection Screen

Continued on next page

MR24579,0000328 –19–22APR08–29/44

3. Dr. ZX will display monitor controller information. Select OK to continue.

   ESC will return to Function Selection Screen.



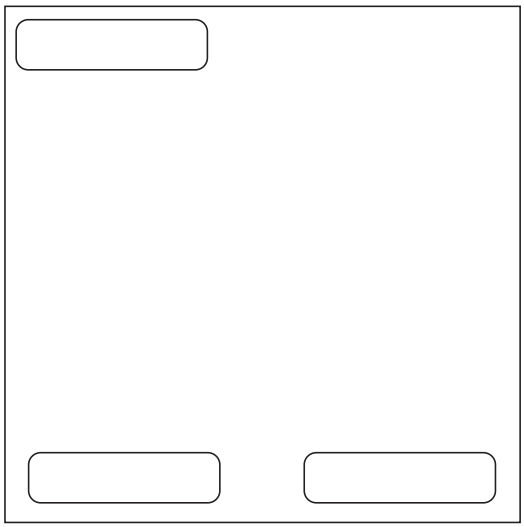
Controller Information Screen

MR24579,0000329 –19–16JAN08–3/7

4. Select Start to proceed into the service program.

   Back will return to Function Selection Screen.

   Password will allow the user to change the Dr. ZX password. See Dr. ZX Password Change. (Group 9015-20.)



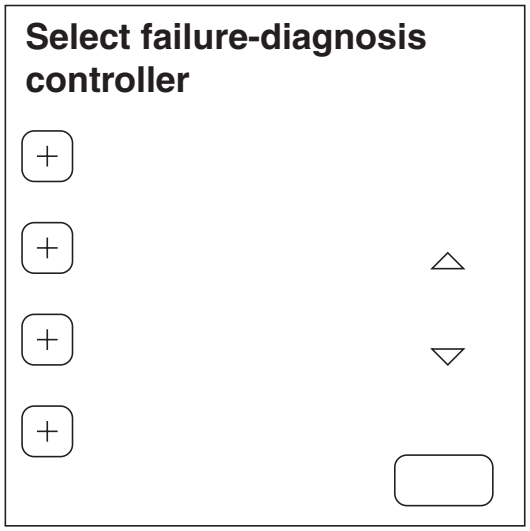
Dr. ZX Start Screen

Continued on next page

MR24579,0000329 –19–16JAN08–4/7

2. Select Information C/U.

   ESC will return to Function Selection Screen.



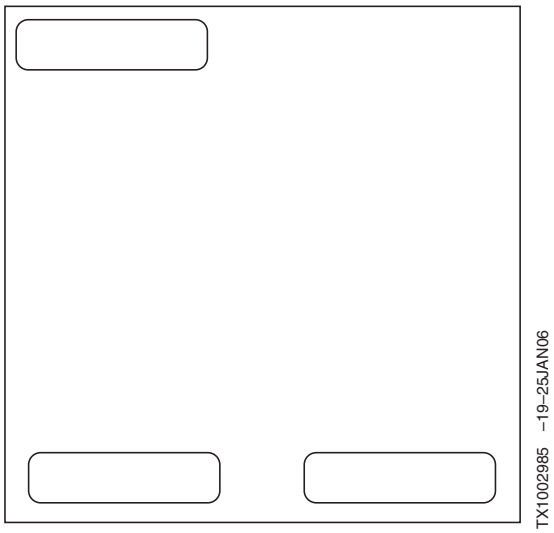
Controller Selection Screen

MR24579,000032D –19–16JAN08–2/8

3. Select Start.

   Back will return to Function Selection Screen.

   Password allows the user to change the password. See Dr. ZX Password Change. (Group 9015-20.)



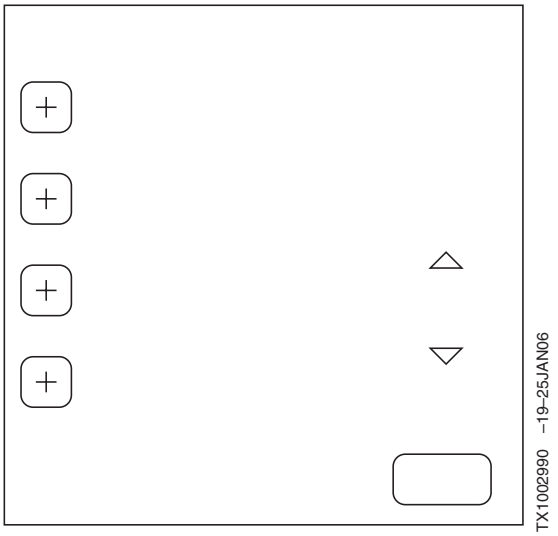
Dr. ZX Start Screen

Continued on next page

MR24579,000032D –19–16JAN08–3/8

6. Select Enter Time.

   ESC will return to Information Controller Setup Screen.



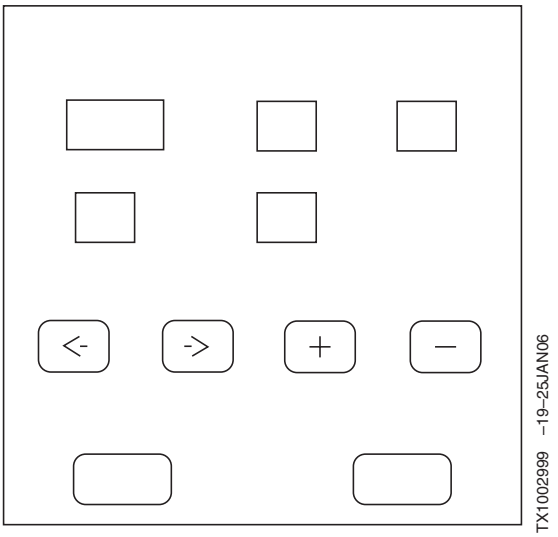
Information C/U: Various Setup Screen

MR24579,000032F –19–16JAN08–6/7

7. Use the right and left arrow keys to select a field, then use the + and - keys to change the value within the selected field.

   Select Set to set time and return to Information Controller Setup Screen.

   ESC will return to Information Controller Setup Screen.



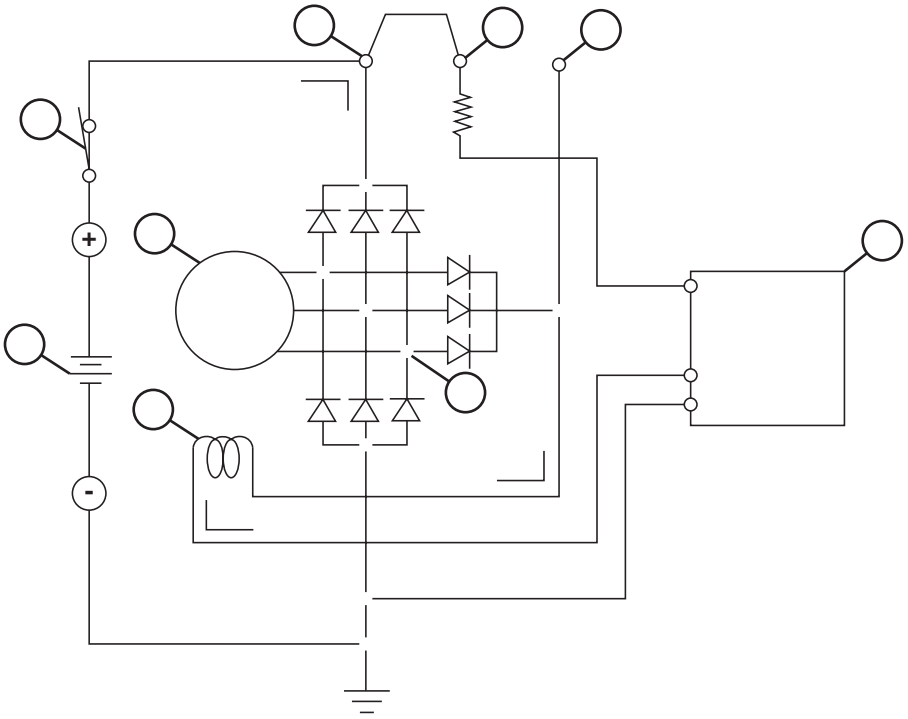
Enter Date and Time Screen

MR24579,000032F –19–16JAN08–7/7

Item		Details
Date		Date of daily report data.
Start Time		Time when key switch is first turned ON during daily operation. (Recorded by key switch ON signal.)
Stop Time		Time when key switch is last turned OFF during daily operation. (Recorded by key switch ON signal.)
Fuel Level		Level of fuel at the end of daily operation. (Recorded by the fuel sensor from the monitor.)
Fuel Usage		Amount of fuel used during a day. (Calculated from Engine Control Unit (ECU))
Machine Hour Meter		Cumulative machine hours. (Recorded from hour meter on monitor.)
	HP Mode Hours	Hours operated in HP mode per day. (Recorded from power mode switch information from Main Controller (MCF))
Engine Operating Hours	P Mode Hours	Hours operated in P mode per day. (Recorded from power mode switch information from Main Controller (MCF))
	E Mode Hours	Hours operated in E mode per day. (Recorded from power mode switch information from Main Controller (MCF))
Auto-Idle Switch ON Time		Hours operated with auto-idle switch ON per day. (Recorded from auto-idle switch information from Main Controller (MCF))
Travel Operating Hours	Fast Travel Hours	Hours operated in fast travel mode per day. (Recorded from travel speed switch information from Main Controller (MCF))
	Slow Travel Hours	Hours operated in slow travel mode per day. (Recorded from travel speed switch information from Main Controller (MCF))
Swing Operating Hours		Hours operated swinging per day. (Recorded from swing pressure sensor information from the Main Controller (MCF))
Digging Operating Hours		Hours operated digging per day. (Recorded from front attachment information from the Main Controller (MCF))
	Breaker Operating Hours	Hours operated with breaker selected per day. (Recorded from attachment information from Main Controller (MCF))
	Secondary Crusher Operating Hours	Hours operated with secondary crusher selected per day. (Recorded from attachment information from Main Controller (MCF))
Attachment Operating Hours	Primary Crusher Operating Hours	Hours operated with primary crusher selected per day. (Recorded from attachment information from Main Controller (MCF))
	Vibrating Hammer Operating Hours	Hours operated with vibrating hammer selected per day. (Recorded from attachment information from Main Controller (MCF))
	Bucket Operating Hours	Hours operated with bucket selected per day. (Recorded from attachment information from Main Controller (MCF))
No Load Time		Hours machine is not operated per day. (Recorded from all pressure sensors from Main Controller (MCF))
Radiator Coolant Temperature		Highest radiator coolant temperature per day. (Recorded from monitor)
Hydraulic Oil Temperature		Highest hydraulic oil temperature per day. (Recorded from Main Controller (MCF))
Intake Air Temperature		Highest intake air temperature per day. (Recorded from Engine Control Unit (ECU))
Engine Operating Hour Distribution Data		Operating hour distribution for engine per day. (Recorded when alternator output signal is available for more than 10 min.)
Loaded Time Distribution Data		Operating hour distribution for machine per day. (Recorded when operating pressure is continuously detected for more than 5 min. with engine running)

Continued on next page

Alternator Test



TX1005683

Alternator Circuit

1—Battery
2—Battery Relay
3—Stator Coil
4—B+ Terminal
5—R Terminal
6—L Terminal
7—Regulator
8—Rectifier Bridge
9—Field Coil

1. **24 V System** — With engine running at slow idle, check **DC** voltage between terminal **R** (5) and ground. Voltage should be **27.5 VDC** or greater[1].
2. With engine running at slow idle, check **DC** voltage between terminal **B+** (4) and ground. Voltage should be **27.5 VDC** or greater[1].
3. If voltage from previous steps is below 27.5 VDC[1], check excitation by disconnecting the **L** (6) and **R** (5) connector and place a jumper wire between the **B+** (4) terminal and the alternator side of the **R** (5) terminal with the engine running.
4. With jumper wire in place between **B+** & **R**, check voltage on **B+** terminal.

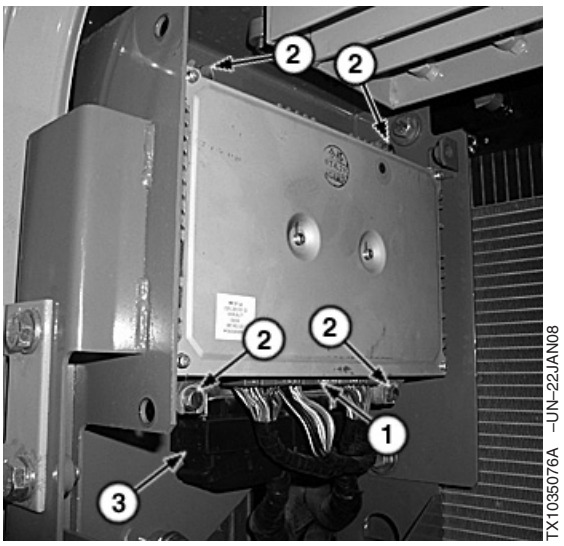
   If alternator voltage increases, check for problem in excitation circuit.
5. Disconnect **L** & **R** connector.
6. Check voltage on pin **L** (6) of the alternator side. Voltage should be **27.5 VDC** or greater.
7. Repeat above steps with lights on to load the alternator.

[1]Note: For 24 V systems with maintenance free batteries, R and B+ voltage should be 28.2 VDC or greater.

Continued on next page

3. Remove cap screws (2) and remove main controller (MCF) from bracket.
4. Disconnect harness from main controller (MCF).

1—Main Controller (MCF) Harness Connector
2—Cap Screw (4 used)
3—Engine Control Module (ECM)



Main Controller (MCF) and Engine Control Module (ECM)

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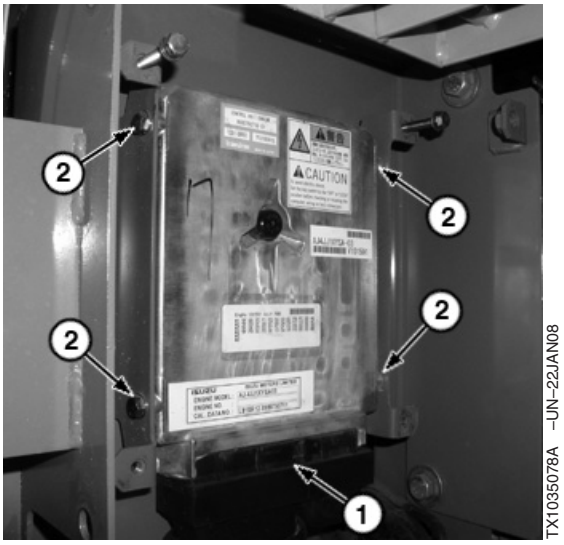
5. Remove cap screws (2) and remove engine control module (ECM) from bracket.
6. Disconnect harness from engine control module (ECM).
7. Replace as necessary.
8. Install engine control module (ECM) to bracket.
9. Connect harness to module.
10. Install main controller to brackets.
11. Connect harness to controller.
12. Install cover and cap screw.

1—Engine Control Module (ECM) Harness Connector
2—Cap Screw (4 used)



Engine Control Module (ECM)

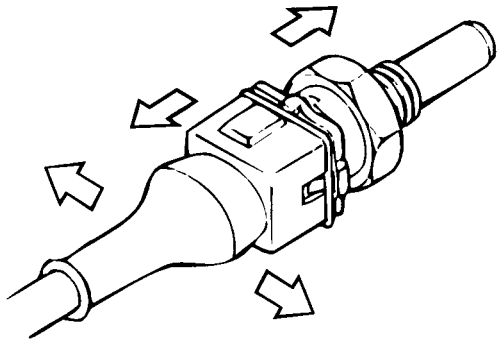
TP97644,00006FE –19–23JAN08–4/4

Disconnecting Spring Wire Clip Connectors

1. Remove wire clip from connector.

   Grasp connector; move connector halves from side-to-side as they're being pulled apart. Do not pull on wiring leads.

2. To reconnect, install wire clip on connector half, push connector halves together until wire retainer "clicks" over tabs.



T8197AO CV

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TP97644,0000706 –19–13NOV07–1/1

Replace DEUTSCH™ Connectors

9015
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,135

1. Select correct size extractor tool for size of wire to be removed:

   - JDG361 Extractor Tool for 12 to 14 gauge wire.
   - JDG362 Extractor Tool for 16 to 18 gauge wire.
   - JDG363 Extractor Tool for 20 gauge wire.

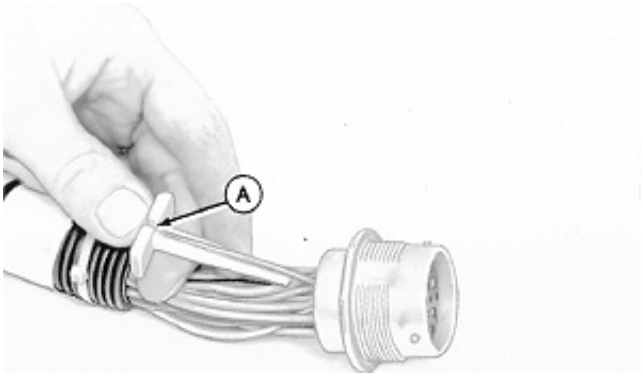
2. Start correct size extractor tool over wire at handle (A).

3. Slide extractor tool rearward along wire until tool tip snaps onto wire.

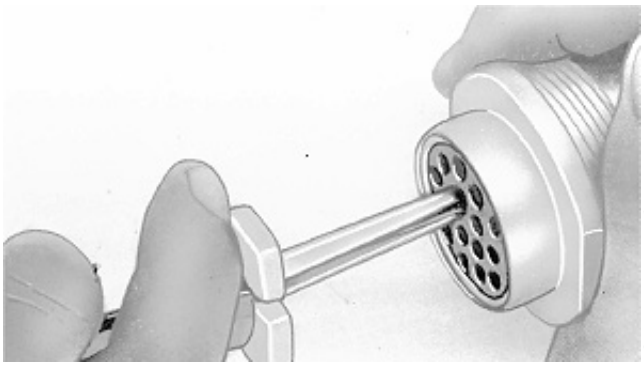
IMPORTANT: Do NOT twist tool when inserting in connector.

4. Slide extractor tool along wire into connector body until it is positioned over terminal contact.

5. Pull wire out of connector body, using extractor tool.



TS0124 –UN–23AUG88



TS120 –UN–23AUG88

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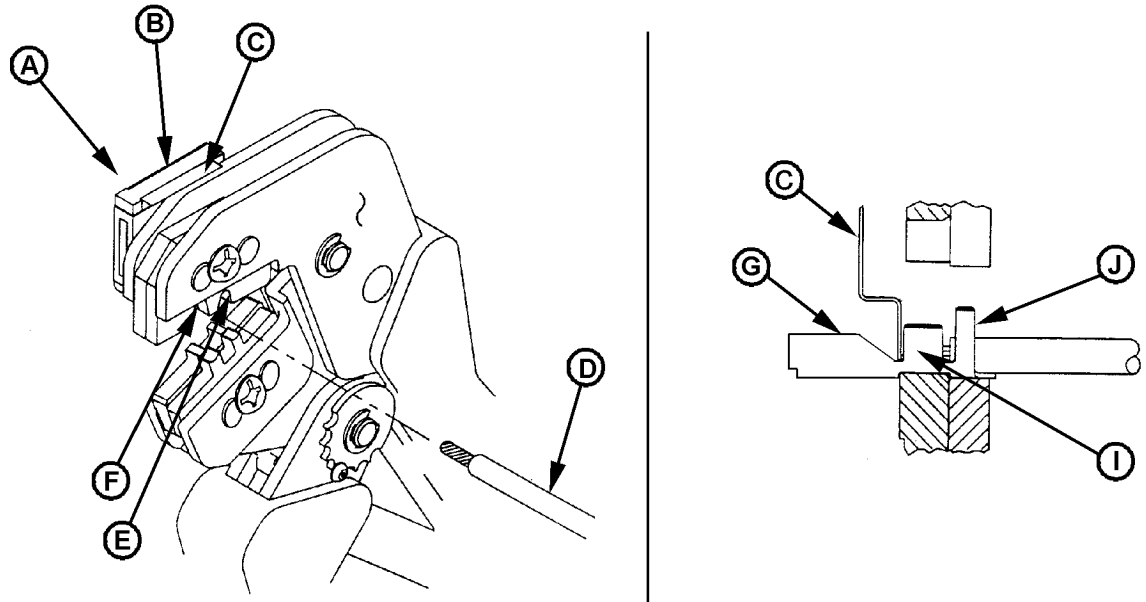
TP97644,0000707 –19–13NOV07–1/2

Install CINCH™ Contact



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A—Top of Tool
B—Contact Support
C—Locator
D—Wire
E—Micro Timer Slot
F—Junior Timer Slot
G—Contact
I—Wire Tab
J—Insulation Tab

1. Hold JDG708 crimping tool so that the tool is facing you as shown (left side of graphic). Squeeze tool handles together and allow them to open fully.

IMPORTANT: Make sure that both sides of the insulation barrel are started evenly into the crimping section. Do NOT attempt to crimp an improperly positioned contact.

2. Position the contact so that the mating end of the contact (G) is on the locator side of the tool (C). Wire and insulation tabs (I and J) should point to top of tool (A). Butt wire tab (I) against the movable locator (C).
3. Hold the contact in position and squeeze the tool handles together until ratchet engages sufficiently to hold the contact in position. Do NOT deform wire and insulation tabs (I and J).
4. Insert stripped wire into contact insulation and wire tabs until it is butted against locator (C).
5. Hold the wire in place. Squeeze tool handles together until ratchet releases. Allow tool handles to open and remove crimped contact.
6. Install contact into connector. (Go to procedure in this group.)

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TP97644,000070F –19–13NOV07–1/1

Diagnose Undercarriage Components Malfunctions

NOTE: Diagnose malfunction charts are arranged from most probable and simplest to verify, to least likely and most difficult to verify.

TP97644,000069B –19–23APR08–1/1

Noisy or Loose Track Chain

– – –1/1

❶ **Incorrect track sag adjustment**	Check track sag. See Check and Adjust Track Sag. (Operator's Manual.) Is track sag within specification?	**YES:** Go to Loose track shoes. **NO:** Adjust track sag. – – –1/1
❷ **Loose track shoes**	Remove loose track shoes to clean material from between shoe and link. Install track shoes and tighten cap screws in proper sequence. See Track Shoe Remove and Install. (Group 0130.) Are track shoes properly installed?	**YES:** Go to Grease leaking from track adjuster seals, grease fitting, or relief valve. **NO:** Install track shoes. – – –1/1
❸ **Grease leaking from track adjuster seals, grease fitting, or relief valve**	Check that grease fitting and valve are tight. Replace grease fitting or valve. See Track Adjuster Cylinder Disassemble and Assemble for seal replacement. (Group 0130.) Are grease fitting, valve and seal properly installed?	**YES:** Diagnostic checkout complete. **NO:** Install grease fitting, valve and seal. – – –1/1

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Tight Track Chain

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❶ **Material packing in sprocket**	Clean material from sprocket. Is sprocket free of material?	**YES:** Go to Track sag less than specification. **NO:** Clean material from sprocket. – – –1/1

Hydraulic System Operation

Main hydraulic system is open-center hydraulic system.

The main hydraulic pump housing contains two pumps in an in-line configuration; pump 1 and pump 2. The pump 1 end of housing is fastened to the engine flywheel housing. Engine output is transmitted to the pump 1 drive shaft through a flex coupling. Engine output is transmitted from the pump 1 drive shaft to the pump 2 drive shaft and then to the pilot pump drive shaft. The pilot pump is mounted on the pump 2 end of housing. The pumps are driven at engine speed.

See Pump 1, Pump 2 and Drive Gearbox Operation. (Group 9015-05.)

See Pilot Pump, Pressure Regulating Valve and Filter Operation. (Group 9025-05.)

Hydraulic oil flow is through suction screen, out of the hydraulic oil tank, and through the suction line to the pumps. Pump 1 delivers supply oil to the right control valve (4-spool). Pump 2 delivers supply oil to the left control valve (5-spool). Supply oil is routed to motors and cylinders by valve spools for their respective function. Hydraulic oil tank is pressurized to ensure that oil flows from the tank, through the suction line, and into the pumps.

See Control Valve Operation. (Group 9025-05.)

See Control Valve Check Valves Identification and Operation. (Group 9025-05.)

Return oil from the motors and cylinders is routed into return passages in control valve by the valve spools. From the return passages, return oil flows out of control valve, through hydraulic oil cooler, through the restriction valve, and then through the return filter in the hydraulic oil tank. The restriction valve is used in the return line after the hydraulic oil cooler to create some back pressure in the return passage of control valve. The back pressure ensures a flow of makeup oil to keep the swing motor case full of oil and a flow of oil through the anticavitation valves to prevent cylinder cavitation.

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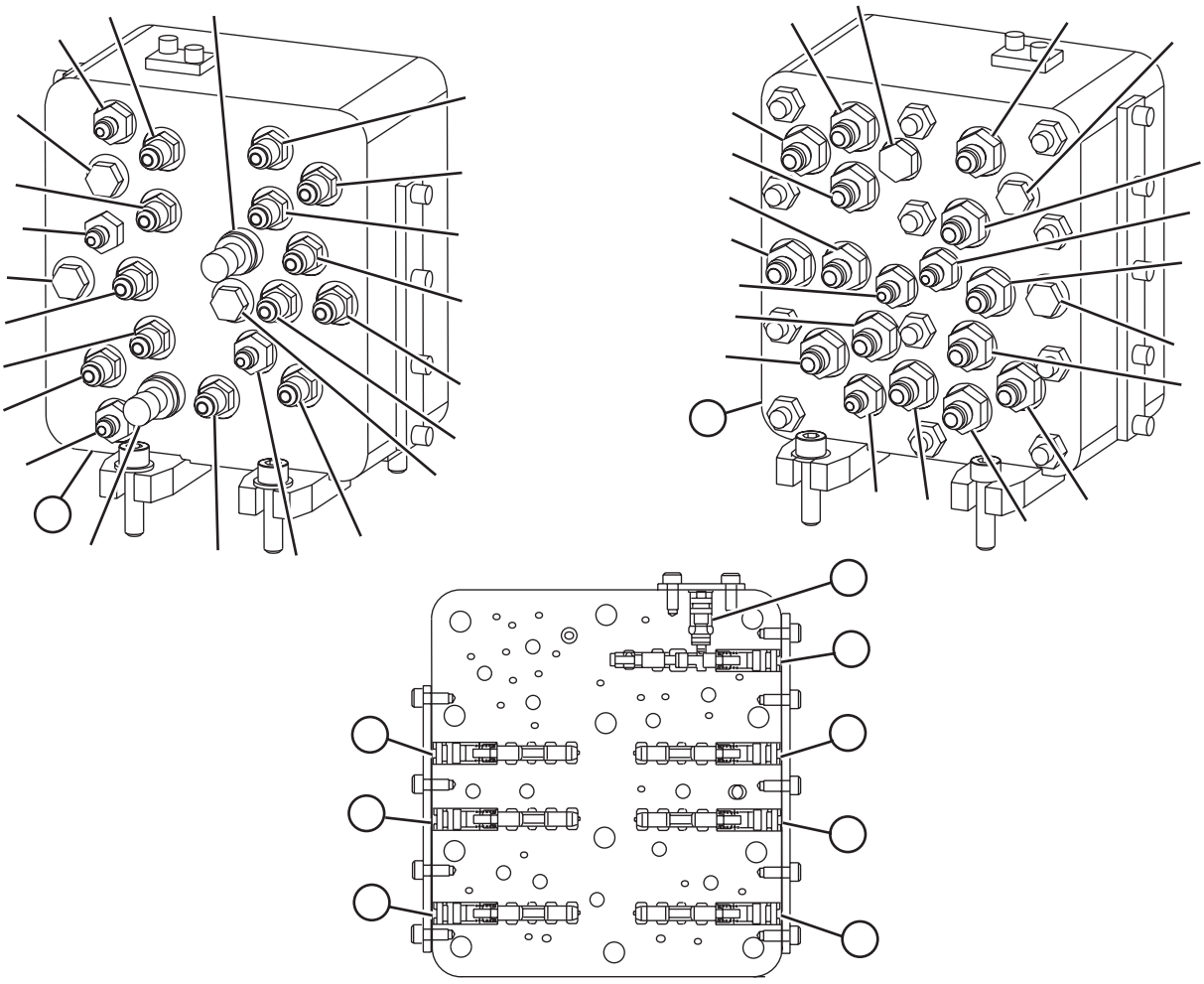
Pilot Signal Manifold Operation



Pilot Signal Manifold

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1, A—Boom Up
2, B—Boom Down
3, C—Arm Out
4, D—Arm In
5, E—Swing Left
6, F—Swing Right
7, G—Bucket Curl
8, H—Bucket Dump
9, I—Left Travel Forward
10, J—Left Travel Reverse
11, K—Right Travel Forward
12, L—Right Travel Reverse
13, M—Plug—Auxiliary (if equipped)
14, N—Plug—Auxiliary (if equipped)
15—Control Valve Side of Pilot Signal Manifold
16—Pilot Control Valve Side of Pilot Signal Manifold
42—Boom Down Shockless Valve
43—Auxiliary Flow Rate Pilot Valve (if equipped)
44—Travel Flow Combiner Pilot Valve (port SL)
45—Swing Park Brake Release Pilot Valve (port SH)
46—Bucket Flow Rate Pilot Valve (port SK)
47—Pump 2 Flow Rate Pilot Valve (port SB)
48—Pump 1 Flow Rate Pilot Valve (port SA)
70—Orifice
B33—Swing Pressure Sensor
B34—Travel Pressure Sensor
DF—To Hydraulic Oil Tank
PH—Plug (not used)
PI—From Pilot Shutoff Solenoid Valve
SA—To Pump 1 Regulator Remote Control Spool
SB—To Pump 2 Regulator Remote Control Spool
SE—To Auxiliary Flow Rate Control Valve—Switch Valve—If Equipped
SH—To Swing Park Brake
SK—To Bucket Flow Rate Control Valve
SL—To Travel Flow Combiner Shuttle Valve
SM—To Hydraulic Oil Tank
SN—Plug (not used)
SP—To Solenoid Valve Manifold (port DP)

Continued on next page

15—Control Valve Side of Pilot Signal Manifold
16—Pilot Control Valve Side of Pilot Signal Manifold
20—Check Valve (4 used)
21—Auxiliary (if equipped)
22—Swing and Auxiliary (if equipped)
23—Swing
24—Bucket
25—Arm, Boom Up, Swing, Auxiliary (if equipped)
26—Boom, Arm, Bucket, Swing, Auxiliary (if equipped)
27—Boom, Arm, Bucket
28—Boom Up, Arm, Bucket, Left Travel, Swing, Auxiliary (if equipped)
29—Arm, Boom, Bucket, Right Travel
30—Boom
31—Boom, Arm, Bucket, Right Travel
32—Boom, Arm
33—Arm
34—Boom, Arm, Bucket, Right Travel
35—Right Travel
36—Left Travel, Right Travel
37—Left Travel
38—Travel Pilot Control Valve
39—Left Pilot Control Valve
40—Right Pilot Control Valve
41—Pilot Signal Manifold
42—Boom Down Shockless Valve
43—Auxiliary Flow Rate Pilot Valve (port SE) (If Equipped)
44—Flow Combiner Pilot Valve (port SL)
45—Swing Park Brake Release Pilot Valve (port SH)
46—Bucket Flow Rate Pilot Valve (port SK)
47—Pump 2 Flow Rate Pilot Valve (port SB)
48—Pump 1 Flow Rate Pilot Valve (port SA)
B33—Swing Pressure Sensor
B34—Travel Pressure Sensor

Shuttle Valves (21—37)

Control pilot oil from the actuated left, right, travel, and auxiliary (if equipped) pilot control valves to the pilot signal manifold is routed by the shuttle valves (21—37) to shift the respective pilot valves (44, 45, 47, 48) and actuate the travel pressure sensor (B34) and swing pressure sensor (B33). The bucket flow rate pilot valve (46) and auxiliary flow rate pilot valve (43) are shifted directly by control pilot oil from port D (arm in function).

Continued on next page

Primary pilot oil from pump 1 or 2 flow rate pilot valves (30) in pilot signal manifold is sensed by the piston (6) in its respective regulator.

Supply oil (600) from pump 1 and pump 2 is sensed through drilled passages in pump housing to pump 1 pressure inlet (27) and pump 2 pressure inlet (28) in each pump regulator.

Primary pilot oil from torque control solenoid valve is routed through steel lines to torque control port (29) in each pump regulator.

Increasing Flow Rate (Displacement)—Actuating a control lever or pedal increases the primary pilot oil pressure from the pump 1 and/or 2 flow rate pilot valve to the piston. Pilot oil pressure pushes the piston and remote control spool (21) left against the spring (3).

Movement of spool opens the passage from large end of servo piston to return in pump housing (19). Primary pilot oil on small end of servo piston pushes piston down, increasing pump angle which increases flow rate (displacement). Movement of the cylinder block, valve plate, and servo piston is transmitted to remote control sleeve (20) and load sleeve (22) by the feedback link (26). Sleeves move left until passage to return is closed. Oil at large end of servo piston is now trapped, holding the pump at flow rate (displacement) that is proportional to pressure of pump control pilot oil from the pump 1 and/or 2 flow rate pilot valve to the piston.

Maximum Flow Rate (Displacement)—When control lever or pedal is actuated to full stroke, primary pilot oil from pump 1 or 2 flow rate pilot valve (port SA or SB) to piston increases to its maximum pressure. Oil pressure pushes the piston and remote control spool to left until spool contacts maximum flow adjusting screw (2). Movement of spool opens the passage from large end of servo piston to return in pump housing. Pilot oil on small end of servo piston pushes piston down, increasing pump flow rate (displacement). As flow rate (displacement) increases, servo piston movement is transmitted to remote control sleeve and load sleeve by feedback link. Sleeves move left until passage to return is closed. Oil at large end of servo piston is now trapped, holding pump at maximum flow rate (displacement).

Decreasing Flow Rate (Displacement)—As control lever or pedal is returned to neutral, the primary pilot oil pressure sensed at piston also decreases. Spring pushes remote control spool and piston to the right. Movement of spool opens a passage for primary pilot oil from pilot oil inlet to flow to large end of servo piston. Pilot oil pressure applied to large end of servo piston pushes it up against pilot oil pressure applied to small end decreasing pump flow. Remote control spool continues to move to right in response to decreasing pump control pilot oil pressure until it contacts piston cylinder. As pump flow rate (displacement) decreases, movement of cylinder block, valve plate, and servo piston is transmitted to remote control sleeve and load sleeve by the feedback link. Sleeves move right until passage for pilot oil is closed. Oil at large end of servo piston is now trapped, holding pump at flow rate (displacement) that is proportional to pressure of pump control pilot oil.

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73—Right Control Valve (4-spool)
74—Left Control Valve (5-spool)
75—Right Travel Spool
78—Bucket Spool
79—Bucket Regenerative Valve
81—Bucket Curl Circuit Relief and Anticavitation Valve
82—Boom 1 Spool
86—Boom Down Circuit Relief and Anticavitation Valve
92—Arm 2 Spool
94—Check Valve (lift check)—Swing Neutral Passage
95—Swing Spool
97—Orifice—Arm 1 Power Passage
98—Check Valve (lift check)—Arm 1 Neutral Passage
100—Arm Regenerative Valve
101—Arm 1 Spool
102—Arm In Circuit Relief and Anticavitation Valve
104—Arm Reduced Leakage Valve—Check Valve
106—Check Valve (lift check)—Boom 2 Power Passage
107—Boom 2 Spool
108—Auxiliary Flow Rate Control Valve—Switch Valve
109—Auxiliary Flow Rate Control Valve—Poppet
110—Auxiliary Spool
111—Plug
112—Check Valve (lift check)—Left Travel Neutral Passage
113—Left Travel Spool
114—Orifice—Travel Power Passage
116—Orifice—Bucket Power Passage
117—Check Valve (lift check)—Bucket Power Passage
118—Flow Combiner Valve
119—Check Valve—Flow Combiner Valve Circuit
121—Check Valve (lift check)—Auxiliary Power Passage
122—Auxiliary Flow Combiner Valve
125—Main Relief Valve Isolation Valve Check Valve—5 Spool
B30—Boom Up Pressure Sensor
B31—Arm In Pressure Sensor

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For bucket dump and curl, pump 1 supply oil is routed from the left control valve neutral passage, through the bucket flow rate control valve—poppet (76) and bucket flow rate control valve—switch valve (77), past the valve spool, and out to the cylinder. Return oil from the cylinder flows past the spool and into the return passage.

In combined operation with right travel valve, pump 1 supply oil also flows from the left control valve neutral passage, through the power passage, flow combiner circuit check valve, flow combiner valve and check valve, travel and bucket combined function check valve and orifice, and past the valve spool out to the cylinder. Pump 2 supply oil flows to the swing, arm, and boom functions. See the following for more information:

- Check valves—See Control Valve Check Valves Identification and Operation (Group 9025-05.)
- Flow combiner valve—See Flow Combiner Valve Operation (Group 9025-05.)

NOTE: The auxiliary valve is not connected for operation as received from the factory. Plugs are installed in the pilot caps and covers are installed on the work ports. Field kits are available for connecting the valve for auxiliary functions.

The flow of supply oil for the auxiliary valve is from pump 2, through the left control valve neutral passage, through the power passage, through the auxiliary flow rate control valve—poppet (109) and auxiliary flow rate control valve—switch valve (108), past the valve spool, and out to the auxiliary function. Return oil from the auxiliary function flows past the valve spool and into the return passage. Supply oil from pump 1 can be combined with supply oil from pump 2 by using the bypass shutoff valve and auxiliary flow combiner valve to operate an auxiliary functions. The pilot lines to the auxiliary flow combiner valve and bypass shutoff valve are connected to the hydraulic oil tank. See Auxiliary Flow Combiner Valve and Bypass Shut-Off Valve Operation for more information. (Group 9025-05.)

Continued on next page

Arm Reduced Leakage Valve Check Valve (104) and Arm Reduced Leakage Valve Switch Valve (105): Located in the arm cylinder rod end circuit to reduced arm cylinder drift in the extended position.

Operational Check: Arm drift in the extended position is excessive. See Boom and Arm Reduced Leakage Valves Operation for more information. (Group 9025-05.)

Bucket Flow Rate Control Valve—Poppet (76) and Bucket Flow Rate Control Valve—Switch Valve (77): Restricts the flow of supply oil to the bucket spool (78) when used in combined operation with boom up and arm in functions. Gives priority to operate boom up and arm in function.

Operational Check: Bucket curl is slow or does not move smoothly in single operation. Also check the regenerative valve in bucket valve (21). See Bucket Flow Rate Control Valve Circuit Operation for more information. (Group 9025-05.)

Auxiliary Flow Rate Valve Control Valve—Poppet (109) and Auxiliary Flow rate Control Valve—Switch Valve (108): Restricts the flow of supply oil to the auxiliary valve (110) when used in combined operation with other dig functions. See Auxiliary Flow Rate Control Valve Circuit Operation—If Equipped for more information. (Group 9025-05.)

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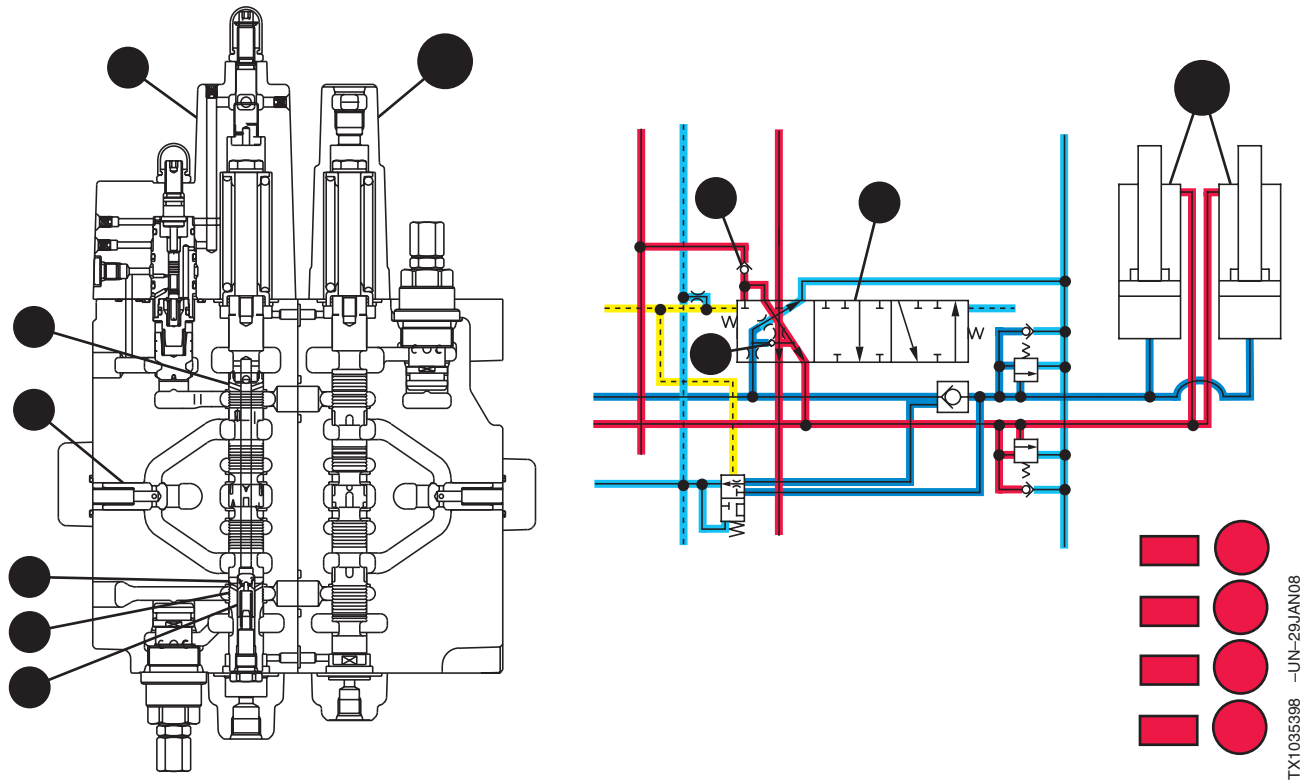
Boom Regenerative Valve Circuit Operation



Boom Regenerative Valve

4—Hole B
5—Hole C
6—Hole A
82—Boom 1 Spool
83—Check Valve (lift check)—Boom 1 Power Passage
84—Boom Regenerative Valve
107—Boom 2 Spool
129—Boom Cylinder (2 used)
600—Supply Oil
602—Pilot Oil
604—Return Oil
605—Regenerative Oil

The function of the boom regenerative valve (84) is to combine regenerative oil (605) from the boom cylinder head end with pump supply oil to the boom cylinder rod end to prevent cavitation and improve function controllability.

Regenerative oil from the cylinder flows back to the control valve top work port and is restricted as it flows past the spool to the return passage. The regenerative oil also flows through hole A (6) in the valve spool and down the center of spool to the regenerative valve. Supply oil (600) flows out the bottom work port and through hole B (4) at the bottom of valve spool to the spring cavity for the boom regenerative valve. If the regenerative oil pressure is higher than the supply oil pressure the regenerative oil pressure pushes the boom regenerative valve open allowing return oil to flow out holes C (5). The regenerative oil combines with the supply oil and flows out the bottom work port to the cylinder.

The boom 2 spool (107) is shifted but regenerative oil flow is blocked and only flows back to the return passage through boom 1 spool (2). The boom 1 power passage lift check—check valve (83) prevents back flow through the control valve. See Control Valve Operation for more information. (Group 9025-05.)

When the supply oil pressure becomes higher than regenerative oil pressure, the boom regenerative valve is pushed closed and held closed against the regenerative oil pressure by the supply oil pressure.

NOTE: The operation of bucket flow rate control valve and auxiliary flow rate control valve is similar. The bucket flow rate control valve operation is shown. The auxiliary valve and auxiliary flow rate valve are not connected for operation as received from the factory. Pilot lines to the auxiliary flow rate control valve are connected to the hydraulic oil tank.

The function of the bucket flow rate control valve is to restrict oil flow through the bucket valve to the cylinder when the bucket, arm in, and boom up are used in combined operation. Restricting oil flow to the bucket cylinder ensures that supply oil flow goes to the higher-loaded boom function to raise the boom.

For bucket operation only, the bucket flow rate pilot valve (port SK) (46) in the pilot signal manifold is not shifted. Supply oil (600) from the right control valve power passage (9) opens the check valve (8) and flows through the selector valve and out to the bucket spool (705). The bucket flow rate control valve—poppet (76) is pushed to the right against the poppet spring (14) and supply oil flows through the notches (13) to the bucket valve spool unrestricted. The end of selector valve is open to return through port SK (704) and the bucket flow rate pilot valve in the pilot signal manifold. See Pilot Signal Manifold Operation for pilot oil functions in pilot signal manifold. (Group 9025-05.) See Control Valve Operation for bucket flow rate control valve circuit location information. (Group 9025-05.)

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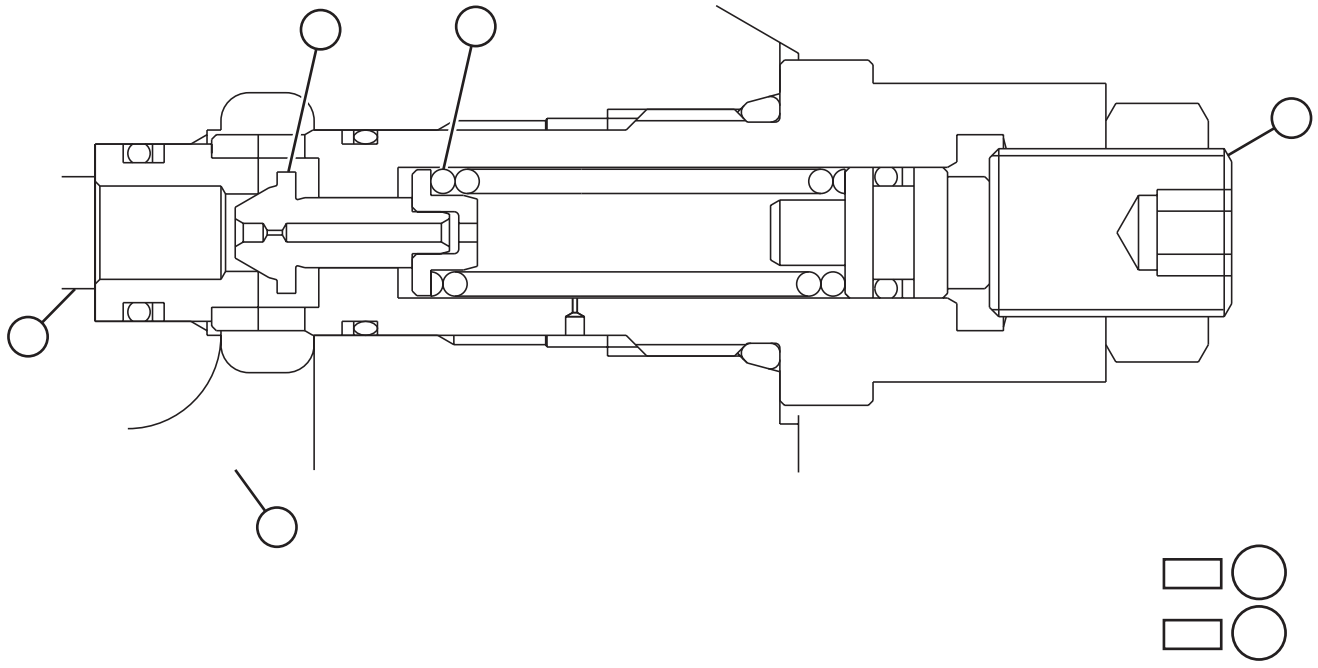

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Swing Crossover Relief Valve—In Neutral Position

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2—Piston
8—Swash Plate
10—Spring
65—Servo Piston
66—Travel Speed Change Valve
67—Shuttle Valve
70—Orifice
604—Return Oil or Pressure-Free Oil
Y25—Travel Speed Solenoid (SI)

Travel Motor Slow Speed—At slow speed (turtle), the oil acting on the travel speed change valve (66) is open to return through the travel speed solenoid valve (Y25). Travel speed change valve is held up by the spring (10). See Travel Motor Speed Circuit Operation for more information.

The oil acting on the servo piston (65) is routed to return through the center of travel speed change valve.

The travel speed change valve blocks the flow of supply oil to the servo piston. Supply oil from the pressurized motor work port is routed to the valve by the shuttle valve (67).

The swash plate (8) is held at maximum displacement. At maximum displacement the motor turns at slow speed with high torque.

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The arm cylinder also uses a cushion ring (not shown) on the rod end of the cylinder to soften movement.

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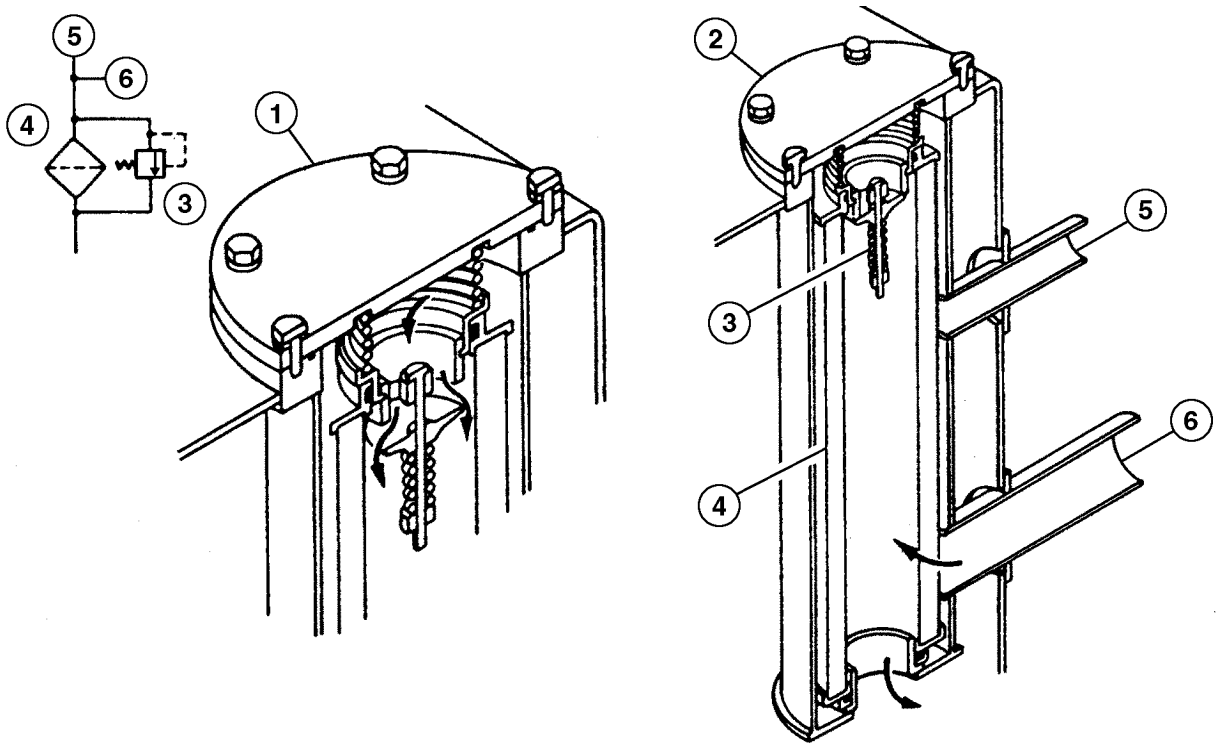
Return Filter Operation



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Return Filter Operation

1—Return Filter Bypass Operation
2—Return Filter Normal Operation
3—Bypass Valve
4—Filter Element
5—Return Oil From Oil Cooler
6—Return Oil From Control Valve

The filter element (4) is located in a chamber inside the hydraulic oil tank. O-rings are used at each end of the filter element to prevent leakage. A spring holds the filter element on its seat.

Return oil from the oil cooler (5) and the control valve (6) flow through the filter element from the outside to the center. Filtered oil flows out the bottom of filter into the hydraulic oil tank.

A bypass valve (3) is located at the top of the filter. The valve opens to protect the filter element against pressure surges in the return circuit and allows a path for return oil if the filter element becomes plugged. During bypass operation, oil flows into the chamber faster than it can flow through the filter element causing the pressure to increase. The higher pressure forces the bypass valve open allowing oil to flow down the center of the filter element and into the hydraulic oil tank. The bypass valve closes when the pressure decreases below the pressure setting of the bypass valve.

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❶ **Pilot shutoff lever in lock position (rearward)**	Check position of pilot shutoff lever. Is pilot shutoff lever in the unlocked (forward) position?	**YES:** Go to Pilot shutoff solenoid valve malfunction. **NO:** Place pilot shutoff lever in unlocked (forward) position. – – –1/1

❷ **Pilot shutoff solenoid valve malfunction**	Check pilot shutoff solenoid valve. See Solenoid Test. (Group 9015-20.) Does pilot shutoff solenoid valve operate correctly?	**YES:** Go to Low pilot oil pressure. **NO:** See Pilot Shutoff Circuit Theory of Operation. (Group 9015-15.) – – –1/1

❸ **Low pilot oil pressure**	Check pilot oil pressure. See Pilot Pressure Regulating Valve Test and Adjustment. (Group 9025-25.) Does pilot oil pressure meet specification?	**YES:** Diagnostic checkout complete. **NO:** Adjust, repair or replace pilot pressure regulating valve. See Pilot Pressure Regulating Valve and Filter Remove and Install. (Group 3360.) **NO:** Pilot pump worn. Inspect, repair, or replace pilot pump. See Pilot Pump Remove and Install. (Group 3360.) – – –1/1

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Function Does Not Stop When Control Lever Released

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❸ **Boom and arm reduced leakage valves (switch valve and poppet) malfunctioning**	Check boom and arm reduced leakage valves (switch valve and poppet) for desired function. See Boom and Arm Reduced Leakage Valves Operation. (Group 9025-05.) Do boom and arm reduced leakage valves (switch valve and poppet) work correctly?	**YES:** Go to Boom manual lower screw loose **NO:** Repair or replace boom and arm reduced leakage valves (switch valve and poppet). See Control Valve Operation for component identification. (Group 9025-05.) See Control Valve (5-Spool) Disassemble and Assemble. (Group 3360.) or see Control Valve (4-Spool) Disassemble and Assemble. (Group 3360.) – – –1/1

❹ **Boom manual lower screw loose**	Inspect boom manual lower screw. See Lower Boom With Engine Stopped. (Operator's Manual.) Is boom manual lower screw tightened to specification?	**YES:** Go to Control valve leakage. **NO:** Tighten boom manual lower screw to specification. – – –1/1

❺ **Control valve leakage**	Inspect control valve for leakage. See Control Valve Operation for component identification. (Group 9025-05.) Is control valve free of leaks?	**YES:** Diagnostic checkout complete. **NO:** Repair or replace control valve components as necessary. See Control Valve (5-Spool) Disassemble and Assemble. (Group 3360.) or see Control Valve (4-Spool) Disassemble and Assemble. (Group 3360.) – – –1/1

Load Falls When Control Valve Is Actuated To Raise Load With Engine Running At Slow Idle

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❹ **Counterbalance valve spool stuck**	Inspect counterbalance valve. See Travel Motor and Park Brake Valve Operation. (Group 9025-05.) Does counterbalance valve spool move freely?	**YES:** Go to Mechanical failure of travel motor or gearbox. **NO:** Repair or replace counterbalance valve. See Travel Motor Cover Disassemble and Assemble. (Group 0260.) – – –1/1

❺ **Mechanical failure of travel motor or gearbox**	Inspect travel motor and gearbox for mechanical failure. See Travel Motor and Park Brake Disassemble and Assemble. (Group 0260.) See Travel Gearbox Disassemble and Assemble. (Group 0250.) Is travel motor and gearbox OK?	**YES:** Go to Center joint leakage. **NO:** Repair or replace travel motor or gearbox. – – –1/1

❻ **Center joint leakage**	Inspect center joint for leakage. See Center Joint Air Test. (Group 0260.) Is center joint OK?	**YES:** Diagnostic checkout complete. **NO:** Repair or replace center joint. See Center Joint Disassemble and Assemble. (Group 0260.) – – –1/1

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Machine Mistracks At All Speeds In Both Directions

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❶ **Incorrect track sag adjustment**	Check track sag. See Check and Adjust Track Sag. (Operator's Manual.) Is track sag within specification?	**YES:** Go to Pilot control valve malfunction. **NO:** Adjust track sag. – – –1/1

2—From Pilot Signal Manifold Left Travel Reverse (port 10)
3—From Pilot Signal Manifold Right Travel Reverse (port 12)
4—From Pilot Signal Manifold Bucket Curl (port 7)
5—From Pilot Signal Manifold Swing Left Pilot (port 5)
6—From Pilot Signal Manifold Boom—Two Down (port 2)
7—From Pilot Signal Manifold Arm In (port 4)
9—From Pilot Signal Manifold Swing Right (port 6)
10—To Oil Cooler
13—To Swing Motor Swing Left (port B)
14—From Pump 2
15—To Swing Motor Swing Right (port A)
16—To Arm Cylinder Head End
19—To Arm Cylinder Rod End
20—To Solenoid Valve Manifold (port DY)
21—To Center Joint Rear Left Port—Left Travel Reverse
22—To Solenoid Valve Manifold (port DY)
23—To Center Joint Front Left Port—Left Travel Forward
24—To Solenoid Valve Manifold (port DH)
25—To Hydraulic Oil Tank (port DC)
26—To Boom Cylinder Head End
28—To Arm In Pressure Sensor (B31)
30—To Bucket Cylinder Rod End
31—From Bucket Flow Rate To Pilot Signal Manifold (port SK)
32—To Center Joint Rear Right Port—Right Travel Reverse
34—From Pump 1
35—To Center Joint Front Right Port—Right Travel Forward
36—To Bucket Cylinder Head End
37—To Boom Cylinder Rod End
38—To Hydraulic Oil Tank (port SN)
39—From Pilot Signal Manifold Right Travel Forward Pilot (port 11)
41—From Pilot Signal Manifold Left Travel Forward Pilot (port 9)
42—Bucket Dump Pilot (port 8)
43—Boom Up Pilot (port 1)
44—To Boom Up Pressure Sensor (B30)
47—Arm Out Pilot (port 3)
48—Plug—Arm Two
49—From Pilot Signal Manifold (port SL)
50—To Hydraulic Oil Tank
56—To Hydraulic Oil Tank (port SJ)
57—From Swing Motor
58—From Arm Regenerative Solenoid Valve (port SC)
59—Plug—Auxilliary Pilot (port 14)
60—Plug—Auxilliary Pilot (port 13)
73—Right Control Valve (4-Spool)
74—Left Control Valve (5-Spool)

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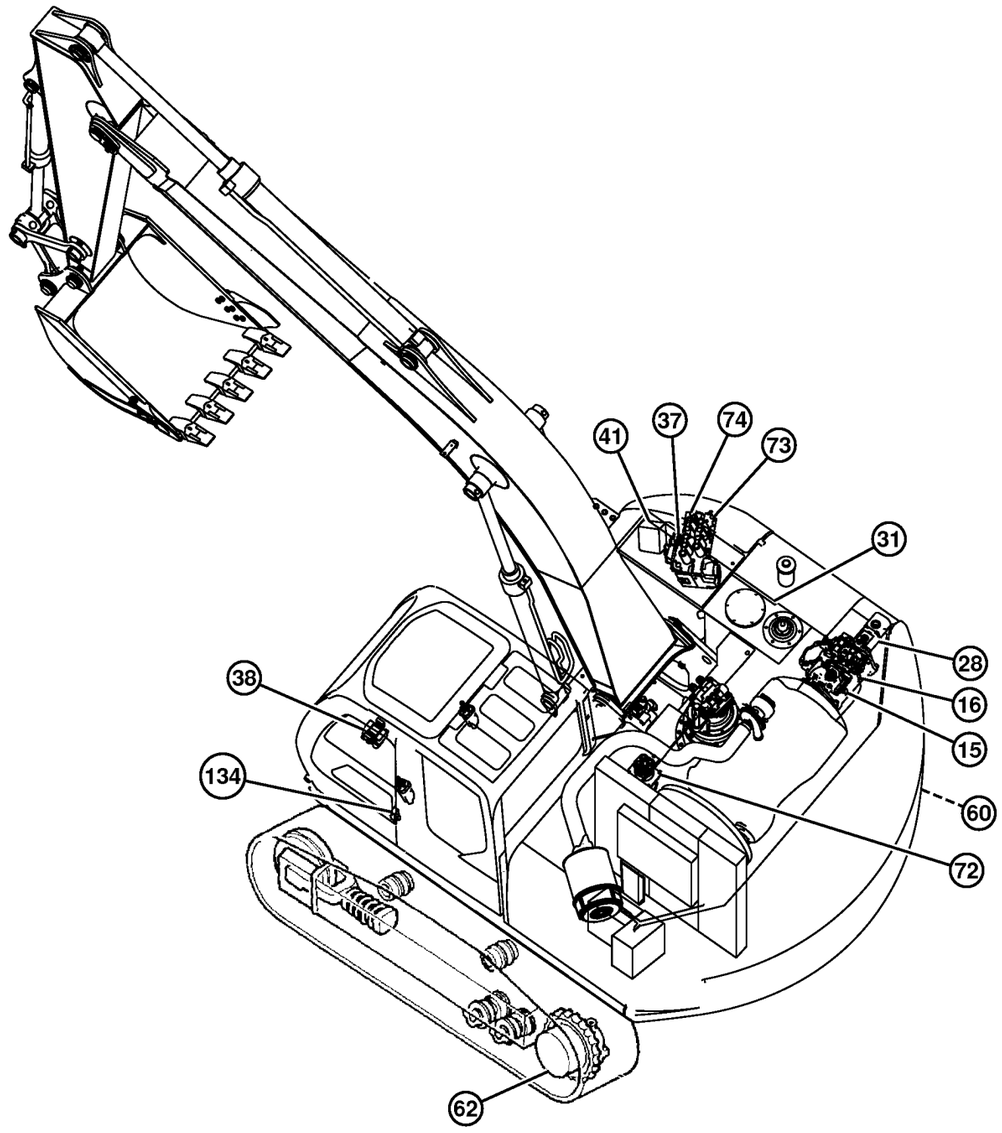
Travel System Component Location



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Travel System Component Location

15—Pump 1 (right, 4-spool)
16—Pump 2 (left, 5-spool)
28—Pilot Pump
31—Hydraulic Oil Tank
37—Solenoid Valve Manifold
38—Travel Pilot Control Valve
41—Pilot Signal Manifold
60—Right Travel Device
62—Left Travel Device
72—Center Joint
73—Right Control Valve (4-spool)
74—Left Control Valve (5-spool)
134—Pilot Shutoff Valve

For more information see Travel Hydraulic System Line Connection. (Group 9025-15)

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1—Boom Up (pilot)
2—Boom Down (pilot)
3—Arm Out (pilot)
4—Arm In (pilot)
5—Swing Left (pilot)
6—Swing Right (pilot)
7—Bucket Curl (pilot)
8—Bucket Dump (pilot)
9—Left Travel Forward (pilot)
10—Left Travel Reverse (pilot)
11—Right Travel Forward (pilot)
12—Right Travel Reverse (pilot)
13—Plug—Auxiliary (pilot)
14—Plug—Auxiliary(pilot)
15—Pump 1 (right, 4-spool)
16—Pump 2 (left, 5-spool)
36—Hydraulic Oil Cooler
52—Swing Motor
61—Right Travel Motor
63—Left Travel Motor
72—Center Joint
73—Right Control Valve (4-spool)
74—Left Control Valve (5-spool)
75—Right Travel Spool
76—Bucket Flow Rate Control Valve—Poppet
77—Bucket Flow Rate Control Valve—Switch Valve
78—Bucket Spool
79—Bucket Regenerative Valve
80—Bucket Dump Circuit Relief and Anticavitation Valve
81—Bucket Curl Circuit Relief and Anticavitation Valve
82—Boom 1 Spool
83—Check Valve (lift check)—Boom 1 Power Passage
84—Boom Regenerative Valve
85—Boom Up Circuit Relief and Anticavitation Valve
86—Boom Down Circuit Relief and Anticavitation Valve
87—Boom Reduced Leakage Valve Check Valve
88—Boom Reduced Leakage Valve Switch Valve
89—Check Valve—Arm 2 Neutral Passage
90—Orifice—Arm 2 Power Passage
91—Check Valve (lift check)—Arm 2 Neutral Passage
92—Arm 2 Spool
93—Bypass Shutoff Valve
94—Check Valve (lift check)—Swing Neutral Passage
95—Swing Spool
96—Check Valve (lift check)—Arm 1 Power Passage
97—Orifice—Arm 1 Power Passage
98—Check Valve (lift check)—Arm 1 Neutral Passage
99—Arm Regenerative Valve—Switch Valve
100—Arm Regenerative Valve
101—Arm 1 Spool
102—Arm In Circuit Relief and Anticavitation Valve
103—Arm Out Circuit Relief and Anticavitation Valve
104—Arm Reduced Leakage Valve—Check Valve
105—Arm Reduced Leakage Valve—Switch Valve
106—Check Valve (lift check)—Boom 2 Power Passage
107—Boom 2 Spool
108—Auxiliary Flow Rate Control Valve—Switch Valve
109—Auxiliary Flow Rate Control Valve—Poppet
110—Auxiliary Spool
111—Plug (2 used)
112—Check Valve (lift check)—Left Travel Neutral Passage
113—Left Travel Spool
114—Orifice—Travel Power Passage
115—Check Valve (lift check)—Travel Power Passage
116—Orifice—Bucket Power Passage
117—Check Valve (lift check)—Bucket Power Passage
118—Flow Combiner Valve
119—Check Valve—Auxiliary Flow Combiner Valve Circuit
120—Orifice—Air Bleed (9 used)
121—Check Valve (lift check)—Auxiliary Power Passage
122—Auxiliary Flow Combiner Valve
123—Check Valve—Travel Flow Combiner Valve Circuit
124—Main Relief Valve Isolation Valve Check Valve—4 Spool
125—Main Relief Valve Isolation Valve Check Valve—5 Spool
126—Main Relief Valve
127—Hydraulic Oil Cooler Bypass Valve
128—Arm Cylinder
129—Boom Cylinder (2 used)
130—Bucket Cylinder
135—Blade Pump
136—Blade Main Relief Valve
137—Blade Control Valve
138—Check Valve (lift check)—Blade Neutral Passage
139—Check Valve (lift check)—Blade Power Passage
140—Blade Spool
141—Blade Up Circuit Relief and Anticavitation Valve
142—Blade Down Circuit Relief and Anticavitation Valve
143—Blade Cylinder (2 used)
600—Supply Oil
601—Blade Supply Oil
602—Return or Pressure-Free Oil
603—Trapped Oil
700—From Blade Pilot Control Valve (blade up)
701—From Blade Pilot Control Valve (blade down)
702—To Travel Motor
703—From Bucket Flow Rate Pilot Valve (port SK)
704—To Hydraulic Oil Tank
705—To Hydraulic Oil Tank
706—From Travel Flow Combiner Shuttle Valve
707—To Solenoid Valve Manifold
708—To Solenoid Valve Manifold
709—To Solenoid Valve Manifold
710—From Blade Signal Shuttle Valve (port C)
711—To Hydraulic Oil Tank
712—From Solenoid Manifold (port SC)
B30—Boom Up Pressure Sensor
B31—Arm In Pressure Sensor

Continued on next page

15—Pump 1
16—Pump 2
28—Pilot Pump
31—Hydraulic Oil Tank
36—Hydraulic Oil Cooler
41—Signal Control Valve (Pilot Valve Side)
51—Swing Motor
72—Center Joint
73—Right Control Valve (4-spool)
74—Left Control Valve (5-spool)
128—Arm Cylinder
129—Boom Cylinder (2 used)
132—Pilot Filter Housing
136—Bucket Cylinder

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12. Disassemble, clean, and inspect each component. Repair or replace damaged components.

IMPORTANT: If system contains a large amount of debris oil cooler can not be completely cleaned of contamination and must be replaced.

13. Replace oil cooler when required.

IMPORTANT: Disconnect hoses and lines from all tee fittings before cleaning. Cleaning sponge may become trapped in hose as it passes through a tee fitting.

14. Clean lines and hoses using JDG1770 Ultra Clean hose kit. Clean smaller oil capacity circuits first and proceed to larger capacity circuits.

NOTE: Close all openings of lines and components with caps and plugs to minimize additional contamination.

15. Install new machine system filter for cleanup procedure.

16. Install all serviced hydraulic components.

17. Install pilot control components.

18. Connect or install lines and hoses.

19. Fill hydraulic oil tank to operating level. See Check Hydraulic Tank Oil Level. (Operators Manual.)

20. Filter tank oil until filter caddy shuts off and contaminant value is ISO Code 13 or lower at 14 micron (c) setting. Use CODE SCROLL to check 4 and 6 micron (c) setting. ISO codes must be within 3 of each other.

Specification	
Contaminant ISO Code Value—4 micron (c) and Larger	ISO Code 19
6 micron (c) and Larger	ISO Code 16
14 micron (c) and Larger	ISO Code 13

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Continued on next page

5. Run machine at specification:

Specification	
Hydraulic Oil—Temperature	45—55°C 110—130°F
Engine—Speed	1650—1750 rpm and 1000—1100 rpm
Work Mode Switch—Position	Dig Mode
Power Mode Switch—Position	P (Standard) Mode
Auto-Idle Switch—Position	OFF

6. Compare pressure readings to specifications. Make adjustments as necessary.

Specification	
Pilot Pressure Regulating Valve—Pressure	3.3—4.8 MPa at 1000—1100 rpm 3309—4826 kPa at 1000—1100 rpm 33.1—48.3 bar at 1000—1100 rpm 480—700 psi at 1000—1100 rpm 3.5—5.0 MPa at 1650—1750 rpm 3509—5012 kPa at 1650—1750 rpm 35.1—50.1 bar at 1650—1750 rpm 509—727 psi at 1650—1750 rpm

7. Release hydraulic oil tank pressure by pushing pressure release button at top of hydraulic oil tank.

Continued on next page

10. Adjust the solenoid valve (1) as needed.

IMPORTANT: Turning adjusting screw out too far may cause oil leakage because the O-ring has come off its seat.

a. Loosen nut (2).

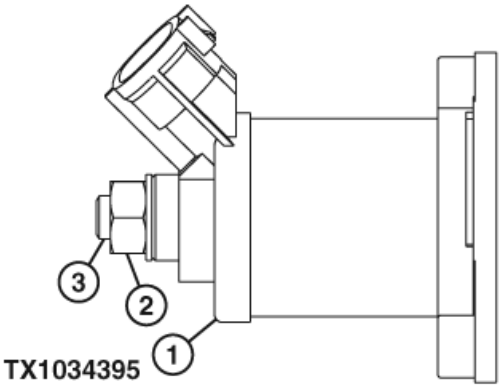
b. Turn adjusting screw (3) IN to increase pressure setting; turn adjusting screw OUT to decrease pressure setting. The length from end of adjusting screw to nut must not exceed specification.

Specification	
Solenoid Valve Adjusting Screw—	
Pressure Change	0.069 MPa approximate per 1/4 turn
	69 kPa approximate per 1/4 turn
	0.69 bar approximate per 1/4 turn
	10 psi approximate per 1/4 turn
End of Adjusting Screw-to-Nut—	
Length	2 mm maximum
	0.079 in. maximum

c. Hold adjusting screw and tighten nut.

Specification	
Solenoid Valve Adjusting Screw-to-Housing Nut—Torque	3.0 N•m
	27 lb-in.

11. Check the pressure setting again.



TX1034395 –UN–15JAN08

Solenoid Valve Adjustment

1—Solenoid Valve
2—Nut
3—Adjusting Screw

TP97644,000074B –19–01FEB08–5/5

10. Adjust the solenoid valve (1) as needed.

IMPORTANT: Turning adjusting screw out too far may cause oil leakage because the O-ring has come off its seat.

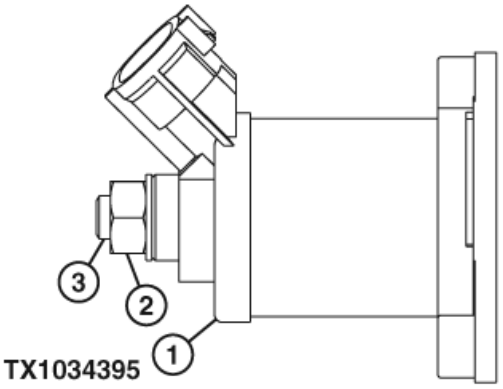
a. Loosen nut (2).

b. Turn adjusting screw (3) in to increase pressure setting; turn adjusting screw out to decrease pressure setting. The length from end of adjusting screw to nut must not exceed specification.

Specification	
Adjusting Screw—Pressure Change	0.069 MPa approximate per 1/4 turn 69 kPa approximate per 1/4 turn 0.69 bar approximate per 1/4 turn 10 psi approximate per 1/4 turn
End of Adjusting Screw-to-Nut—Length	2 mm or less 0.079 in. or less

c. Hold adjusting screw. Tighten nut.

Specification	
Adjusting Screw-to-Housing Nut—Torque	3 N•m 27 lb-in.



TX1034395 –UN–15JAN08

Solenoid Valve Adjustment

1—Solenoid Valve
2—Nut
3—Adjusting Screw

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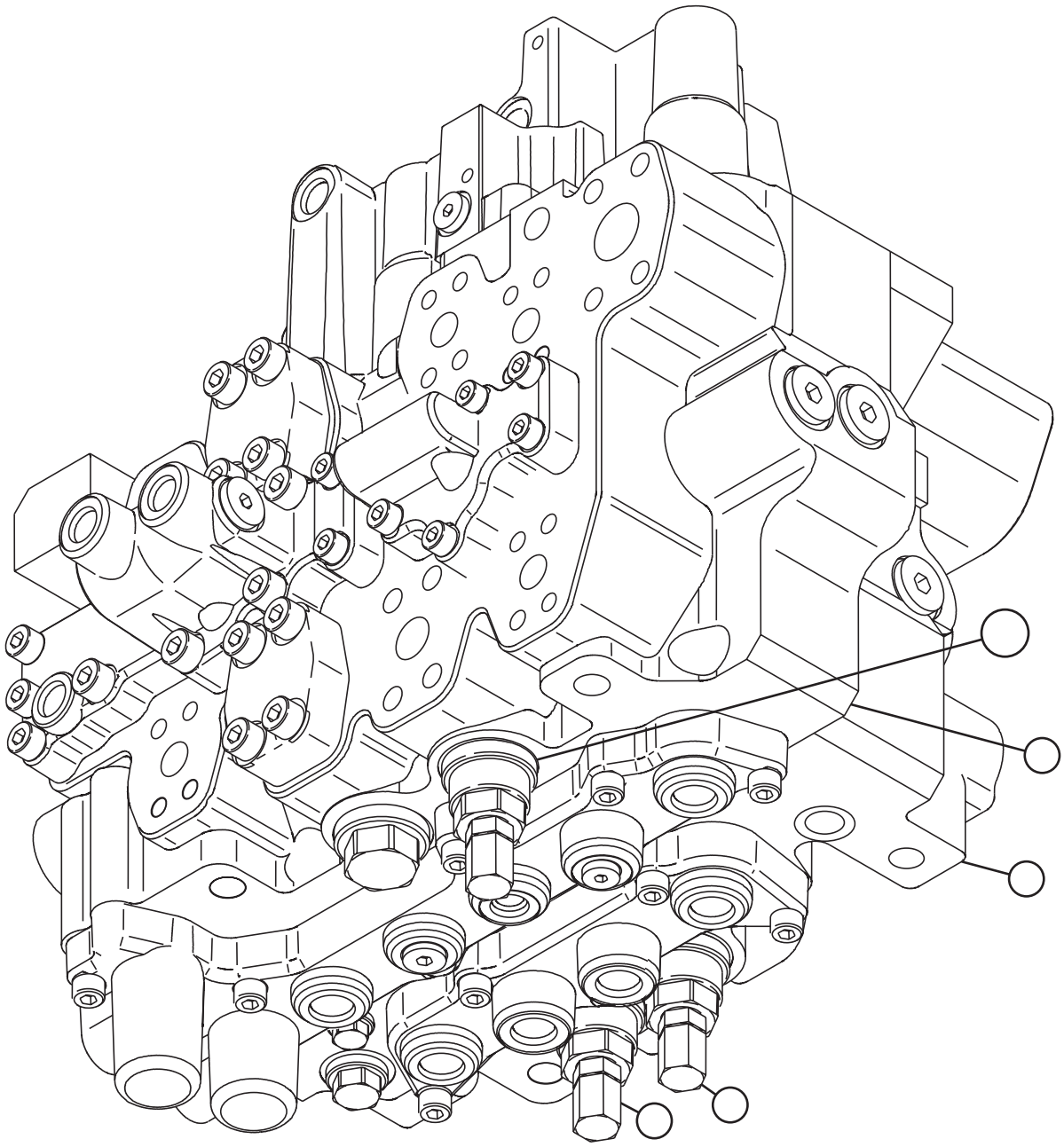


TX1035591

Control Valve Circuit Relief Valves—Left Rear and Bottom

73—Right Control Valve (4-spool)
74—Left Control Valve (5-spool)
81—Bucket Curl Circuit Relief and Anticavitation Valve
86—Boom Down Circuit Relief and Anticavitation Valve
102—Arm In Circuit Relief and Anticavitation Valve

Actuate the function over relief for circuit relief valve (80, 81, 85, 86, 102, and 103) being checked. Record pressure reading.

Continued on next page

TX1035591 –UN–31JAN08

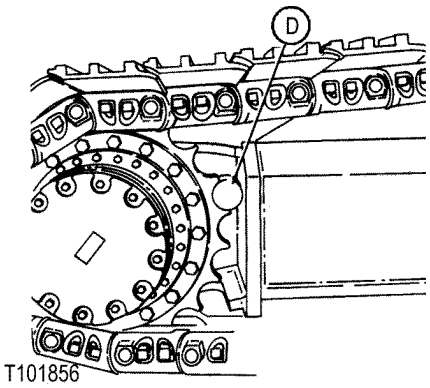
3. Install 76.2 mm (3 in.) OD pin or round bar stock between the sprocket and track frame to stall travel motor.

4. Run machine at specification.

Specification

Hydraulic Oil—Temperature	45—55°C 110—130°F
Engine—Speed	1300 rpm approximate
Work Mode Switch—Position	Dig Mode
Power Mode Switch—Position	P (Standard) Mode
Auto-Idle Switch—Position	OFF

D—76.2 mm (3 in.) OD Pin



T101856 –UN–02JUL96

Travel Motor Stalled Using Pin

TP97644,0000753 –19–01FEB08–3/5

5. Slowly actuate the travel function for the crossover relief valve (20 or 21) being checked.

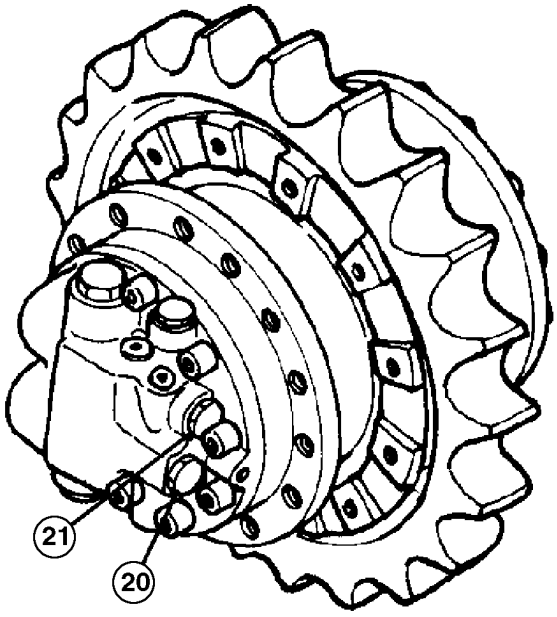
   Record the pressure reading. Make adjustments as necessary.

Specification

Travel Motor Crossover Relief Valve—Pressure	35.1—37.6 MPa 35 074—37 576 kPa 351—376 bar 5087—5450 psi

6. Stop engine. Release hydraulic oil tank pressure by pushing pressure release button at top of hydraulic oil tank.

20—Forward Crossover Relief Valve
21—Reverse Crossover Relief Valve



TX1000688 –UN–28NOV05

Travel Motor Crossover Relief Locations

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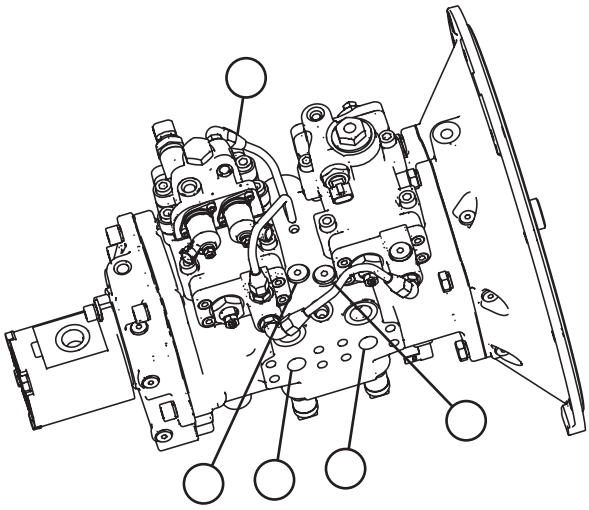
Connect pump delivery ports to inlet of flowmeters. Connect lines from outlet of flowmeters to pump-to-control valve lines from control valve using JT03452 Split Flange Connector Plate Kit.

MR24579,0000337 –19–01FEB08–3/10

4. Disconnect torque control line form regulator. Close ports in regulator using plugs.

1—Pump 1 Delivery Port
2—Pump 2 Delivery Port
3—Pump 2 Test Port
4—Pump 1 Test Port
5—Torque Control Line



TX1035207 –UN–24JAN08

Pump Port Locations

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MR24579,0000337 –19–01FEB08–4/10

3. Disconnect the drain line (3) at return manifold. Put line in a calibrated container (4). Install a JT03025 Cap (2) on fitting (1).

4. Raise track off the ground for side being checked.

5. Run machine at specification.

Specification

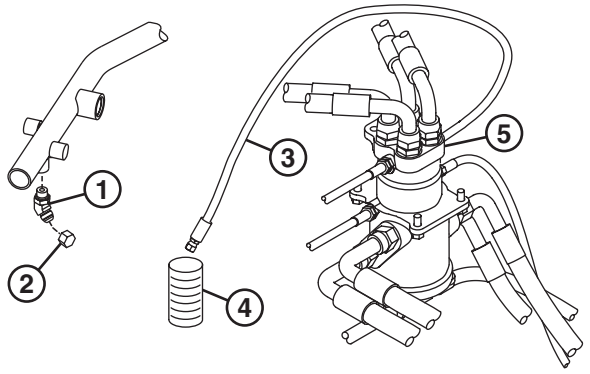
Engine—Speed	1650—1750 rpm
Work Mode Switch—Position	Dig Mode
Power Mode Switch—Position	P (Standard) Mode
Auto-Idle—Position	OFF
Travel Speed Switch—Position	Fast (Rabbit)

6. For travel motor being checked, actuate travel forward function at full speed for one minute. Record amount of leakage. Repeat procedure for reverse.

   Compare leakage to specification. Repair or replace travel motor as necessary.

Specification

Travel Motor with Track Raised—	
Leakage	1.8 L/min or less
	0.48 gpm or less



T144139 –UN–19JUL01

Center Joint and Return Manifold

1—45° Elbow Fitting
2—JT03025 Cap
3—Travel Motor Drain Line
4—Calibrated Container
5—Center Joint

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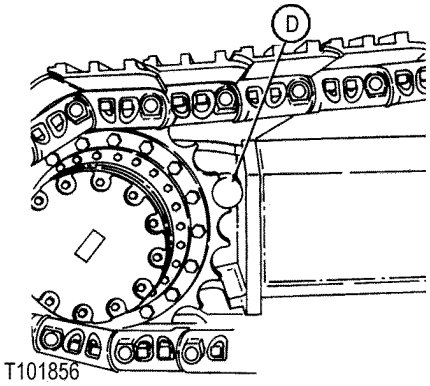
7. To check travel motor for leakage at stall, install pin (D) or round bar stock between the sprocket and track frame on the side being tested.

8. Actuate the forward travel function being checked to full stroke for one minute. Record the amount of leakage.

   Repeat procedure by stalling the motor in several different positions and then take an average of readings. Repeat procedure for reverse.

Specification

Travel Motor Stalled—Leakage	2.5 L/min or less
	0.66 gpm or less



T101856 –UN–02JUL96

Travel Motor Stalled Using Pin

D—76.2 mm (3 in.) OD Pin

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TP97644,0000758 –19–15JAN08–3/4

Symptom	Problem	Solution
	Refrigerant hose kinked, pinched, or collapsed	Re-route or re-index hoses. Replace collapsed hoses. See Heater and Air Conditioner Component Location. (Group 9031-15.) See Refrigerant Hoses and Tubing Inspection. (Group 9031-25.)
	Heater or evaporator fins restricted with dirt or dust	Clean heater or evaporator fins. See Heater and Air Conditioner Component Location. (Group 9031-15.) See Heater and Air Conditioner Remove and Install. (Group 1830.)
	Air conditioner and heater mixer servomotor door open	Check door for obstructions and test servomotor. See Right Console Harness (W7) Wiring Diagram. (Group 9015-10.)
	Compressor clutch slipping or failed	Inspect and replace compressor clutch if necessary. Perform Air Conditioner Compressor Clutch Test. (Group 9031-25.)
	Warm outside air leaking into cab	Inspect, repair, or replace door and window seals. See Windowpane Remove and Install. (Group 1810.) See Sliding Window Remove and Install. (Group 1810.)
	System refrigerant (R134a) charge low	Perform Charge R134a System. (Group 1830.)Perform Refrigerant Leak Test. (Group 9031-25.)
	Evaporator fins frosting or freezing	Freeze control switch not positioned correctly in evaporator core. Reposition switch in evaporator core. See Heater and Air Conditioner Component Location. (Group 9031-25.)

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Section 9050
Reference Material

Contents

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