



Service Manual

M70D	36/48v	A1EC4 - 60200 - 80199
	72/80v	A1EC4 - 80200 - 99999
M80D	36/48v	A1EC4 - 60200 - 80199
	72/80v	A1EC4 - 80200 - 99999
M100D	36/48v	A1EC4 - 60200 - 80199
	72/80v	A1EC4 - 80200 - 99999
M120D	36/48v	A1EC5 - 60200 - 80199
	72/80v	A1EC5 - 80200 - 99999

INDEX

Specifications

Component Measurements	5
Console	6
Contactor Tip Clearance	7
Control Panel	8
Current Measurements	5
Direction Switch	6
Display Layout	6
Fuses	7
Head Capacitor	7
Instrument Panel	6
Logic Board Layout	5
Thermal Switch	7
Transistor Connections	5
Transistor Measurements	5

Systems Operation

Accessory Circuits	26
DC-DC Converter	27
Horn Circuit	26
Hour Meter Circuit	26
Actuation Circuit	28
Capacitor Charging Circuit	29
Drive Circuit	41
Bypass Circuit With Shunt Field Activated	46
Bypass Circuit Without Shunt Field Activated	47
Control Circuit	41
Current Limit	45
Electrical Braking (Regenerative and Plugging)	48
Flyback Circuit	44
Failure Protection Circuit	45
Power Circuit	42
Thermal Protection Circuits	45
General Information	17
Glossary	10
Hydraulic Pump Motor Circuit	29
Lift Circuit	36
Power Steering Circuit	29
Tilt And Auxiliary Control	40
Location of Control Panel Components	15

Logic Unit	20
Option Jumpers	20
Operational Circuit Elements	22
Accelerator Control	26
Battery Discharge Indicator (BDI)	22
Vehicle Monitoring System	22
Chat Mode	25
Contactors	25
Current Sensor	25
International Pictorial Symbols	24
On Board "Run Time" Diagnostics – (Fault Detection)	22
Resistor (Charging)	25
Programmable Features	18
Activating Default Settings	19
Programming Features	20
Symbol Library	14

Testing And Adjusting

Accessing Stored Faults	53
System Tests And Adjustments	107
Component Tests	110
Accelerator Control	113
Capacitor (Head)	113
Conductor And Switch Continuity	113
Contactor (Bypass Activation)	114
Contactor Components	115
Current Sensor	115
DC-DC Converter	116
Diode Replacement	117
Diodes	117
Display Panel	114
Driver Board (Off Vehicle)	124
Driver Board (On Vehicle)	118
Logic Unit Quick Reference Voltage Check	111
Resistor (Charging)	128
Resistors (R322 and R312)	127
Thermal Switch	128
Transistors T1P, T2P, T3P, T1D, T2D And T3D	126
Transistor Replacement T1P, T2P, T3P, T1D, T2D And T3D Valve Control Card	126
Vehicle Monitoring System Self Test	114
Vehicle Monitoring System Quick Reference Voltage Check	110
Discharging Head Capacitor (HEAD CAP)	107

Thermal Switch

Contacts open at 81 to 89°C (178 to 192°F)
Contacts close at 69 to 77°C (156 to 170°F)

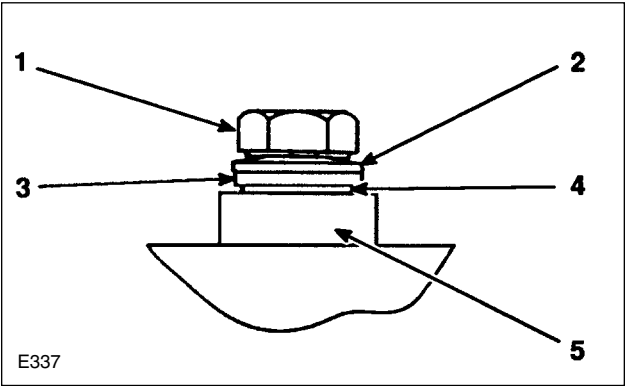
Contactor Tip Clearance (Gap)

Line, lift, bypass, regen no adjustment
Direction (forward and reverse) 2.62+ .08 mm
(.103+ .003 in)

Fuses

Key 10A
Line
 (72/80 V) 675V
 (36/48) 750A
Horn (if equipped) 3A
Drive shunt field 10A
Pump shunt field 10A

Head Capacitor

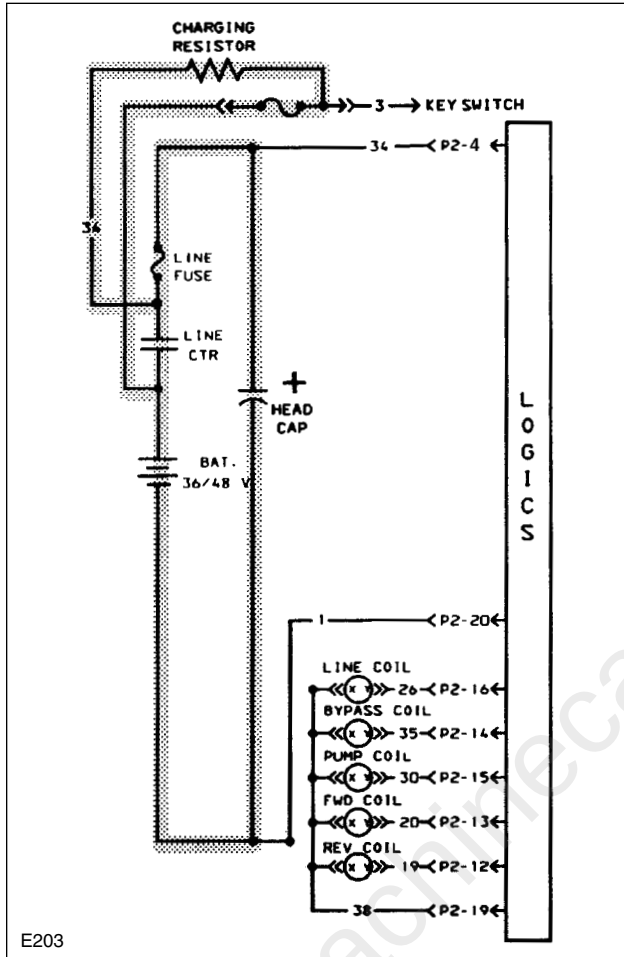


NOTE: Proper torque and assembly of capacitor hardware is critical. Avoid disassembly unless capacitor has to be replaced.

- (1) Tighten capacitor terminal bolt to a torque of 4.5 to 5.5 N·m (40 to 50 lb in)
- (2) Spring washer 8T2229.
- (3) Ring terminal of wire assembly.
- (4) Lockwasher 8C3398.
- (5) Head capacitor terminal.

With the line contactor tips closed, the logics continues its checks for any "Run Time" faults. If no faults are detected, the display will indicate the battery charge level, the power steering system operates, the pump and drive power circuits receive battery voltage and the logics receives battery voltage on wire #34 at P2-4.

Capacitor Charging Circuit



Capacitor Charging Circuit (Typical Example)

A charging resistor is used to maintain voltage on the head capacitor whenever the battery is connected and the line contactor is open. This voltage reduces arcing of the line contactor tips during line contactor activation. The charging resistor is installed parallel with the line contactor tips. Current flows from battery positive through the key fuse, charging resistor, line fuse and the positive heat sink into battery negative. This circuit will maintain a voltage across the head capacitor above approximately 20 volts.

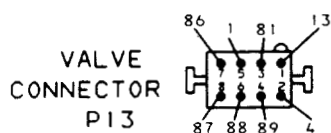
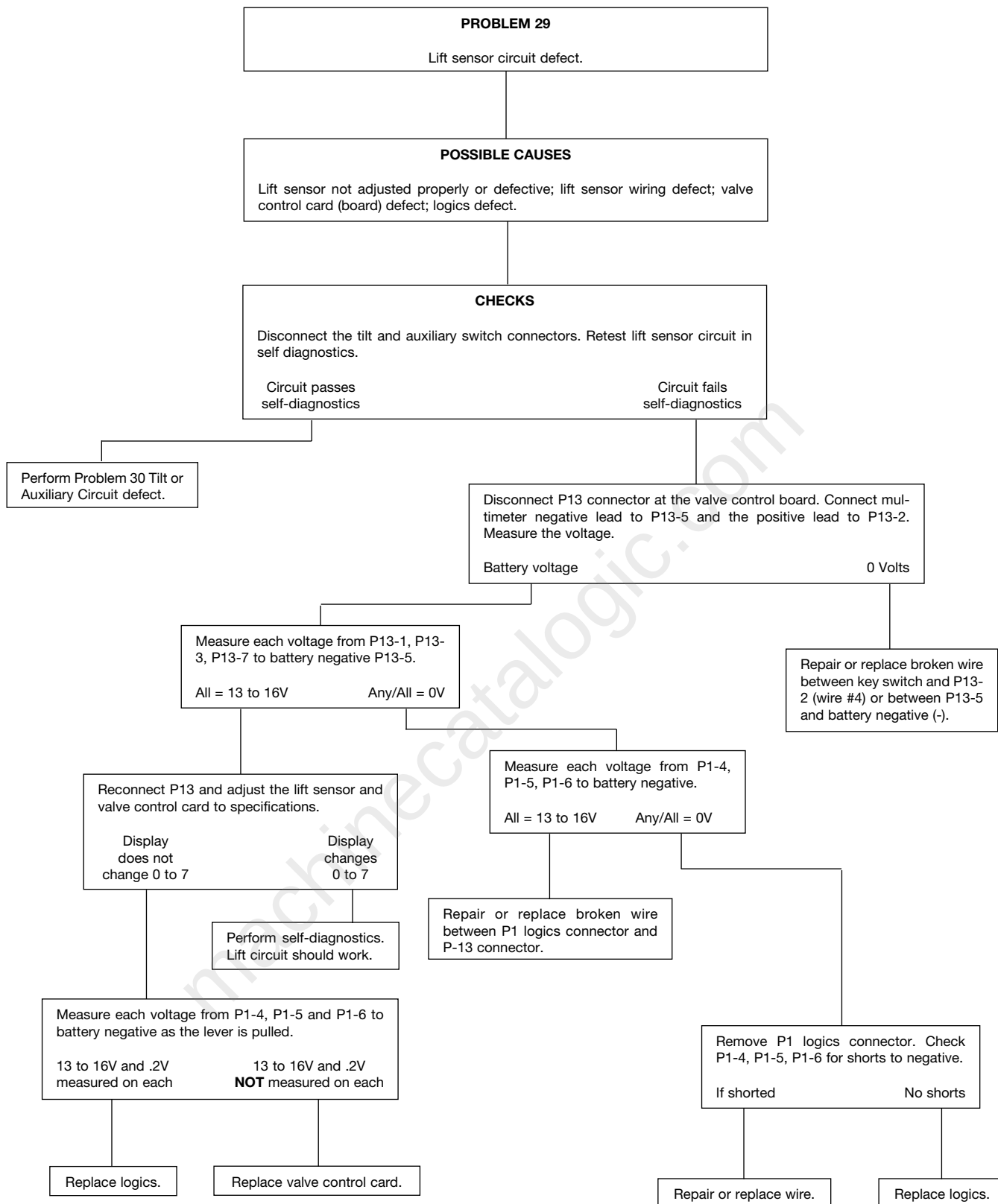
Hydraulic Pump Motor Circuit

Only one hydraulic pump motor is used for all power steering, lift, tilt, and auxiliary hydraulic functions. To activate the pump circuit, the seat switch, key switch and line contactor must be closed first as explained in the topic, Actuation Circuit. The power steering, lift, tilt, and auxiliary circuits are explained as follows:

Power Steering Circuit

The power steering (PS) circuit has two speeds (PS idle and PS in use) independent of the lifting speeds.

NOTE: Shaded lines on the circuit diagrams indicate current flow. Other circuits can be activated at the same time, but each one is shown separately to illustrate current flow in each individual circuit.



NOTE: Before lift truck is placed into service, connect tilt and auxiliary switches and verify proper adjustment.

[illegible]

Resistors

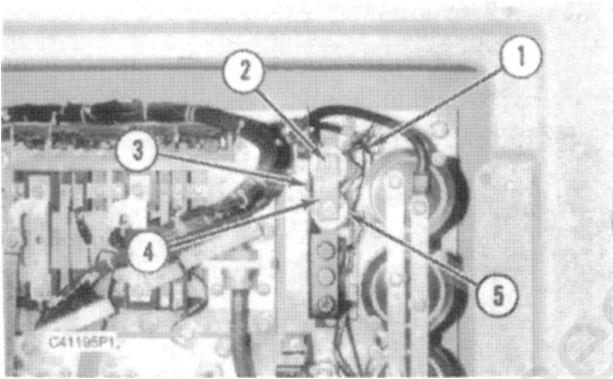
Remove & Install Resistors

WARNING

Battery Voltage and high amperage are present. Injury to personnel is possible. Disconnect the battery and discharge the head capacitor (HEAD CAP) before any contact is made with control panel.

START BY:

- a. remove logic unit



NOTE

Mark all electrical wiring and cables with identification for installation purposes.

1. Disconnect four wires (1) from the resistors.
2. Remove two nuts (2) and one screw (3).
3. Remove bracket (4) and slide two resistors (5) off of the threaded rods.
4. Slide the two resistors (5) onto the threaded rods and install bracket (4).
5. Install one screw (3) and two nuts (2).
6. Connect four wires (1) to the resistors.

NOTE

The following steps are for the installation of the resistors.

END BY:

- a. install logic unit

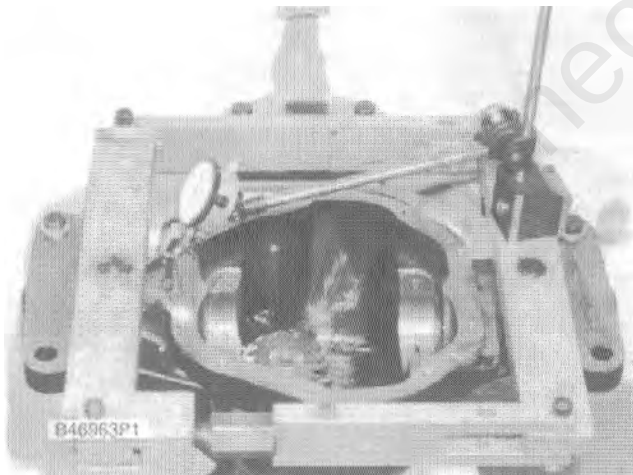
DIFFERENTIAL AND FINAL DRIVE

EXAMPLE: If the total distance moved was **1.78 mm (.070)** (Reference Shims Thickness for Differential Bearings) and Step 5 an indication of **0.97 mm (.038 in)** was read, the **0.97 mm (.038 in)** shims must be added on the side of the differential behind the ring gear [shim pack (1)]. The remainder of the shims, **0.81 mm (.032 in)** thick, plus **0.38 mm (.015)** [or **1.19 mm (.047 in)** total] must be installed on the side of the differential next to the teeth of the ring gear [shim pack (3)].

6. Remove the differential, remove the master bearings and install the shims on the correct side of the differential. Install the bearing cones and cups.

NOTE

Do not cause a distortion to the housing of more than **0.30 mm (.012 in)** or the housing could be damaged.



Differential Housing Distortion

7. Use a spreader and a dial gauge indicator group as shown to cause a distortion to the housing of **0.25 to 0.30 mm (.010 to .012 in)** maximum.
8. Remove the dial indicator and install the differential into the housing. Make sure that the differential is installed completely, and the

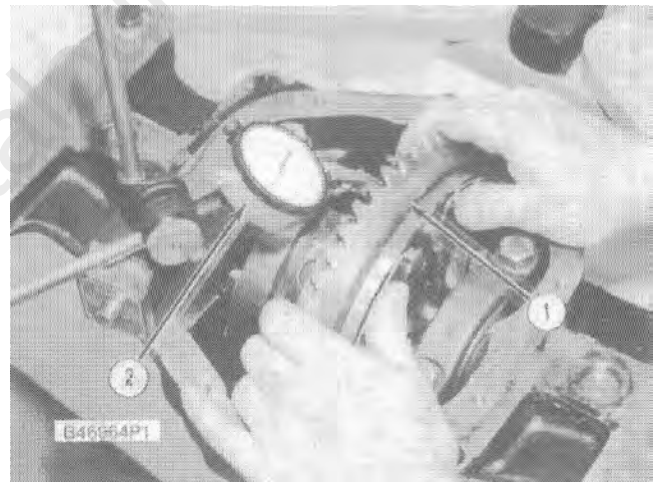
gears are engaged properly, then remove the spreader.

9. Install the bearing caps and bolts. Tighten the bolts to a torque of **84 to 98 N•m (63 to 72 lb ft)**.

NOTE

Make sure that the marks on the bearing caps and the housing are in correct alignment.

Gear Clearance (Backlash) Adjustment



Gear clearance (backlash) check

(1) Ring gear. (2) 8T5096 Dial Indicator Group.

Check the ring gear and the bevel pinion clearance (backlash) at three points around ring gear (1). There must be an equal space between each point.

1. Install indicator (2) on the case and hold the end yoke, so that it will not turn.
2. Move ring indicator (1) backward and forward while the indication is read. The gear clearance (backlash) must be **0.13 to 0.23 mm (.005 to .009 in)** and must not change more than **0.08 mm (.003 in)** between the three points. A change of more than

11. Move stone (3) across the commutator at the back edge of the brushes for a short time. This will take the shiny finish off the commutator and seat the new brushes.
12. Turn the key switch to the OFF position and disconnect the batteries. Check the contact surface of each brush. At least 85% of the brush contact surface of each brush must show wear. If necessary, do Steps 9 through 12 again until the correct wear can be seen on the brush contact surface.

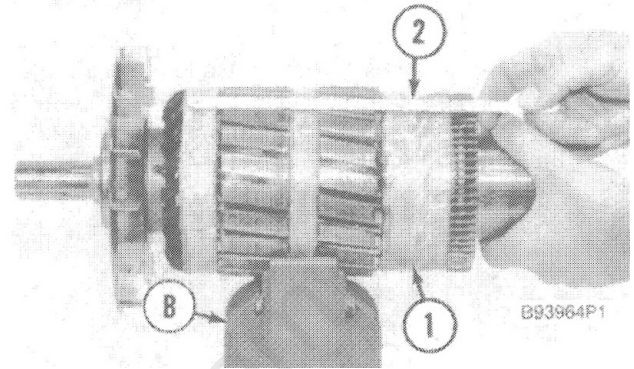
NOTE

Never use air pressure that is more than 205 kPa (30 psi). Make sure the line is equipped with a water filter.

13. After the brushes have the correct seat contact surface, operate the motor at slow speed. Use compressed (pressure) air to remove all dust and abrasive grit.

Armature Tests

Short Circuit Test



Short Circuit Test (Typical Example)

(1) Armature. (2) Hacksaw blade. (B) Growler.

1. Position the armature (1) windings in the jaws of growler (B).
2. Turn the growler on. Slowly turn the armature in the growler jaws while a hacksaw blade (2) is held over the windings.
3. If the windings are shorted, there will be a vibration to the hacksaw blade. There will be no vibration if the windings do not have a short.

The odor of burned insulation from the drive motor while it is in operation is an indication of a short in the armature.

If the armature windings are shorted replace the armature.

Full Version Available

Caterpillar M120D Forklift Service and Schematic Manual (SENB8470)

Caterpillar M120D Forklift service manual, covers hydraulics, mast, drive unit, wiring, and engine work. Downloadable PDF format.

[VIEW THE FULL MANUAL](https://machinecatalogic.com/caterpillar-m120d-forklift-service-and-schematic-manual-senb8470/)

<https://machinecatalogic.com/caterpillar-m120d-forklift-service-and-schematic-manual-senb8470/>