PART NO.

TATA HITACHI

Reliable solutions

Technical Manual

Troubleshooting

ZAXIS 470H

GI - SERIES

Hydraulic Excavator

Serial No. :

ZX470H - 000001 ONWARDS

Use Handholds and Steps

- Falling is one of the major causes of personal injury.
  - When you get on and off the machine, always face the machine and maintain a three-point contact with the steps and handrails.
  - Do not use any controls as hand-holds.
  - Never jump on or off the machine. Never mount or dismount a moving machine.
  - Be careful of slippery conditions on platforms, steps, and handrails when leaving the machine.
  - Never get on and off the machine with tools in your hands.

SA-439

Adjust the Operator's Seat

- A poorly adjusted seat for either the operator or for the work at hand may quickly fatigue the operator leading to misoperations.
  - The seat should be adjusted whenever changing the operator for the machine.
  - The operator should be able to fully depress the pedals and to correctly operate the control levers with his back against the seat back.
  - If not, move the seat forward or backward, and check again.
  - Adjust the rear view mirror position so that the best rear visibility is obtained from the operator's seat. If the mirror is broken, immediately replace it with a new one.

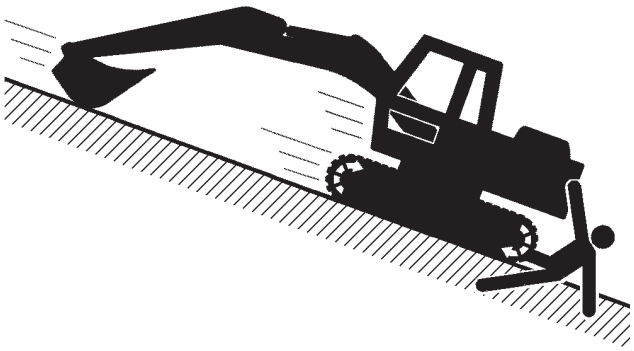
SA-378

Avoid Injury from Rollaway Accidents

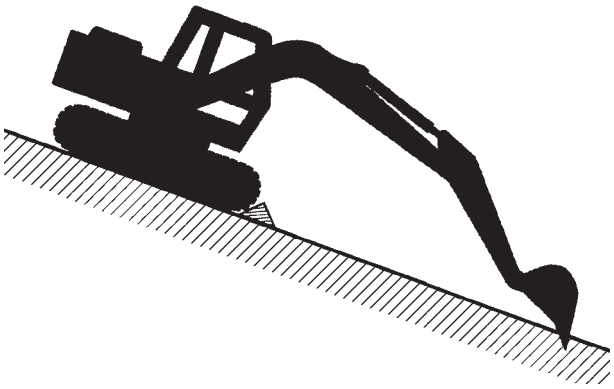
- Death or serious injury may result if you attempt to mount or stop a moving machine.

To avoid rollaways:

- Select level ground when possible to park the machine.
- Do not park the machine on a grade.
- Lower the bucket and/or other work tools to the ground.
- Turn the auto-idle switch OFF and the power mode switch ECO.
- Run the engine at slow idle speed without load for 5 minutes to cool down the engine.
- Stop the engine and remove the key from the key switch.
- Pull the pilot control shut-off lever to LOCK position.
- Block both tracks and lower the bucket to the ground. Thrust the bucket teeth into the ground if you must park on a grade.
- Position the machine to prevent rolling.
- Park at a reasonable distance from other machines.



SA-391



SA-2273

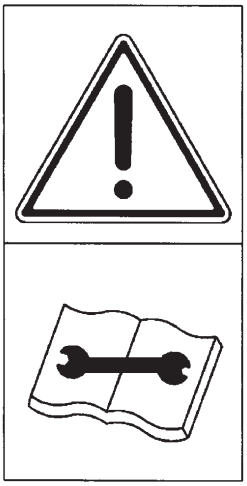
- Sufficiently illuminate the work site. Use a maintenance work light when working under or inside the machine.
- Always use a work light protected with a guard. In case the light bulb is broken, spilled fuel, oil, antifreeze fluid, or window washer fluid may catch fire.

SA-037

Warn Others of Service Work

- Unexpected machine movement can cause serious injury.
  - Before performing any work on the machine, attach a "Do Not Operate" tag on the control lever.

  This tag is available from your authorized dealer.



SS2045102

Support Machine Properly

- Never attempt to work on the machine without securing the machine first.
  - Always lower the attachment to the ground before you work on the machine.
  - If you must work on a lifted machine or attachment, securely support the machine or attachment. Do not support the machine on cinder blocks, hollow tires, or props that may crumble under continuous load. Do not work under a machine that is supported solely by a jack.

SA-527

Prevent Battery Explosions

- Battery gas can explode.
  - Keep sparks, lighted matches, and flame away from the top of battery.
  - Never check battery charge by placing a metal object across the posts. Use a voltmeter or hydrometer.
  - Do not charge a frozen battery; it may explode. Warm the battery to 16 ˚C (60 ˚F) first.
  - Do not continue to use or charge the battery when electrolyte level is lower than specified. Explosion of the battery may result.
  - Loose terminals may produce sparks. Securely tighten all terminals.
  - Connect terminals to the correct electrical poles. Failure to do so may cause damage to the electrical parts or fire.

- Battery electrolyte is poisonous. If the battery should explode, battery electrolyte may be splashed into eyes, possibly resulting in blindness.
  - Be sure to wear eye protection when checking electrolyte specific gravity.

SA-032

Service Air Conditioning System Safely

- If spilled onto skin, refrigerant may cause a cold contact burn.
  - Refer to the instructions described on the container for proper use when handling the refrigerant.
  - Use a recovery and recycling system to avoid leaking refrigerant into the atmosphere.
  - Never touch the refrigerant.

SA-405

Preparation for Performance Tests

Observe the following rules in order to carry out performance tests accurately and safely.

THE MACHINE

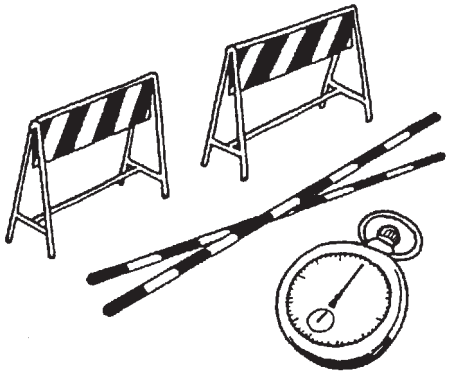
1. Repair any defects and damage found, such as oil or water leaks, loose bolts, cracks and so on, before starting to test.

TEST AREA

1. Select a hard and flat surface.
2. Secure enough space to allow the machine to run straight more than 20 m (65 ft 7 in), and to make a full swing with the front attachment extended.
3. If required, rope off the test area and provide signboards to keep unauthorized personnel away.

PRECAUTIONS

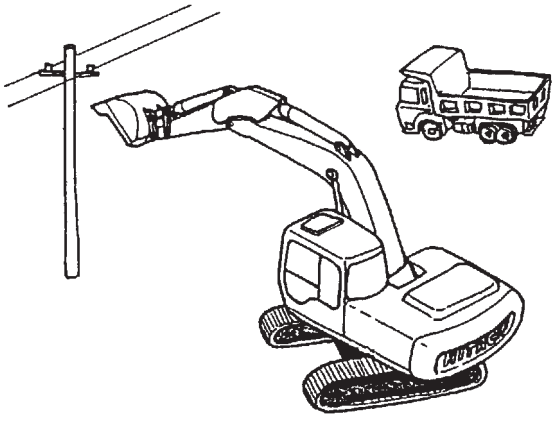
1. Before starting to test, agree upon the signals to be employed for communication among coworkers. Once the test is started, be sure to communicate with each other using these signals, and to follow them without fail.
2. Operate the machine carefully and always give first priority to safety.
3. While testing, always take care to avoid accidents due to landslides or contact with high-voltage power lines. Always confirm that there is sufficient space for full swings.
4. Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.



T105-06-01-003

MAKE PRECISE MEASUREMENT

1. Accurately calibrate test instruments in advance to obtain correct data.
2. Carry out tests under the exact test conditions prescribed for each test item.
3. Repeat the same test and confirm that the test data obtained can be produced repeatedly. Use mean values of measurements if necessary.



T105-06-01-004

Item		Reference Value	Measured Value				Remarks
			First	Second	Third	Average	
PUMP 1 REGULATOR VALVE CURRENT	(mA)	308					When boom raise relieving
PUMP 2 REGULATOR VALVE CURRENT	(mA)	300					When boom raise relieving
ARM 2 FLOW CONTROL VALVE CURRENT	(mA)	495					When arm roll-in relieving
SWING FLOW CONTROL VALVE CURRENT	(mA)	490					When boom raise relieving and swing
AUXILIARY VALVE 1 CURRENT	(mA)	-					
AUXILIARY VALVE 2 CURRENT	(mA)	-					

Adjustment:

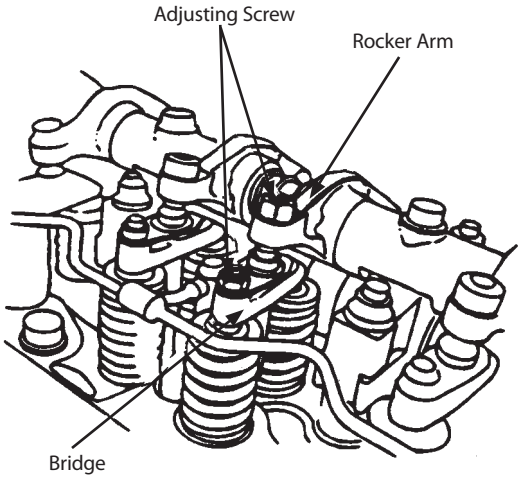
If the measured valve clearances do not conform to the standard value, adjust the valve clearance in the same order of the measurement.

1. Completely loosen the adjusting screws on the bridge and rocker arm.
2. Insert a 0.4 mm feeler gauge. Adjust the valve clearance with the adjusting screw on the rocker arm. Do not adjust the clearance too tight at this stage. Leave a slight looseness. Securely lock the adjusting screw with the lock nut.

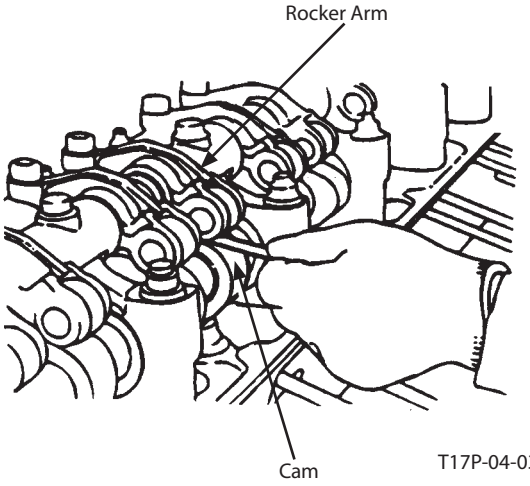
   m : 79 N·m (80 kgf·m, 58 lbf·ft)

3. With a feeler gauge inserted, screw in the adjusting screw on the bridge gradually until it touches to the end of the valve stem. Check that the movement of the feeler gauge becomes stiff.
4. In this condition, the opposite end of the bridge is raised. Readjust by loosening the adjusting screw on the bridge until there is a slight drag on the feeler gauge and tighten the lock nut securely.

   m : 54 N·m (5.5 kgf·m, 40 lbf·ft)



T17P-04-03-001



T17P-04-03-002

Travel Motor Leakage

Summary:

To measure the parking brake function on a specified slope.

Preparation:

1. The surface of the test slope shall be even with a gradient of 20 % (11.31 °).
2. Hold the bucket 0.2 to 0.3 m (8 to 12 in) above the ground with the arm and bucket fully rolled in.

IMPORTANT: The bucket teeth will hit the boom if the bucket is rolled-in with the arm fully rolled-in. As for this condition: arm fully rolled-in + Bucket fully rolled-in, set the bucket at fully rolled-in and a perform arm roll-in operation.

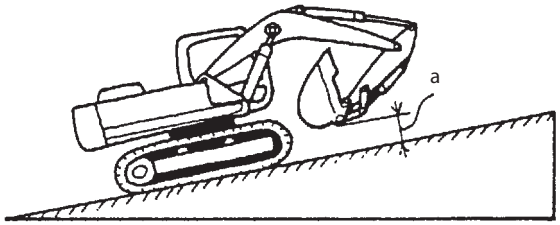
3. Maintain the hydraulic oil temperature at 50±5 °C (122±9 °F).

Measurement:

1. Measure the travel parking brake slip amount while parked.
2. Climb the slope and place the travel levers in neutral.
3. Stop the engine.
4. After the machine stops, put the matching marks on a track link or shoe, and the track side frame.
5. After 5 minutes, measure the distance between the marks on the track link or shoe and the track side frame.

Evaluation:

Refer to Operational Performance Standard.



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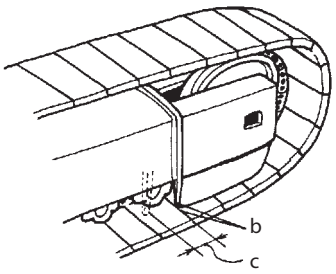


T105-06-03-006

a - 0.2 to 0.3 m (8 to 12 in)
b - Alignment marks on the track side frame and shoe when the machine comes to a stop.
c - Displacement measured after 5 minutes.

Dig Function Drift Check

Summary:

Measure dig function drift, which can be caused by oil leakage in the control valve and boom, arm, and bucket cylinders, with the loaded bucket.

NOTE: When testing the dig function drift just after cylinder replacement, slowly operate each cylinder to its stroke end to release air.

Preparation:

1. Load bucket fully. In lieu of loading the bucket, weight (W) of the following specification can be used.

   W=2850 kg (6280 lb)

2. Position the front attachment as follows:

   With the arm cylinder fully retracted and the bucket cylinder fully extended.

3. With the arm rolled out and the bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin.

4. Maintain the hydraulic oil temperature at 50±5 °C (122±9 °F).

Measurement:

1. Stop the engine.

2. Five minutes after the engine has been stopped, measure the change in the position of the bottom of the bucket, as well as the boom, arm and bucket cylinders.

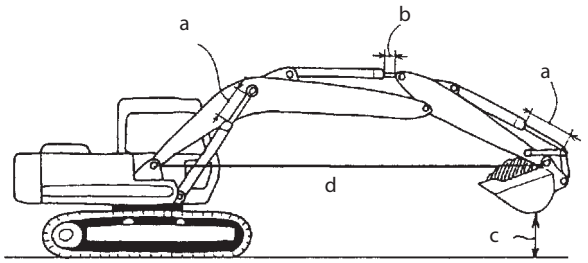
3. Perform the measurement three times and calculate the average values.

Evaluation:

Refer to the Operational Performance Standard.

Remedy:

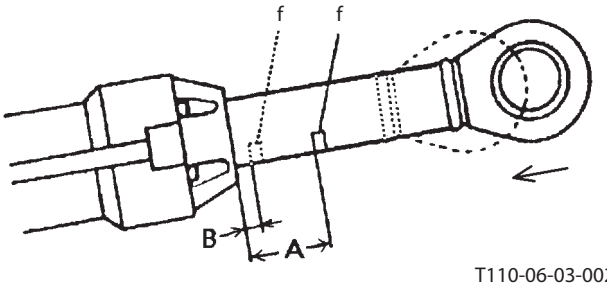
Refer to the Troubleshooting B.



T105-06-03-021

a - Retraced Distance
b - Extended Distance
c - Bucket Bottom
d - Same Height

e



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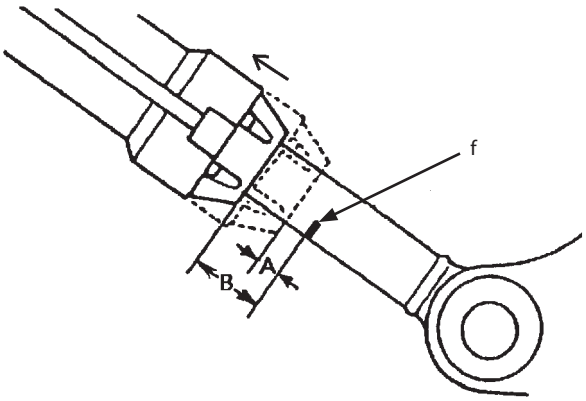
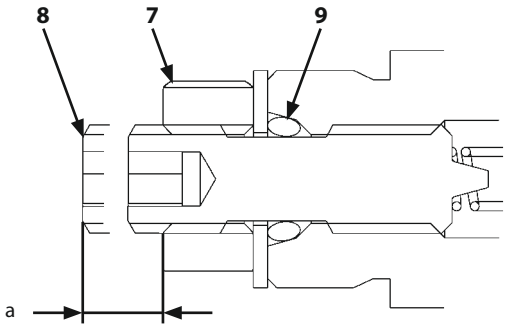
g



T110-06-03-001

e - Boom and Bucket Cylinder Retraction
f - Mark
g - Arm Cylinder Extension

Solenoid Valve Adjustment Procedure



T1V1-04-05-004

IMPORTANT: As O-ring(9) is damaged and oil leakage may cause, do not loosen adjusting screw (8) excessively.

Do not loosen adjusting screw (8) more than 2 turns.

1. Loosen lock nut (7). Turn adjusting screw (8) and adjust the set pressure.
2. After adjustment, tighten lock nut (7).

: 10 mm

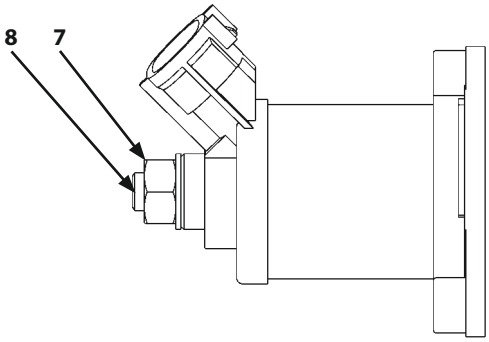
: 5 N·m (0.5 kgf·m, 3.7 lbf·ft)

: 3 mm

3. After adjustment, check the set pressure.

NOTE: Standard Change in Pressure (Reference)

Screw Turns		1/4	1/2	3/4	1
Change in Pressure	kPa	69	137	206	275
	(kgf/cm^2)	(0.7)	(1.4)	(2.1)	(2.8)
	(psi)	(10)	(20)	(30)	(40)



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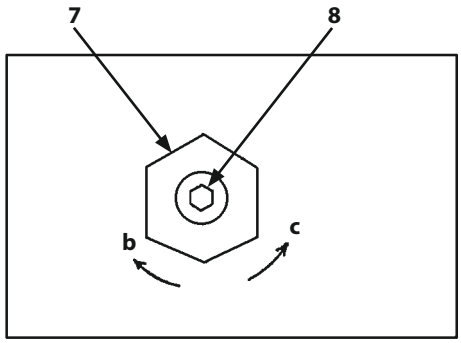


W107-02-05-129

a- 2.0 mm (0.08 in)
b- Pressure Increase
c- Pressure Decrease
7- Lock Nut
8- Adjusting Screw
9- O-Ring

Measurement:

1. Measurement Conditions are below.

Engine Control Dial	Power Mode Switch	Auto-Idle Switch	Work Mode
Fast Idle	PWR Mode	OFF	Digging Mode

2. Slowly operate the bucket, arm and boom control levers to the stroke ends and relieve each function.
3. Read pressures at this time.
4. Perform the measurement for the bucket, arm and boom in that order.
5. Repeat the measurement three times and calculate the average value for each.

Evaluation:

1. Performance of the overload relief valves are normal if the measured main relief pressures are within the specified value range.

   Refer to the Operational Performance Standard.

Swing Motor Drainage

Summary:

1. Measure amount of oil draining from the swing motor while swinging the upperstructure and check the swing motor performance.
2. The amount of drain oil from the swing motor will change depending on hydraulic oil temperature.

Preparation:

1. Maintain hydraulic oil temperature at 50±5 °C (122±9 °F). Rotate the swing motor in order to warm inside of the motor.
2. Stop the engine. Push air bleed valve on top of the hydraulic oil tank and release any remaining pressure.
3. Measure the left swing motor drainage:

   Disconnect drain hose (2) at left side tee (B). Connect the test drain hose (3/4-16UN) to the motor side and plug (ST 6637) to drain hose (2).

   Measure the right swing motor drainage:

   Disconnect right drain hose (1) at right side tee (A). Install plug (ST 6491) on the tee side.

: 27 mm

: 93 N·m (9.5 kgf·m, 70 lbf·ft)

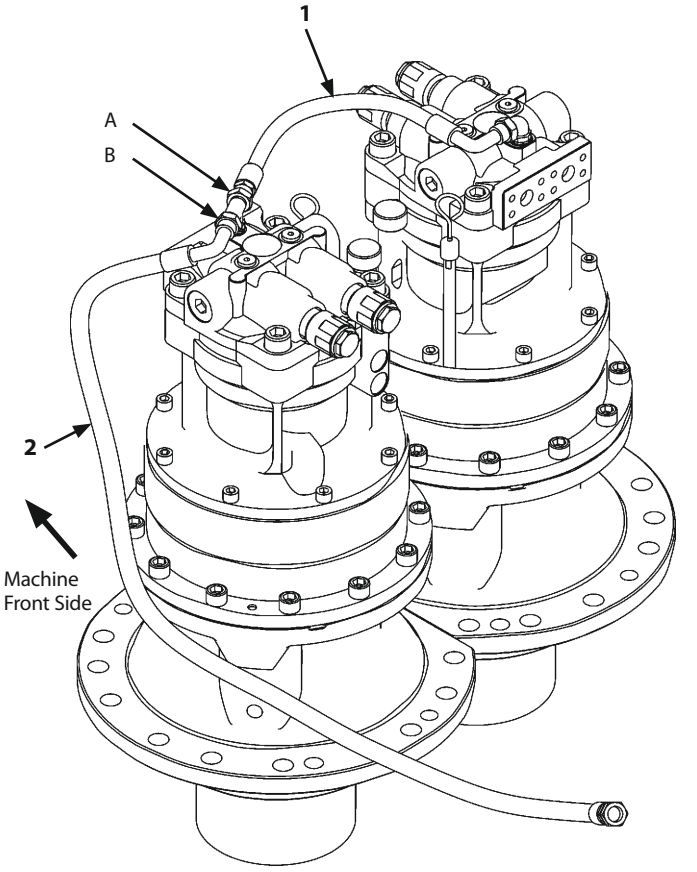
CAUTION: Prevent personal injury. Always make sure that the area is clear and that co-workers are out of the swing area before starting machine operation.

Also, take care not to fall off the machine

Preconditions for Measurement:

1. Measurement conditions are below.

Engine Control Dial	Power Mode Switch	Auto-Idle Switch	Work Mode
Fast Idle	PWR Mode	OFF	Digging Mode



T16J-04-04-007

1- Drain Hose (Between Swing Motor)
2- Drain Hose (Return Hydraulic Oil Tank)
A- Right Side Tee
B- Left Side Tee

Engine Speed Adjustment and Engine Learning

After removing and/or replacing the components as described below for repair and/or inspection, or if error in engine speed is found, readjust engine speed and perform engine learning.

- Removal of the engine, engine control cable, or EC motor
- Replacement of ECF

Adjustment of Engine Speed:

1. Set the key switch to the START position and start the engine.

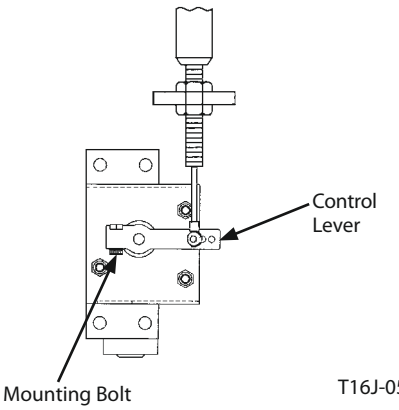
NOTE: Turn the air conditioner OFF.

2. Set the engine control dial to the slow idle speed position. (The output voltage from EC sensor is 2.5 V.)
3. Loosen the mounting bolt of the control lever attached to the EC motor output shaft.
4. While monitoring the actual engine speed with MPDr. or the engine speed meter, adjust the control lever so that the minimum speed (slow idle) matches the specification. Specification: Refer to OPERATIONAL PERFORMANCE TEST.
5. Tighten the mounting bolt and secure the control lever to the EC motor output shaft.

: 50 N·m (5 kgf·m)

NOTE: Do not lubricate the EC motor output shaft.

6. Perform engine learning.



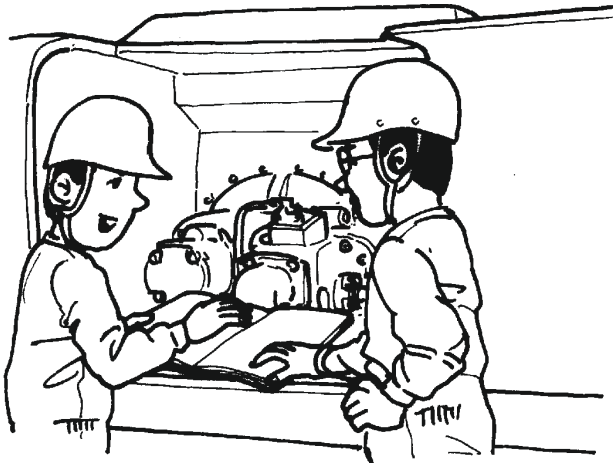
T16J-05-04-002

6. Trace possible causes

Before reaching a conclusion, check the most suspect causes again.

Try to identify the actual cause of the trouble.

Based on your conclusion, make a plan for appropriate repairs to avoid consequent malfunctions.



T107-07-01-007

Battery Voltage Check

1. Turn the key switch OFF. Check voltage between the battery positive terminal and the body (ground).

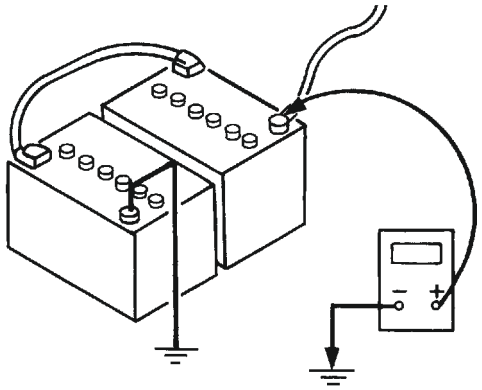
   Normal Voltage: 24 V

NOTE: If voltage is abnormal, recharge or replace the battery.

2. Start the engine. Check voltage between the battery positive terminal and the body (ground).

   Normal Voltage: 26 to 28 V

NOTE: If voltage is abnormal, check the charging system.



T162-05-06-005

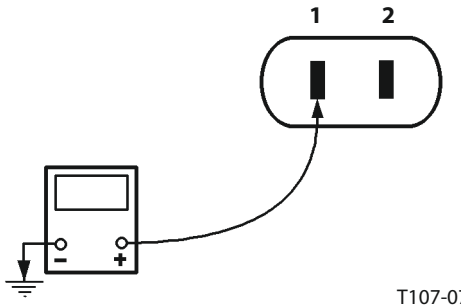
5-Volt Circuit

- Voltage between terminal #1 and the body
  Disconnect the connector with the key switch OFF. Measure voltage between terminal #1 on the body harness end connector and the body (ground).

  - Key Switch: ON
  - Black (negative) probe terminal of circuit tester: To ground to the body
  - Red (Positive) probe terminal of circuit tester: To terminal #1

  Evaluation: If the measuring voltage is within 5 ± 0.5 volts, the circuit up to terminal #1 is normal.

Two Polarities



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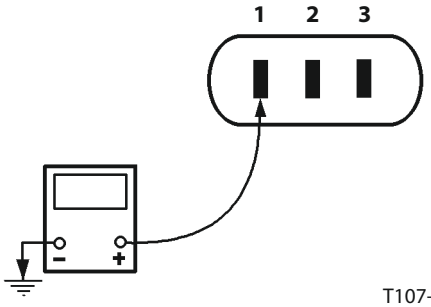
Three Polarities



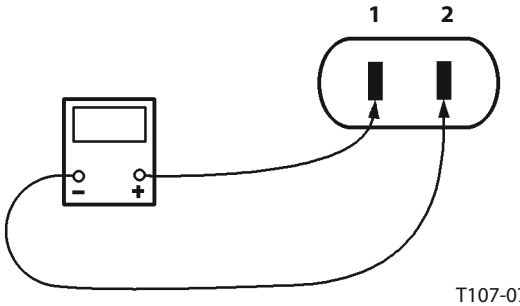
T107-07-05-007

- Voltage between terminal #1 and the ground terminal
  Turn OFF the key switch, and disconnect the sensor connector. Measure the voltage between terminal #1 (5 V power supply) on the body harness end connector and the ground terminal (terminal #2 for two-polarities or terminal #3 for three-polarities connector) under the following conditions.

  - Key Switch: ON
  - Black (negative) probe terminal of circuit tester: To ground terminal (Terminal #2 or #3)
  - Red (Positive) probe terminal of circuit tester: To terminal #1

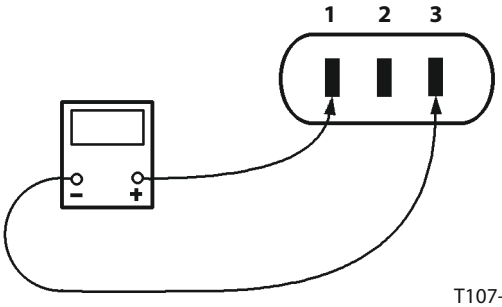
  Evaluation: If the measuring voltage is within 5 ± 0.5 volts, the circuit up to terminal #1 or the ground terminal (terminal #2 or #3) is normal.

Two Polarities



T107-07-05-008

Three Polarities



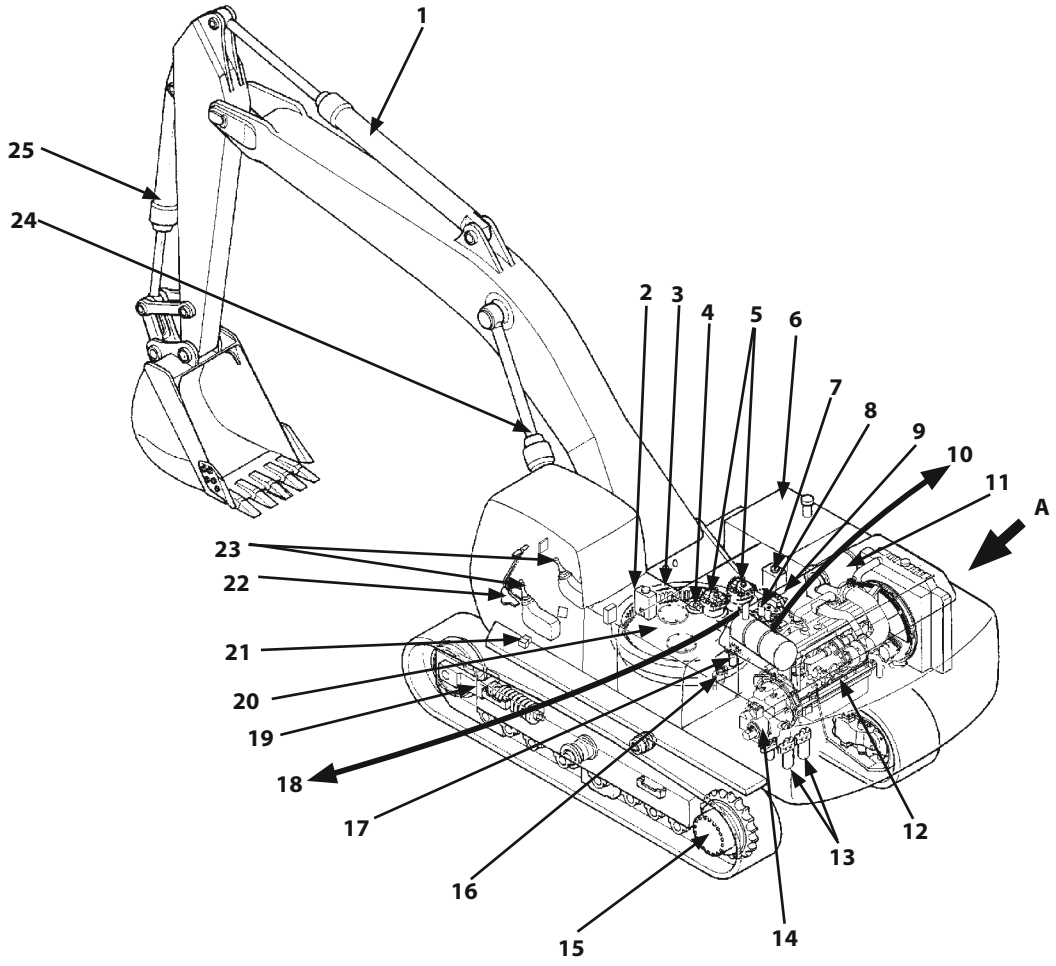
T107-07-05-009

Main Controller (MC)

Item	Unit	Data
Demand Engine Speed	min^{-1}	Input signal from engine control dial
Actual Engine Speed	min^{-1}	Input signal from ECF
Engine Speed Deviation	min^{-1}	Difference between actual engine speed and requested engine speed
EC Dial	V	Input signal from engine control dial
Hydraulic Oil Temperature	°C	Input signal from hydraulic oil temperature sensor
Tgt Pump 1 Flow Rate	L	Command signal to pump 1 control solenoid valve
Tgt Pump 2 Flow Rate	L	Command signal to pump 2 control solenoid valve
Tgt Pump 1 Displacement	cm^3	Calculation signal from engine speed and input signal from pump 1 delivery pressure sensor
Tgt Pump 2 Displacement	cm^3	Calculation signal from engine speed and input signal from pump 2 delivery pressure sensor
Pump 1 Load Factor	%	Calculation signal from engine speed and input signal from pump 1 delivery pressure sensor
Pump 2 Load Factor	%	Calculation signal from engine speed and input signal from pump 2 delivery pressure sensor
Pump 1 Delivery Pressure	MPa	Input signal from pump 1 delivery pressure sensor
Pump 2 Delivery Pressure	MPa	Input signal from pump 2 delivery pressure sensor
Boom Raise Pilot Pressure	MPa	Input signal from pressure sensor (boom raise)
Arm Roll-In Pilot Pressure	MPa	Input signal from pressure sensor (arm roll-in)
Bucket Roll-In Pilot Press	MPa	Input signal from pressure sensor (bucket roll-in)
Travel Pilot Pressure	MPa	Input signal from pressure sensor (travel)
Front ATT Pilot Pressure	MPa	Maximum value of input signals from pressure sensors (boom raise, boom lower, arm roll-in, arm roll-out, bucket roll-in, bucket roll-out, and attachment)
Swing Pilot Pressure	MPa	Input signal from pressure sensor (swing)

Logo	Alarm	Trouble Screen	Remedy
 T1J1-05-01-005	Auto-Lubrication Indicator	This indicator will light when any trouble occurs in the auto-lubrication system. Replace the grease container or check the piping.	Refer to Troubleshooting A.
 M1CC-01-039	Hydraulic Oil Filter Restriction Alarm	Hydraulic Oil Filter Is Clogged. Replace Hydraulic Oil Filter Element.	Refer to Troubleshooting A.
 M183-01-067	Air Cleaner Restriction Alarm	Air Cleaner Is Clogged. Clean Or Replace Air Cleaner Element.	Refer to Troubleshooting A.
 MDAA-01-034	System Failure Alarm	Machine Network System Is Abnormal. Contact Your Nearest Authorized Dealer.	Refer to Troubleshooting A.
 MDAA-01-036	Pilot Control Shut-Off Lever Alarm	Pilot Control Shut-Off Lever System Is Abnormal. Contact Your Nearest Authorized Dealer.	Refer to Troubleshooting A.

Main Component

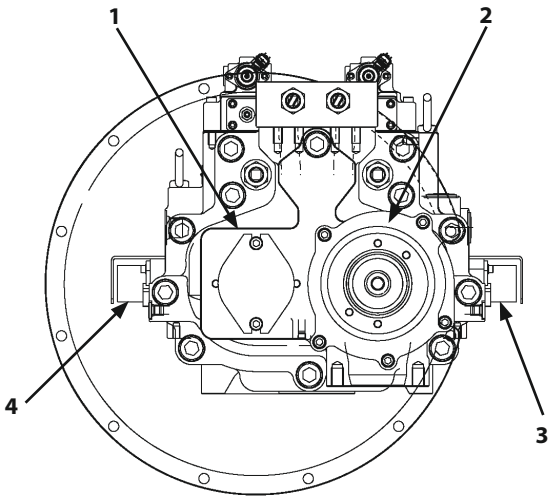


TJAC-01-02-001

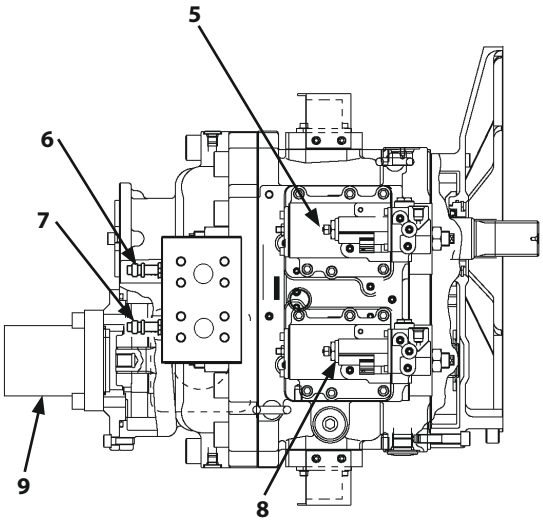
1- Arm Cylinder
2- Washer Tank
3- Swing Bearing
4- Center Joint
5- Swing Device
6- Fuel Tank
7- Reserve Tank
8- Control Valve
9- Signal Control Valve
10- Shockless Valve (Refer to T5-4-2.)
11- Air Cleaner
12- Engine
13- Engine Oil Filter
14- Pump Device
15- Travel Device
16- Drain Filter
17- Pilot Filter/ Pilot Relief Valve
18- Check Valve/Accumulator
19- Track Adjuster
20- Hydraulic Oil Tank
21- Pilot Shut-Off Solenoid Valve
22- Travel Pilot Valve
23- Front Attachment / Swing Pilot Valve
24- Boom Cylinder
25- Bucket Cylinder

A- Refer to T5-4-2

Pump Device



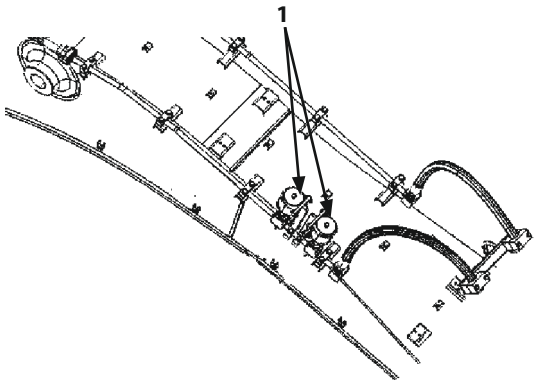
T16J-01-01-002



T16J-01-01-003

1- Pump 2
2- Pump 1
3- Pump 1 Displacement Angle Sensor
4- Pump 2 Displacement Angle Sensor
5- Pump 2 Control Solenoid Valve
6- Pump 2 Delivery Pressure Sensor
7- Pump 1 Delivery Pressure Sensor
8- Pump 1 Control Solenoid Valve
9- Pilot Pump

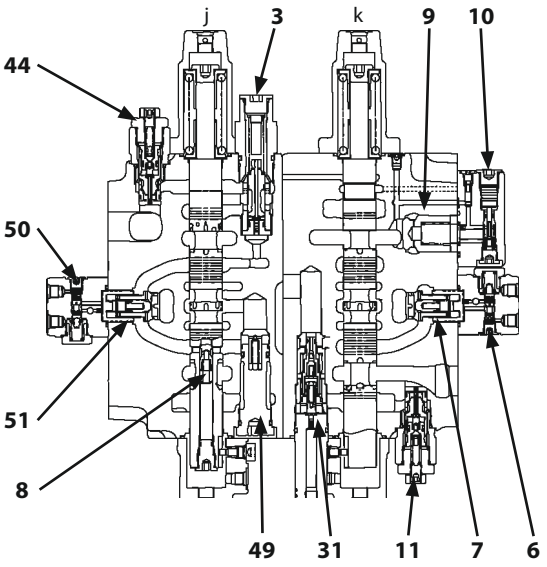
Boom Upper Side



TJAA-01-02-108

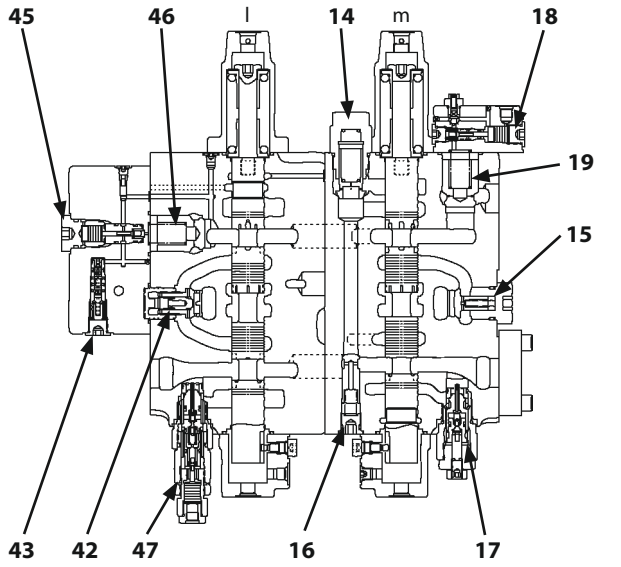
1- Accumulator (High Pressure)

Section D-D



TJAA-03-03-042

Section E-E



TJAA-03-03-013

j - Arm 2

1- Check Valve (Arm Make-Up)
2- Bypass Shut-Out Valve (A Side)
3- Arm Regeneration Cut Valve
4- Swing Flow Rate Control Valve (Selector Valve)
5- Swing Flow Rate Control Valve (Poppet Valve)
6- Arm 1 Flow Rate Control Valve (Selector Valve)
7- Arm 1 Flow Rate Control Valve (Poppet Valve)
8- Arm Regenerative Valve
9- Arm Rod Anti-Drift Valve (Check Valve)
10- Arm Rod Anti-Drift Valve (Selector Valve)
11- Overload Relief Valve (Arm: Bottom Side)
12- Overload Relief Valve (Arm: Rod Side)
13- Load Check Valve (Arm 1 Tandem Circuit)
14- Boost Check Valve (Boom Regeneration Back Pressure Valve)

k - Arm 1

15- Load Check Valve (Boom 2 Parallel Circuit)
16- Check Valve (Boom 2 Regenerative Circuit)
17- Overload Relief Valve (Boom 2: Rod Side)
18- Boom 2 Anti-Drift Valve (Selector Valve)
19- Boom 2 Anti-Drift Valve (Check Valve)
20- Load Check Valve (Auxiliary Tandem Circuit)
21- Overload Relief Valve (Auxiliary)
22- Load Check Valve (Auxiliary Parallel Circuit)
23- Overload Relief Valve (Auxiliary)
24- Load Check Valve (Travel (Left) Tandem Circuit)
25- Load Check Valve (Travel (Left) Parallel Circuit)
26- Bypass Shut-Out Valve (B Side)
27- Check Valve (Bucket Flow Combiner Circuit)

l - Boom 1

28- Check Valve (Bucket Flow Combiner Circuit)
29- Check Valve (Main Relief Circuit)
30- Auxiliary Flow Combiner Valve (Selector Valve)
31- Auxiliary Flow Combiner Valve (Poppet Valve)
32- Check Valve (Auxiliary Flow Combiner Circuit)
33- Flow Combiner Valve
34- Check Valve (Flow Combiner Circuit)
35- Check Valve (Main Relief Circuit)
36- Main Relief Valve
37- Load Check Valve (Bucket Parallel Circuit)
38- Bucket Regeneration Cut Valve
39- Overload Relief Valve (Bucket: Rod Side)
40- Overload Relief Valve (Bucket: Bottom Side)
41- Boom Flow Rate Control Valve (Selector Valve)

m - Boom 2

42- Boom Flow Rate Control Valve (Poppet Valve)
43- Boom Lower Meter-In Cut Valve
44- Overload Relief Valve (Boom 1: Bottom Side)
45- Boom 1 Anti-Drift Valve (Selector Valve)
46- Boom 1 Anti-Drift Valve (Check Valve)
47- Boom Overload Relief Valve (Low Pressure) (Boom 1: Rod Side)
48- Boom Overload Relief Control Valve
49- Load Check Valve (Arm 2 Tandem Circuit)
50- Arm 2 Flow Rate Control Valve (Selector Valve)
51- Arm 2 Flow Rate Control Valve (Poppet Valve)
52- Bucket Regenerative Valve
53- Pump 1
54- Pump 2

Control Valve Side

Port Name	Connected to	Remark
Port 1	Control Valve	Boom Raise Pilot Pressure
Port 2	Control Valve	Boom Lower Pilot Pressure
Port 3	Control Valve	Arm Roll-Out Pilot Pressure
Port 4	Control Valve	Arm Roll-In Pilot Pressure
Port 5	Control Valve	Left Swing Pilot Pressure
Port 6	Control Valve	Right Swing Pilot Pressure
Port 7	Control Valve	Bucket Roll-In Pilot Pressure
Port 8	Control Valve	Bucket Roll-Out Pilot Pressure
Port 9	Control Valve	Left Travel Forward Pilot Pressure
Port 10	Control Valve	Left Travel Reverse Pilot Pressure
Port 11	Control Valve	Right Travel Forward Pilot Pressure
Port 12	Control Valve	Right Travel Reverse Pilot Pressure
Port 13	Control Valve	Auxiliary Pilot Pressure
Port 14	Control Valve	Auxiliary Pilot Pressure
Port S3	Pressure Sensor (Swing)	-
Port SE	Control Valve	Arm 1 Flow Rate Control Valve Control Pressure
Port SM	Pressure Sensor (Attachment) (OP)	-
Port SN	-	Plug
Port SP	Hydraulic Oil Tank	Returning to Hydraulic Oil Tank
Port SL	Control Valve	Flow Combiner Valve Control Pressure
Port SK	-	Plug
Port TR	Pressure Sensor (Travel)	-

Proportional Solenoid Valve Failure

Fault Code	Trouble	Cause	Symptoms in Machine Operation When Trouble Occurs	Remedy
11405-3	4-Spool Solenoid Valve Unit (SC) FB High Input	Current: more than 920 mA	The travel motor displacement is fixed	Check the harness
11405-4	4-Spool Solenoid Valve Unit (SC) FB Low Input	Current: less than 56 mA	The travel motor displacement is fixed	Check the harness

Fault Code	Trouble	Cause	Symptoms in Machine Operation When Trouble Occurs	Remedy
11980-3	Auxiliary Control Solenoid Valve Unit (SB) FB High Input	Current: more than 920 mA	Attachment relief control is impossible	Check the harness
11980-4	Auxiliary Control Solenoid Valve Unit (SB) FB Low Input	Current: less than 56 mA	Attachment relief control is impossible	Check the harness
11989-3	2-Spool Solenoid Valve Unit (SC) FB High Input	Current: more than 920 mA	Boom mode selector control is impossible	Check the harness
11989-4	2-Spool Solenoid Valve Unit (SC) FB Low Input	Current: less than 56 mA	Boom mode selector control is impossible	Check the harness

Communication Terminal Fault Code List

Fault Code	Trouble	Cause	Remedy
14100-2	Communication Terminal: Abnormal EEPROM	The internal memory of satellite communication terminal (optional) is abnormal.	Replace the controller (satellite communication terminal)
14101-2	Communication Terminal: Abnormal IB/OB Queue	The internal memory of satellite communication terminal (optional) is abnormal.	Replace the controller (satellite communication terminal)
14102-2	Communication Terminal: Abnormal Local Loop Back	Abnormality is detected on communication test with the satellite.	Check the communication antenna for satellite
14103-2	Communication Terminal: No Satellite Found	Satellite can not be caught.	Check the communication antenna for satellite
14104-2	Communication Terminal: Remote Loop Back Error 1	Abnormality is detected on communication test with the satellite and base station.	Replace the controller (satellite communication terminal)
14105-2	Communication Terminal: Remote Loop Back Error 2	Abnormality is detected on communication test with the satellite and base station.	Replace the controller (satellite communication terminal)
14106-2	Communication Terminal: Transmission/Receiving Data Unmatched	Transmission/receiving data with the satellite is unmatched.	Replace the controller (satellite communication terminal)
14107-2	Communication Terminal: Abnormal GSM Module	Abnormal mobile communication equipment	Replace the controller (mobile communication terminal)

NOTE: Fault codes 14100-2 to 14106-2 are satellite communication terminal. Fault code 14107-2 is mobile communication terminal.

MC Fault Codes 11008, 11010

Monitor Controller (Monitor) Fault Codes 13004, 13006, 13007

Preparation

- Check the wiring connections first.
- Check the CAN1 harness between the controllers.
  (Refer to CAN1 Harness Check on T5-5-40 to 42.)

Fault Code	Trouble	Inspection Method	Cause
11008-2	Monitor Controller (Information) Communication Error 2 (CAN1)	Continuity check (open circuit)	Open circuit in harness
		Discontinuity check (shorted circuit)	Shorted circuit in harness
11010-2	Monitor Controller (Monitor) Communication Error 2 (CAN1)	Continuity check (open circuit)	Open circuit in harness
		Discontinuity check (shorted circuit)	Shorted circuit in harness
13004-2	MC Communication Error 2	Continuity check (open circuit)	Open circuit in harness
		Discontinuity check (shorted circuit)	Shorted circuit in harness
13006-2	Monitor Controller (Information) Communication Error 2	Continuity check (open circuit)	Open circuit in harness
		Discontinuity check (shorted circuit)	Shorted circuit in harness
13007-2	Wiper/Light Controller Communication Error	Continuity check (open circuit)	Open circuit in harness
		Discontinuity check (shorted circuit)	Shorted circuit in harness

MC Fault Code 11408

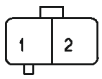
Preparation

- Check the wiring connections first.

Fault Code	Trouble	Inspection Method	Evaluation	Cause
11408-3	4-Spool Solenoid Valve Unit (SF) FB High Input	Measurement of resistance between solenoid valve #1 and #2	0 Ω (Normal value: 22 Ω)	Faulty solenoid valve
		-	Normal in above check.	Shorted circuit in harness #1 and #2
11408-4	4-Spool Solenoid Valve Unit (SF) FB Low Input	Measurement of resistance between solenoid valve #1 and #2	∞ Ω (Normal value: 22 Ω)	Faulty solenoid valve
		Measurement of voltage between solenoid valve harness end #1 and body	0 V	Open circuit in harness #1
		Monitor Bypass Cut Control P/S FB	0 mA	Open circuit in harness #2

Connector (Harness end)

- Solenoid Valve Connector



T1V1-05-04-003

MC Fault Code 11953

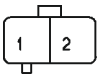
Preparation

- Check the wiring connections first.

Fault Code	Trouble	Inspection Method	Evaluation	Cause
11953-3	2-Spool Solenoid Valve Unit (SI) FB High Input	Measurement of resistance between solenoid valve #1 and #2	0 Ω (Normal value: 22 Ω)	Faulty solenoid valve
		-	Normal in above check	Shorted circuit in harness #1 and #2
11953-4	2-Spool Solenoid Valve Unit (SI) FB Low Input	Measurement of resistance between solenoid valve #1 and #2	∞ Ω (Normal value: 22 Ω)	Faulty solenoid valve
		Measurement of voltage between solenoid valve harness end #1 and body	0 V	Open circuit in harness #1
		Monitor Swing Flw Cont P/S O/P FB	0 mA	Open circuit in harness #2

Connector (Harness end)

- Solenoid Valve Connector



T1V1-05-04-003

ECF Fault Code 16606

Preparation

- Check the wiring connections first.

Fault Code	Trouble	Inspection Method	Evaluation	Cause
16606-3	Abnormal EC Angle Sensor High Voltage	Measurement of resistance between sensor #1 and #2.	0 / ∞ Ω (Normal value: 2.0±0.4 kΩ)	Faulty EC sensor
			Normal in above check.	Shorted circuit in harness #1 and #2
16606-4	Abnormal EC Angle Sensor Low Voltage	Measurement of resistance between sensor #1 and #2.	0 / ∞ Ω (Normal value: 2.0±0.4 kΩ)	Faulty EC sensor
		Measurement of voltage between sensor harness end #1 and body.	0 V	Open circuit in harness #1
		Measurement of voltage between sensor harness end #1 and #3.	0 V	Open circuit in harness #3
		-	Normal in above check.	Open circuit in harness #2

Connector (Harness end)

TDCD-05-06-009

Parts / Item	Power Digging Switch	Engine Learning Switch
Function	Shifts 4-spool solenoid valve unit (SI) and activates power digging. ON: 0 V → Increasing pressure OFF: 5 V → Not increasing pressure	Starts engine learning. ON: 0 V → Learning OFF: 5 V → Normal control
Symptoms in control system when trouble occurs	Same as shown below	Engine learning cannot be performed.
Symptoms in machine operation when trouble occurs	Open circuit: Pressure does not increase. Shorted circuit: Pressure increases for 8 seconds when the key switch is turned ON, and after pressure does not increase.	Machine will operate normally if problem is caused by open circuit or discontinuity of switch. (Only learning cannot be performed.) If shorted circuit occurs, learning mode operation starts. Therefore, engine will stall at 2 or 20 seconds after engine starts.
Evaluation by Fault Code	-	-
Evaluation by Monitoring	MC: Power Boost Switch	ECF: Eng Learning SW
Evaluation by using Test Harness	-	-
Note	-	-
Descriptions of Control (Operational Principle Section in T/M)	T2-2	T2-2

Parts / Item	Pressure Sensor (Attachment) (OP)	Pump 1 Control Solenoid Valve	Pump 2 Control Solenoid Valve
Function	Monitors attachment pilot pressure.	Changes pump 1 swash angle.	Changes pump 2 swash angle.
Symptoms in control system when trouble occurs	When output is less than 0.1 V or more than 4.75 V, the following symptoms occur.	Same as shown below	Same as shown below
Symptoms in machine operation when trouble occurs	The flow rate is fixed at the setting of breaker.	High current: The engine stalls or engine lug-down is remarkable at high loaded. Low current: Machine overall operation is slow	High current: The engine stalls or engine lug-down is remarkable at high loaded. Low current: Machine overall operation is slow.
Evaluation by Fault Code	11942	11951	11950
Evaluation by Monitoring	MC: ATT 1 Pilot Pressure	MC: Pump 1 (4 Units) P/S Output, Pump 1 (4 Units) P/S O/P FB	MC: Pump 2 (5 Units) P/S Output, Pump 2 (5 Units) P/S O/P FB
Evaluation by using Test Harness	-	-	-
Note	Possible to judge if pressure sensor is faulty or port is clogged by switching pressure sensor with other pressure sensor.	-	-
Descriptions of Control (Operational Principle Section in T/M)	T2-2	T2-2	T2-2

Parts / Item	Pump 2 Flow Rate Control Valve	Arm Flow Rate Control Valve Control Spool	Swing Parking Brake Release Spool
Function	Supplies flow rate control pressure according to pilot pressure to pressure sensor (5-spool side) when operating boom, arm, swing and travel (left).	Is shifted by arm roll-in pilot pressure. Supplies swing pilot pressure to arm 1 flow rate control valve in control valve.	Is shifted by pilot pressure of boom, arm, bucket, and swing, Supplies release pressure to swing parking brake.
Symptoms in control system when trouble occurs	Same as shown below	Same as shown below	Same as shown below
Symptoms in machine operation when trouble occurs	If stuck in fully closed position, control valve (5-spool side) control pressure is not monitored. If stuck in fully open position, pressure sensor (5-spool side) monitors maximum pressure.	If stuck in fully closed position, swing speed is slow during combined operation of swing and arm roll-in. If stuck in fully open position, swing speed is slow during combined operation of swing and arm roll-out	If stuck in fully closed position, swing parking brake is kept applied. (Dragging is felt.) If stuck in fully open position, swing parking brake is kept released. (Machine vibrates while traveling.)
Evaluation by Fault Code	-	-	-
Evaluation by Monitoring	-	-	-
Evaluation by using Test Harness	-	-	-
Note	-	-	-
Descriptions of Control (Operational Principle Section in T/M)	T3-6	T3-6	T3-6

Front Attachment System Troubleshooting

Trouble Symptom / Parts	F-1 All front attachment actuator power are weak.	F-2 Even if power digging switch is pushed, power does not increase. Boom raise power is weak during digging operation.	F-3 Some cylinders are not operated or speeds are slow.
MC		○	
Power Mode Switch			
Power Digging Switch		●	
Main Pump 1		○	
Main Pump 2		○	
Pilot Pump		○	
Pump 1 Regulator			
Pump 2 Regulator			
Pump 1 Delivery Pressure Sensor		○	
Pump 2 Delivery Pressure Sensor		○	
Pump 1 Control Solenoid Valve			
Pump 2 Control Solenoid Valve			
Main Relief Valve	●	●	
Boom Anti-Drift Valve			
Arm Anti-Drift Valve (Rod Side)			
Arm Regenerative Valve			
Bucket Regenerative Valve			
Bucket Regeneration Cut Valve			
Arm 1 Flow Rate Control Valve			
Arm 2 Flow Rate Control Valve			
Bypass Shut-Out Valve			
Boom Lower Meter-In Cut Valve			
Boom Overload Relief Selection Valve			
Load Check Valve			
Spool			●
Pressure Sensor (Boom Raise)		○	
Pressure Sensor (Boom Lower)			
Pressure Sensor (Arm Roll-In)			
Pressure Sensor (Arm Roll-Out)			
Pressure Sensor (Bucket Roll-In)			
Pressure Sensor (Bucket Roll-Out)			
Cylinder			○
Pilot Valve			●
Shockless Valve (Signal Control Valve)			● (Only Boom)
Shuttle Valve (Signal Control Valve)			○
Pressure Sensor (Travel)			
Pressure Sensor (Swing)			
Pressure Sensor (4-Spool Side)			
Pressure Sensor (5-Spool Side)			
Swing Flow Rate Control Valve			
4-Spool Solenoid Valve Unit (SG)			
4-Spool Solenoid Valve Unit (SI)	○	○	
4-Spool Solenoid Valve Unit (SF)			
4-Spool Solenoid Valve Unit (SC)			
2-Spool Solenoid Valve Unit (SC)			
2-Spool Solenoid Valve Unit (SI)			
Pilot Filter	○	○	○
Pilot Relief Valve	○	○	○
Remark			

Engine System Troubleshooting

E-1 Starter does not rotate.

Preparation

- Check that the pilot shut-off lever is in the LOCK position.
- This trouble has nothing to do with the electronic control system such as MC.
- Check the wiring connections first.
- In case the radio with the key switch set in the ACC position and the horn with the key switch set in the OFF position are operated normally, the harness between battery and key switch terminal B is considered normal.

Procedure	Inspection Method	Condition	Evaluation	Cause
1	Measure battery voltage and electrolyte density.	-	The measured values are not within the normal values (Normal value: Voltage: 24 V or more: 1.26 or more)	Faulty battery
2	Switch the starter cut relay with other general relay	Set the key switch to START after switching relays	Starter: Rotating	Faulty starter cut relay
3	Measure voltage between starter cut relay harness end #1 and body	Key Switch: START	0 V	Open circuit in harness between key switch and starter cut relay
4	Measure voltage at starter relay 2 harness end terminal S	Key Switch: START	0 V	Open circuit in harness between starter cut relay and starter relay 2
5	Measure voltage at starter cut relay harness end #2	Key Switch: ON	0 V	Shorted circuit in harness between starter cut relay and engine stop switch
6	Measure voltage at battery relay terminal A	Key Switch: ON	0 V	Faulty battery relay
7	Measure voltage at starter terminal S	Key Switch: START	0 V	Faulty starter relay 2
8	Check continuity between key switch #1 and #6	Key Switch: START	∞ Ω	Faulty key switch
9	-	-	The check mentioned above is normal	Faulty starter

E-11 Engine stalls under adverse operating conditions such as at high altitude.

Preparation

- If speed-sensing control is inoperable, the engine will stall under adverse operating conditions.
- There are two pump control solenoid valves and two regulators. Both solenoid valves or regulators are unlikely to be faulty at the same time. If one of solenoid valve or regulator fails, mistrack will be caused during travel.
- Check the wiring connections first.

Procedure	Inspection Method	Condition	Evaluation	Cause
1	Install a pressure gauge to the output port and check change in pressure when a control lever is operated	-	Pressure does not change according to control lever stroke	Faulty pump control solenoid valve
2	-	-	The check mentioned above is normal	Faulty regulator

F-4 Bucket roll-in speed is slow and power is weak during digging operation.

Preparation

- Refer to SYSTEM / Hydraulic System / Bucket Regenerative Cut Circuit.
- Check the wiring connections first.

Procedure	Inspection Method	Condition	Evaluation	Cause
1	Disassemble and inspect the bucket regeneration cut valve	-	There is abnormality	Faulty bucket regeneration cut valve
2	Disassemble and inspect the bucket regenerative valve	-	There is abnormality	Faulty bucket regenerative valve
3	-	-	The check mentioned above is normal	Find out cause of trouble by tracing other trouble symptoms

Swing System Troubleshooting

S-1 Swing is slow or unmoving.

	Specification (sec/3 rev)	Remark
Swing Speed	21.0±1.5	The bucket should be empty

Preparation

- Check whether the pilot system is faulty or the main circuit is faulty.
- If other functions (front attachment and travel) are operated normally, the pilot pump (primary pilot pressure) and pump flow rate control are considered to be normal. If the pilot system is faulty, the cause of trouble may exist in the circuit after the pilot valve.

Procedure	Inspection Method	Condition	Evaluation	Cause
1	Monitor Swing Pilot Pressure	Fully swing	The measured values are not within the normal values (Normal Value: 3.4-4.0 MPa)	Faulty pilot valve
2	Monitor Front ATT Pilot Pressure	When relieving arm	The measured values are not within the normal values (Normal Value: 3.4-4.0 MPa)	Faulty swing parking brake release spool in signal control valve
3	Disassemble and inspect the parking brake release valve in the swing motor	-	There is abnormality	Faulty swing parking brake release valve
4	Monitor Pump 2 Delivery Pressure	When relieving swing	The measured values are not within the normal values (Normal Value: 28.4 MPa)	Faulty swing relief valve
5	Measure the swing motor drainage	With constant speed	The measured values are not within the normal values (Normal Value: 0.2-0.3 L/min)	Faulty swing motor
6	-	-	The check mentioned above is normal	Faulty swing reduction gear

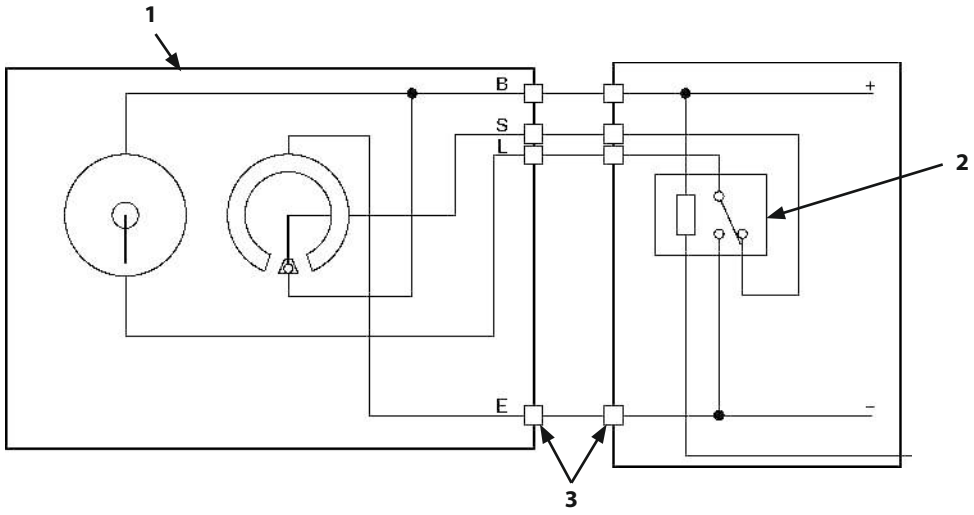
O-4 Wiper is not operated.

Preparation

- The wiper is driven by electric power routed via the relay circuit. The relay circuit is controlled by the wiper/light controller.
- In case the wiper is not operated, first check if the wiper relay is activated. Next, check if electric power is routed to the wiper motor.
- When the front window is open, the wiper is not operated. Check that the front window is closed securely.
- In case the washer is also not operated, check fuse #2.

Procedure	Inspection Method	Condition	Evaluation	Cause
1	Switch the wiper relay with other general relay	Key Switch: ON	The wiper is operated	Faulty wiper relay
2	Monitor Wiper 1 Input (or Wiper 2 Input)	Wiper Switch: ON Position (or Overhead Window Wiper Switch: ON Position)	OFF is displayed	Faulty wiper switch or open circuit in harness between wiper switch and wiper/light controller
3	Monitor Wiper 1 Output (or Wiper 2 Output)	Wiper Switch: ON Position (or Overhead Window Wiper Switch: ON Position)	OFF is displayed	Open circuit in harness between wiper relay and wiper/light controller
4	Measure voltage between window contact (cab side) terminals B and L	Key Switch: ON Wiper Switch: ON	0 V	Open circuit in harness between wiper relay and window contact
5	Measure voltage between window contact (wiper motor side) terminals B and L	Key Switch: ON Wiper Switch: ON	0 V	Open circuit in harness between window contact and wiper motor
6	-	-	The check mentioned above is normal	Faulty wiper motor

Wiper Driving Circuit



T1V1-05-07-004

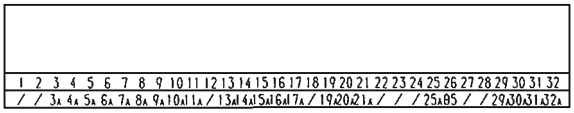
1- Wiper Motor 2- Wiper Relay 3- Window Contact

Functions of Main Parts

The functions of the main parts for the air conditioner are described below. The connector No. is shown in the parentheses after the part name.

- Controller

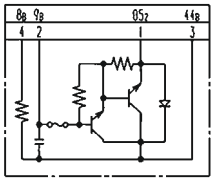
Controls the air conditioning system. According to the operator's requests sent via the switches, and the information regarding the air and refrigerant temperature sent from the sensors, the controller judges the air conditioner operating status and controls the blower motor and/or compressor operation as needed by operating the relays. In addition, the controller informs the operator of the air conditioner operating status by displaying the information on the monitor panel.



TDAA-05-07-002

- Power Transistor (CN7)

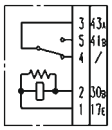
An electric switch to control blower motor voltage.



TDAA-05-07-003

- Blower Motor Relay (CN3)

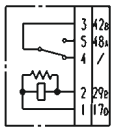
Supplies 24 volts of electricity to the blower motor when the air conditioner is operated. The blower motor relay is turned ON when excited by the current from terminal #30 in controller.



TDAA-05-07-004

- Compressor Relay (CN4)

Supplies 24 volts of electricity to the compressor clutch when the air conditioner is operated. The compressor relay is turned ON when excited by the current from terminal #29 in controller.



TDAA-05-07-005

Faulty cooling (1)

Condition:
- Fault code: Un-displayed
- Airflow volume: faulty

Blower motor rotates	Normal speed	Clogged re-circulated air filter		Filter cleaning
		Clogged fresh air filter		Filter cleaning
		Obstacles are found in inlet area		Remove obstacles
		Deformation or breakage of blower		Replacement of blower
		Frosted evaporator		To A
		Adhered dirt on evaporator surface		Evaporator surface cleaning
	Slow speed	Power source decreases		Check battery charging system
		Poor battery terminal contact		Repair
		Faulty blower motor		Replace
		Faulty power transistor		Replace
Blower motor does not rotate	Faulty blower motor relay			Replace
	Faulty blower motor			Replace
	Faulty power transistor			Replace
	Blower interferes with case			Repair
	Faulty controller			Replace the controller
	Faulty ground in body			Make sure to ground
	Faulty wiring, disconnection of connector			Wirings inspection
	Blowout of power transistor thermal fuse due to locked motor			Replace motor
	Blowout of fuse	Replace with the same capacity fuse	Blower motor is locked	Replace blower motor
			Faulty wiring	Refer to wiring diagram and check
			Shorted circuit	Wirings inspection

Faulty heating (1)

Condition:

- Fault code: Un-displayed

Faulty air flow volume	Blower motor rotates	Normal speed	Clogged re-circulated air filter		Filter cleaning
			Clogged fresh air filter		Filter cleaning
			Obstacles are found in inlet area		Remove obstacles
			Deformation or breakage of blower		Replacement of blower
			Frosted evaporator		To A
			Adhered dirt on evaporator surface		Evaporator surface cleaning
		Slow speed	Power source decreases		Check battery charging system
			Poor battery terminal contact		Repair
			Faulty blower motor		Replace
			Faulty power transistor		Replace
	Blower motor does not rotate	Blowout of fuse	Replace with the same capacity fuse	Blower motor is locked	Replace blower motor
				Faulty wiring	Refer to wiring diagram and check
				Shorted circuit	Wirings inspection
		Faulty blower motor relay			Replace
		Faulty blower motor			Replace
		Faulty power transistor			Replace
		Blower interferes with case			Repair
		Faulty controller			Replace the controller
		Faulty ground in body			Make sure to ground
		Faulty wiring, disconnection of connector			Wirings inspection
		Blowout of power transistor thermal fuse due to locked motor			Replace motor
Air flow volume is normal	Coolant temperature is low				
	Coolant temperature is normal	Disconnection of air mix damper link			Setting link again
		Air incorporation in hot-water circuit			Air Bleeding Circuit
		Clogging, breakage and bending of piping			Repair or replace.
		Extremely low ambient temperature			
		Low engine coolant level			Charge engine coolant to proper level
		Broken heater core			Replace heater core

Work after Replacing Components

The following work is required after replacing compressor, high pressure hose, low pressure hose, condenser, receiver tank, liquid hose, and air conditioner unit. The same work is required when gas leakage is found.

1. Refill Compressor Oil

2. Charge Air Conditioner with Refrigerant

- Purging
- Charge air conditioner with refrigerant
- Warm-up operation
- Inspection