Service Manual

JS200
from machine no. 705001
JS210
from machine no. 705648
JS220
from machine no. 705001
JS240
from machine no. 708001
JS260
from machine no. 708501

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Issue 2

Contents Page No.

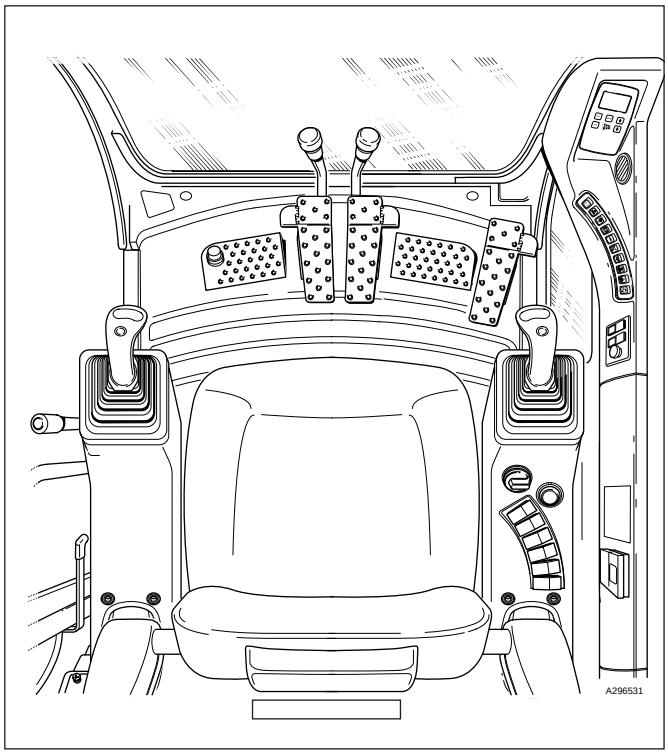
The A.M.S. system

The JCB A.M.S. system (Advanced Management System) is a whole machine electronic control system which replaces the CAPS II system. The system controls engine speed, pump power, transmission, excavator functions, lights, wiper, auxiliary circuits, warning lamps, etc.

The **AMS manual supplement 9803/6450** is an addition to the following JS XO Machine Service Manuals:

Manual No.	Machine No.	Serial No.
9803/6410	JS 130	759561
	JS 160/180	703075
9803/6310	JS 130W	717027
	JS 145W	810001
	JS 160W	718966
	JS 175W	875001
9803/6400	JS 200/210	706966
	JS 220	706966
	JS 240/JS 260	709004
9803/6320	JS 200W	809056
9803/6420	JS 330	712847
	JS 460	714550

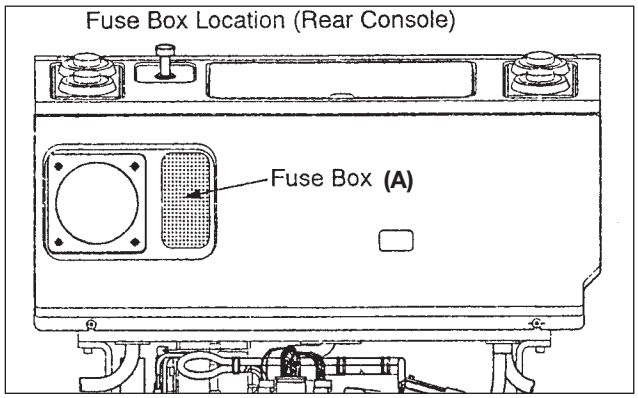
Note: Only those areas of the machines which detail the AMS system are covered in the supplement. For all other aspects refer to the above manuals.

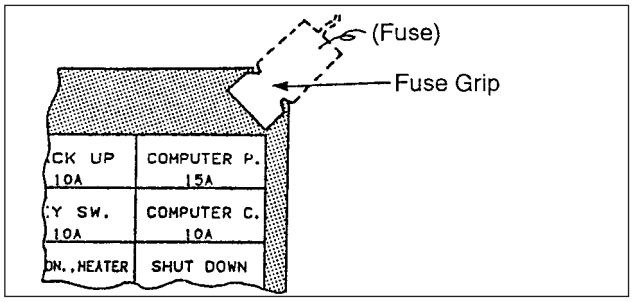


AMS JS200/210/220/240/260 Tracked Machine

Circuit Protection; Fuse rating and circuit names

BACK UP 10A	COMPUTER P. 15A
KEY SW. 10A	COMPUTER C. 10A
AIRCON., HEATER 20A	SHUT DOWN 15A
LAMP 15A	LEVER LOCK 10A
LAMP (SPARE) 15A	LUBRICATOR 10A
LAMP (SPARE) 15A	WARNING BEACON 10A
LAMP (SPARE) 15A	OIL PUMP 20A
WIPER, WASHER 15A	CONDENSER MOTOR 15A
HORN, ROOM LAMP 10A	SPARE 10A
RADIO, LIGHTER 10A	SPARE 10A





Fuse Replacement

*See illustration on the right for location of Fuse Box (**A**).*

1. Prepare the machine, stop the engine remove the starter key.
2. Prepare an appropriate fuse of the correct amperage, remove cover.

Note: The fuse cover's right corner is the grip.

3. Replace the blown fuse with a new one.
4. Install the fuse cover.

Note: If the reason for the blown fuse is unknown or the fuse fails repeatedly, check the electrical circuit(s) concerned.

Lighting and Horn

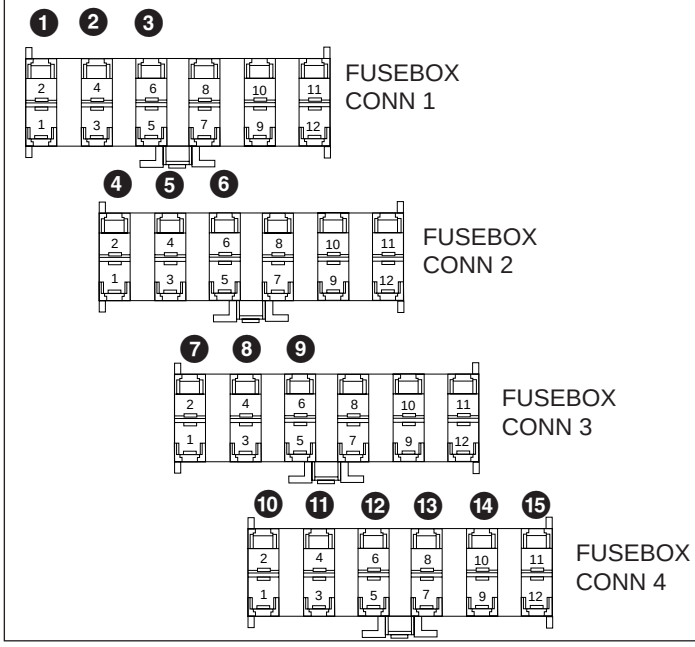
		Voltage	Wattage	No. off
Working light	Tank	24 V	70 W	1
Boom		24 V	70 W	1
Roof light	Cab	24 V	10 W	1
Horn		24 V		2

Fuses for later Machines

The electrical circuits are protected by fuses. The fuses are located in a fuse box on the rear console. If a fuse blows, find out why and rectify the fault. Ensure the power is turned off.

1	Radio/Lighter	10A
2	Warning Beacon	10A
3	Fuel Pump	20A
4	Lamp Option	15A
5	Lamp Standard	15A
6	Horn/ Room Light	10A
7	Back-Up	10A
8	Key Switch	10A
9	Shut Down	15A
10	Computer Power	15A
11	Computer Control	10A
12	Lever Lock	10A
13	Heater	20A
14	Wiper/washer	10A
15	Auxiliary	10A

Fuse layout for later machines



Batteries

Testing - Specific Gravity

The specific gravity of the electrolyte gives an idea of the state of charge of the battery. Readings should be taken using a hydrometer, when the electrolyte temperature is 15°C (60°F). If the battery has recently been on charge, wait approximately one hour (or slightly discharge the battery) to dissipate the 'surface charge' before testing.

Readings should be as tabulated and should not vary between cells by more than 0.04. A greater variation indicates an internal fault on that particular cell.

If the electrolyte temperature is other than 15°C (60°F) a 'correction factor' must be applied to the reading obtained. Add 0.007 per 10°C (18°F) if the temperature is higher than 15°C (60°F) and subtract the same if the temperature is lower.

Specific Gravity at 15°C (60°F)

	Fully Charged	Half Discharged	Fully Discharged
Ambient temperature up to 27°C (80°F)	1.270-1.290	1.190-1.210	1.110-1.130
Ambient temperature above 27°C (80°F)	1.240-1.260	1.170-1.190	1.090-1.110

* Battery Testing

This test is to determine the electrical condition of the battery and to give an indication of the remaining useful 'life'.

Before testing ensure that the battery is at least 75% charged (SG of 1.23 to 1.25 for ambient temperature up to 27°C).

Ensure that the battery is completely disconnected from the vehicle.

Connect up the battery tester (part no. 993/85700) as follows:

1 Set the CHECK/LOAD switch **A** to OFF.

2 Set rocker switch **B** to the battery voltage (12V).

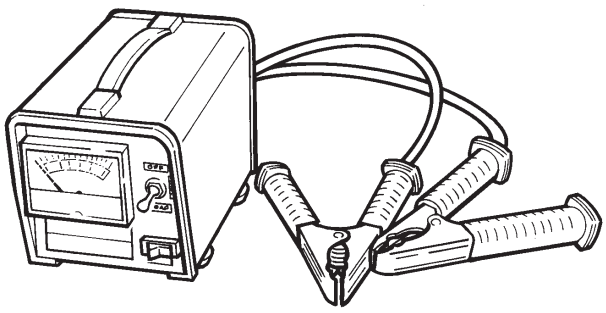
3 Connect the red flying lead to the battery positive (+) terminal and the black flying lead to the battery negative (-) terminal.

4 Set the CHECK/LOAD switch **A** to CHECK to read the battery no-load voltage which should be at least 12.4 volts.

5 Set the CHECK/LOAD switch **A** to LOAD and hold down for 5 - 10 seconds until the meter reading stabilises. The reading should be at least 9 volts.

Note: Do not hold the switch in the load position for more than 10 seconds.

6 If the foregoing tests are unsatisfactory, consult Fault Diagnosis below.



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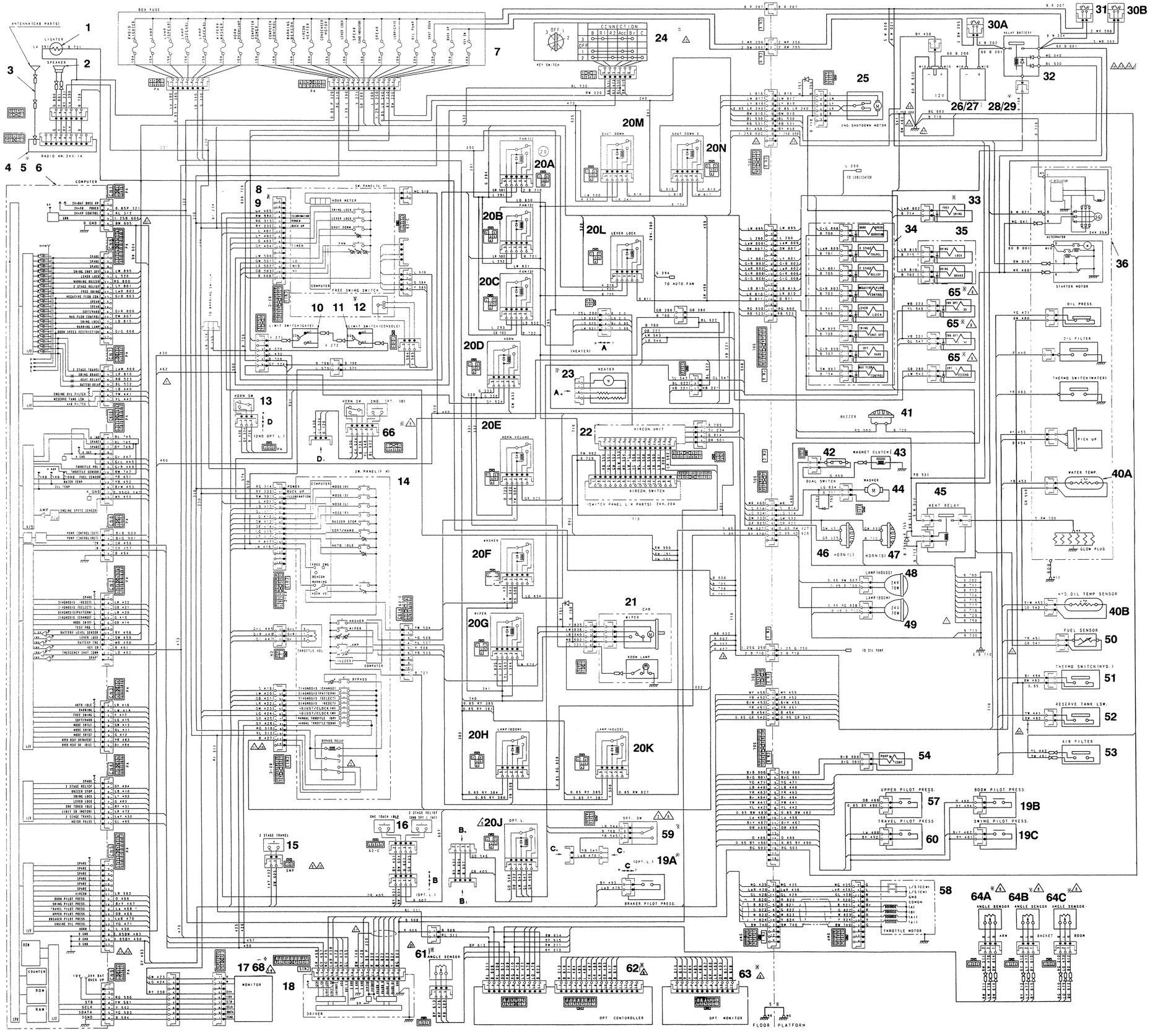
Fault Diagnosis

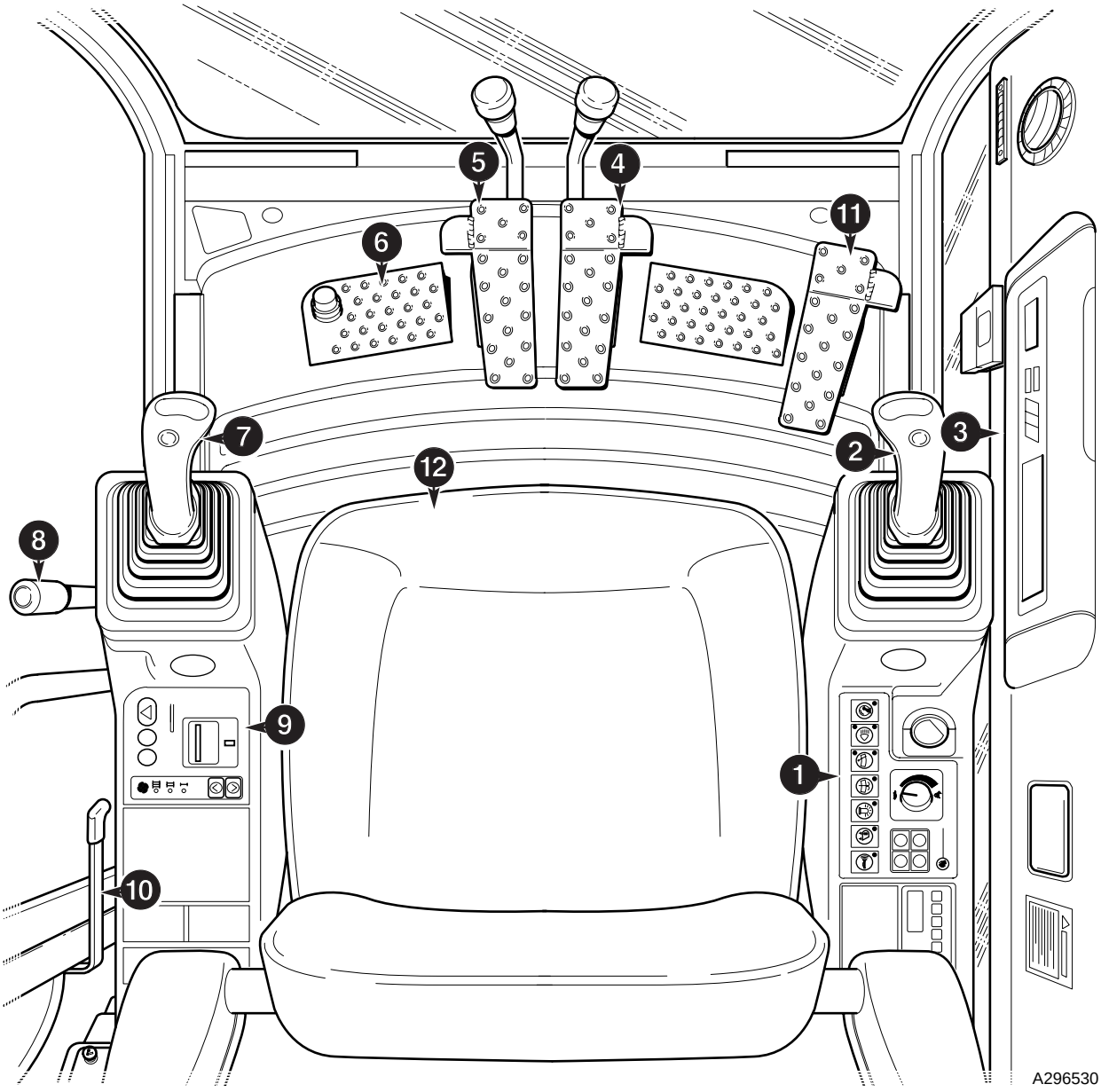
	Battery Tester Readings		Remedy
1	CHECK: LOAD:	0 - 12.6 Volts less than 6 Volts	Renew Battery
2	CHECK: LOAD:	6 - 12.4 Volts less than 9 Volts and falls steadily but remains in yellow zone.	Recharge and re-test. If tests still unsatisfactory renew battery.
3	CHECK: LOAD:	less than 10 Volts less than 3 Volts	Indicates battery has been over-discharged and unlikely to recover. Renew battery.
4	CHECK:	more than 11 Volts	Charge battery which will probably recover.

Main Components

1 Cigar Lighter
2 Loudspeaker
3 Radio Aerial Lead
4 Radio (Standard)
5 Radio (AM/FM) (Optional)
6 System Controller (Computer)
7 Fuse Box
8 Switch Panel - Left Hand (Standard)
9 Switch Panel - Left Hand (Optional)
10 Limit Switch - Lever Lock (Gate)
11 Limit Switch - Lever Lock (Console)
12 Switch - Free Swing (Optional)
13 Horn Push
14 Switch Panel - Right Hand
15 Switch - Speed Change
16 Switch - One Touch Idle
17 Monitor, Controller
18 Driver
19A Push-button - Breaker Pilot Pressure
19B Push-button - Boom Pilot Pressure
19C Push-button - Swing Pilot Pressure
20A Relay - Fan 1
20B Relay - Fan 2
20C Relay - Fan 3
20D Relay - Horn
20E Relay - Horn Volume
20F Relay - Screenwasher
20G Relay - Screenwiper
20H Relay - Lamp (Boom)
20J Relay - Auxiliary Lamps (Optional)
20K Relay - Cab Light
20L Relay - Lever Lock
20M Relay - Engine Shutdown 1
20N Relay - Engine Shutdown 2
21 Indicator Lamp-wiper Motor
22 Air Conditioning Unit
23 Cab Heater
24 Starter Switch
25 Motor - Engine Shut-down
26/28 Batteries - Standard
27/29 Batteries - Heavy Duty (Optional)
30A Fusible Link - Starter Switch/Back-up Fuses
30B Fusible Link - Engine Shut-down Fuse
31 Fusible Link - Fuse Box
32 Relay - Battery
33 Solenoid Valve Free Swing (Optional)
34 Solenoid Valve Block
35 Solenoid Valve - Swing Brake/Swing Lock
36 Engine Block
40A Sensor - Water Temperature
40B Sensor - Hydraulic Oil Temperature
41 Warning Buzzer
42 Air Conditioning - Drier Switch
43 Air Conditioning - Compressor Magnetic Clutch
44 Motor - Screen Washer
45 Relay - Engine Glow Plugs
46 Horn - Loud
47 Horn - Standard
48 Working Lights - Cab Mounted
49 Working Lights - Boom Mounted
50 Sensor - Fuel Level
51 Switch - Hydraulic Oil Overheat
52 Switch - Hydraulic Oil Reserve Tank Level
53 Switch - Air Filter Blocked
54 Control - Hydraulic Pump
57 Pressure Switch - Upper Pilot Pressure
58 Motor - Engine Throttle
59 Solenoid - Breaker Pilot Pressure (Optional)
60 Pressure Switch - Travel Pilot Pressure
61 Pressure Switch - Angle Sensor (Optional)
62 Controller - Optional
63 Monitor - Optional
64A Angle Sensor - Dipper (Optional)
64B Angle Sensor - Bucket (Optional)
64C Angle Sensor - Boom (Optional)
65 Solenoid (3) - Optional
66 Switch - Double (Optional)
68 Monitor - Optional


ANTENNA(CAB PARTS)
RADIO AM. 24V. 1A
COMPUTER
KEY SWITCH
CONNECTION
ENG. SHUTDOWN MOTOR
RELAY BATTERY
ALTERNATOR
STARTER MOTOR
OIL PRESS.
OIL FILTER
THERMO SWITCH(WATER)
PICK UP
WATER TEMP.
GLOW PLUG
HYD. OIL TEMP SENSOR
FUEL SENSOR
THERMO SWITCH(HYD.)
RESERVE TANK LSW.
AIR FILTER
HEAT RELAY
BUZZER
MAGNET CLUTCH
WASHER
HORN(S)
LAMP(HOUSE)
LAMP(BOOM)
HEATER
AIRCON UNIT
AIRCON. SWITCH
HORN SW
HORN VOLUME
KEY SW
LEVER LOCK
SHUT DOWN
SHUT DOWN 2
FAN
FREE SWING SWITCH
LIMIT SWITCH(GATE)
LIMIT SWITCH(CONSOLE)
TO AUTO FAN
TO LUBRICATOR
TO OIL PUMP
CAB
WIPER
ROOM LAMP
BYPASS
BYPASS RELAY
THROTTLE VOL
BEACON WARNING
ONE TOUCH IDLE
2 STAGE RELIEF
2 STAGE TRAVEL
BRAKER PILOT PRESS.
UPPER PILOT PRESS.
TRAVEL PILOT PRESS
BOOM PILOT PRESS.
SWING PILOT PRESS.
THROTTLE MOTOR
ANGLE SENSOR
ARM
BACKET
BOOM
MONITOR
DRIVER
OPT. CONTOROLLER
OPT. MONITOR
FLOOR
PLATFORM
ROM
COUNTER
RAM
1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17 68. 18. 19A. 19B. 19C. 20A. 20B. 20C. 20D. 20E. 20F. 20G. 20H. 20J. 20K. 20L. 20M. 20N. 21. 22. 23. 24. 25. 26/27. 28/29. 30A. 30B. 31. 32. 33. 34. 35. 36. 40A. 40B. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 57. 58. 59. 60. 61. 62. 63. 64A. 64B. 64C. 65.

Operator's Cab



1 **Right Console**

2 **Right Excavator Joystick Control**

3 **Display Monitor**

4 **Right Hand Track Control**

5 **Left Hand Track Control**

6 **Travel Speed Range Change Switch**

7 **Left Excavator Joystick Control**

8 **Control Lock Lever**

9 **Left Console**

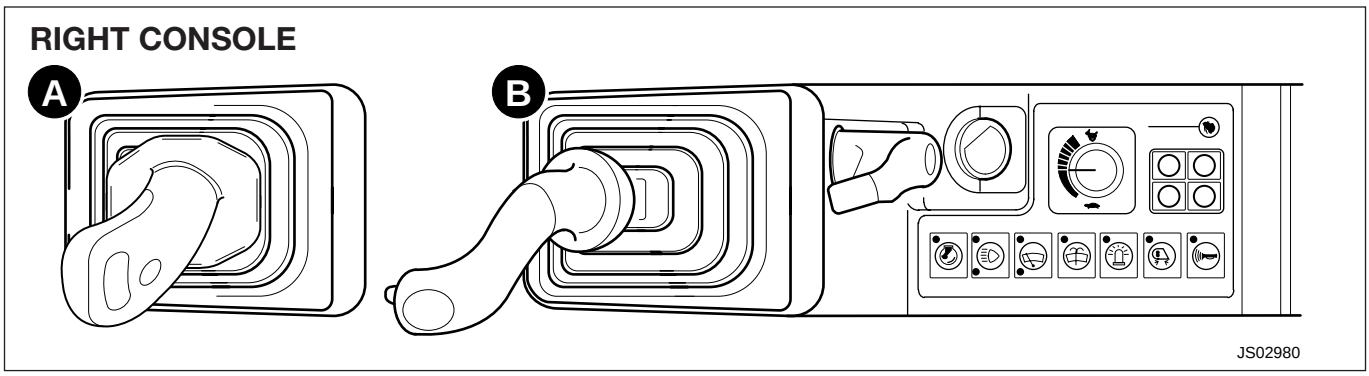
10 **Door Lock Release Lever**

11 **Optional Circuit Pedal (if fitted)**

12 **Operators seat**

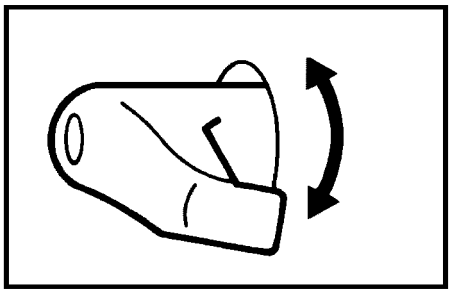
Right Console

* *For correct operation and description see* '**Operator's Handbook**'

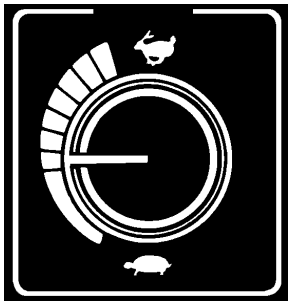


Note: *Your machine will be equipped with hand controller type* ***A*** *or* ***B****.*

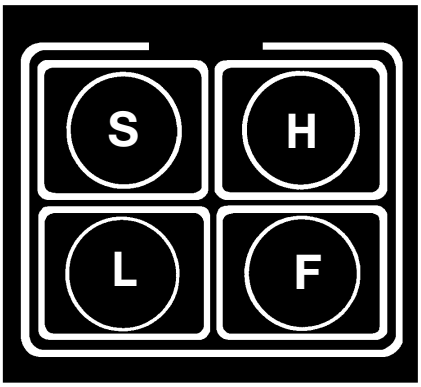
* **Right Console Tilt Handle (If fitted)**



Throttle Volume Control

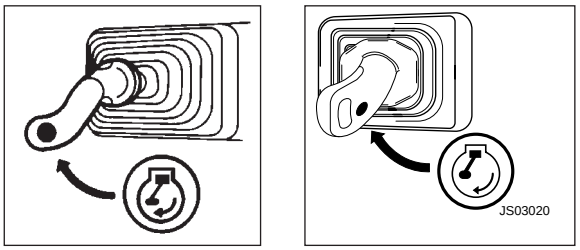


Mode Selection

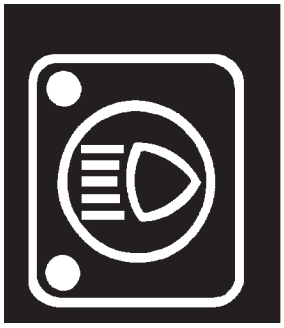


One Touch/Auto change switch

Idle Switch



Work lamp Switch

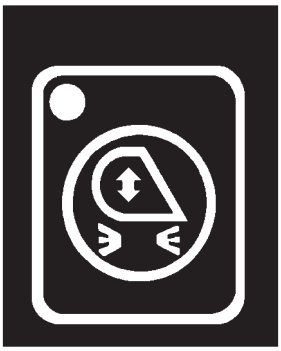


Wiper Switch

Washer Switch

Right Console (continued)

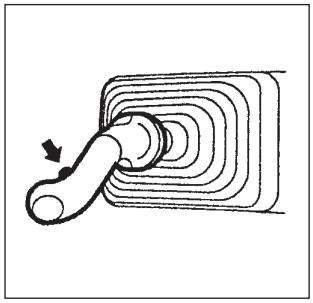
Soft/Hard *



Buzzer Stop Switch

*

Power-up button



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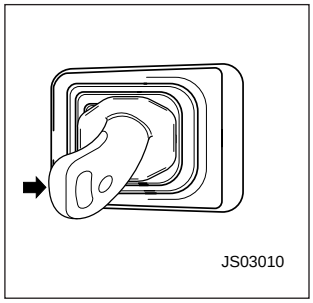
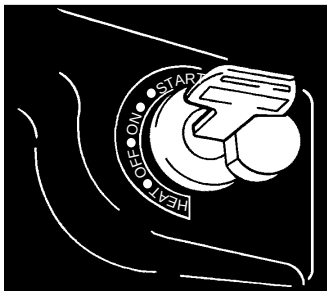
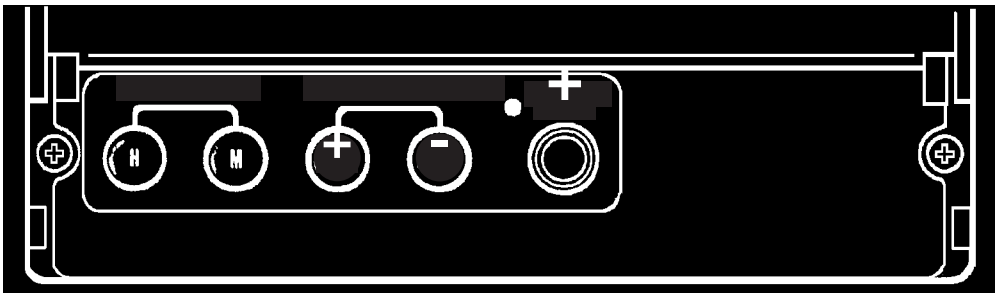


Horn Volume *

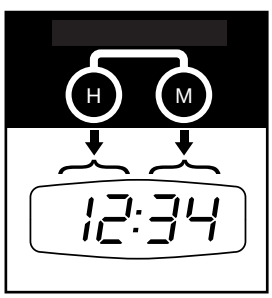
Starter Switch



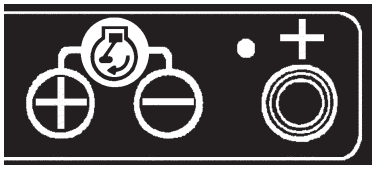
Right Console (side panel)



Time Adjust *



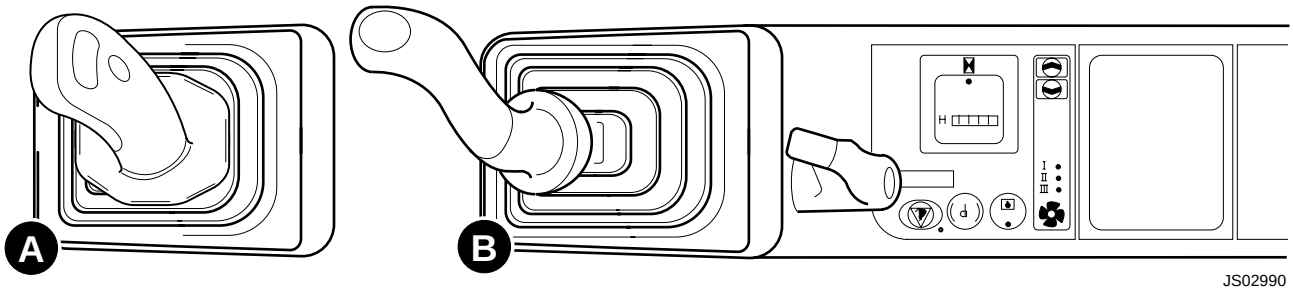
Back-up *



Left Console

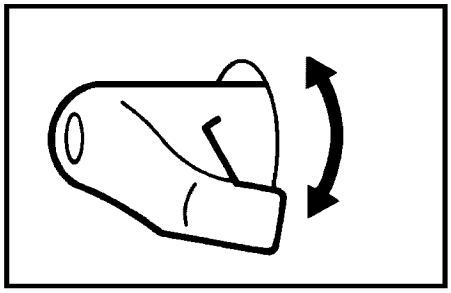
*For correct operation and description see '**Operator's Manual**'*

* **LEFT CONSOLE**

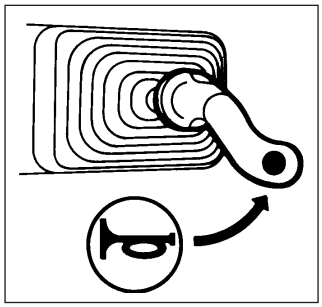


***Note:** Your machine will be equipped with hand controller type **A** or **B**.*

Left Console Tilt Handle



Horn Switch



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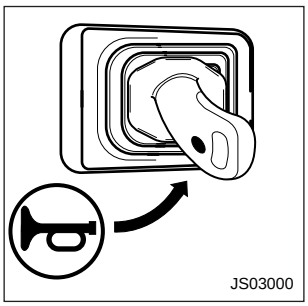
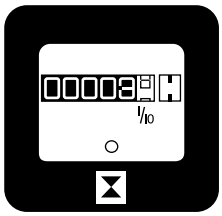
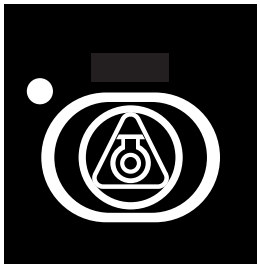


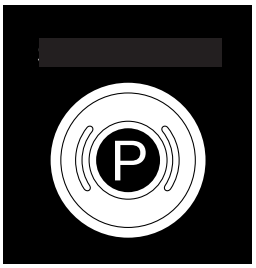
Hour Meter



Emergency Stop Switch *

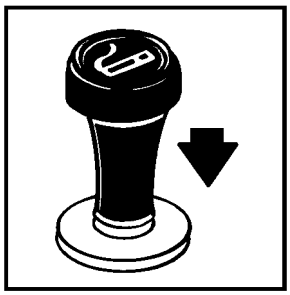


Swing Brake Switch *

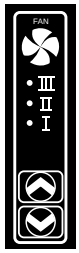


Lever-lock Switch *

Cigarette Lighter

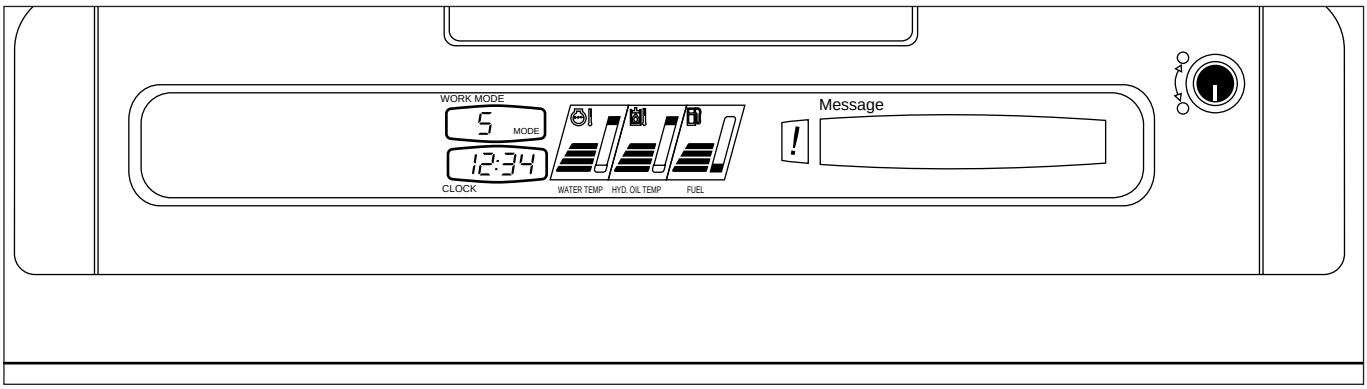


Heater and Air Conditioning

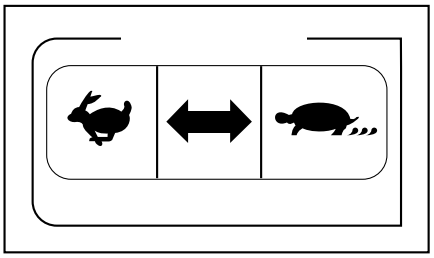


Monitor

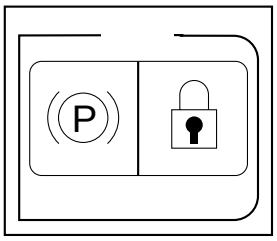
*For correct operation see '**Operator's Manual**'*



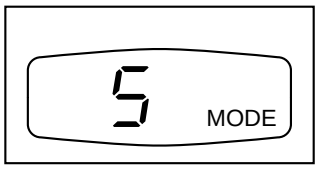
Machine Condition Indicators *



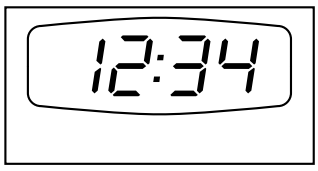
Lock Indicator *



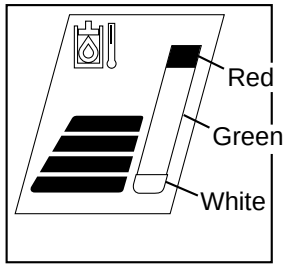
Work Mode Indicator *



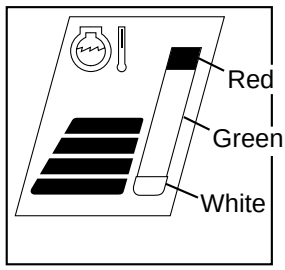
Time Indicator *



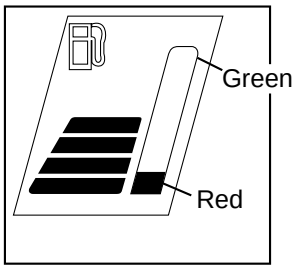
Bar Graph Hydraulic Oil Temp *



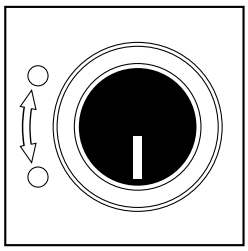
Water Temp *



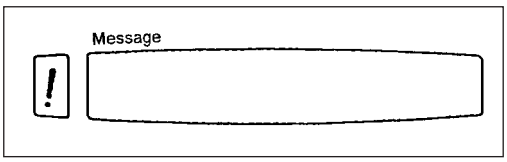
Fuel Indicator *



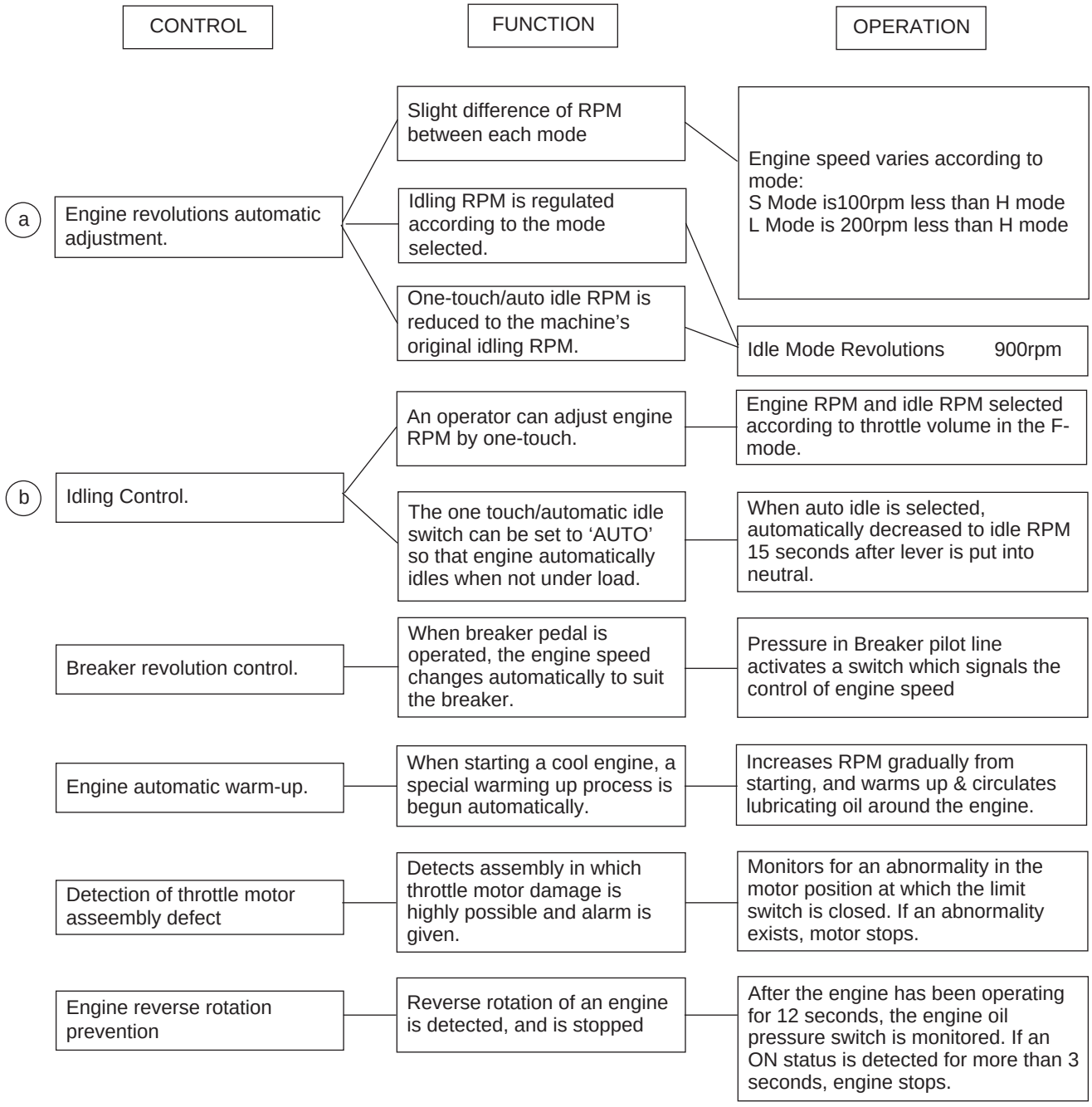
Brightness Control



Message Indicator



Control, Function, Operation

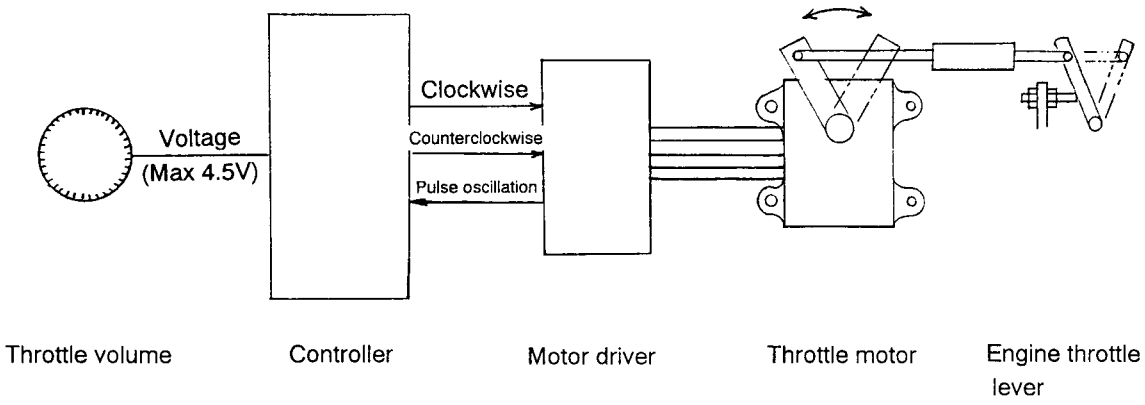


Control, Function, Operation

	CONTROL	FUNCTION	OPERATION
3	Pump control	Pump control depends on work such as, H mode, large working load, S mode, good fuel economy, and L mode, for fine operation.	The supply current to electromagnetic proportional pressure reducing valve which is built into the pump, is regulated.
3	Boom lowering speed regulation	It also decreases boom lowering speed in L/F mode.	When L/F mode is selected the boom lowering stroke of control valve spool is restricted.
4	Cushioned Boom Starting	Prevents shock loads when starting to lower the boom.	When starting, a momentary negative control signal is generated.
5	Pressure raising system	Power increased when more force is desired, or during travel.	Pressure raised by 2-stage MRV being operated by solenoid valve.
6	3-speed travel and max. flow cut	High, middle or low speed travel operation obtained by switch. Performance improved during F mode.	Selects travel motor 2-speed positions, to give function of restricting max. flow of pump.
7	Cushion control	When cushion control is selected shock is relieved when boom and arm are de-selected. When hard operation is selected, the cushion is turned off.	Modulates movement of control valve boom/arm spools when they are deselected.
8	Power cut delay	A power supply is maintained to allow electrical devices to be operated after key switch is tuned to OFF .	After the key switch is turned OFF there is a 5 seconds delay before the battery relay is cut OFF.
9	Swing brake/swing lock	Key OFF or lock SW ON: 100% swing brake. Key ON and operation other than swing: 50% swing brake. Swing operation: 0% (release).	Pressure is maintained by a pressure reducing valve, dependent upon brake selection.
10	Lever lock (Left console)	Unless the controls are immobilised, by raising the left console, entering and leaving the cab is impossible. In an emergency, it is possible to shut off the services immediately by raising the console.	With left console raised the controls are isolated.
12	Overload protection	If power transistor output of controller is shorted, the controller is protected.	An overcurrent sensing circuit is fitted within the controller. When the output is shorted, the power transistor output is stopped, thus preventing an internal overload in the computer.
13	Monitor display	Radiator water temperature Hydraulic oil temperature Fuel remaining Warning display	

Basic Operation

The engine throttle control is done with the electric throttle motor.

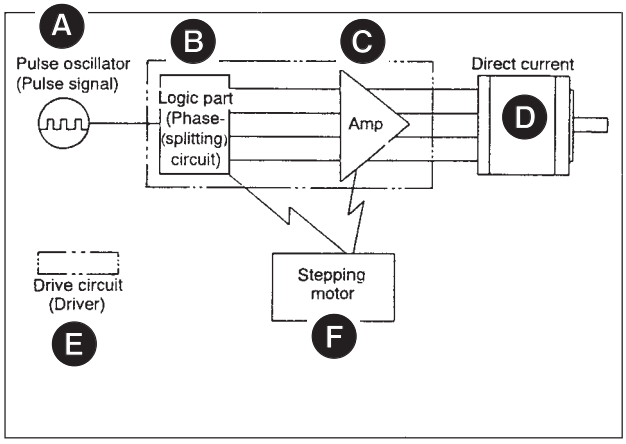


A stepping motor is now used as part of the throttle motor.

Stepping Motor

This rotates in direct synchronization with the amount of pulses received from the pulse oscillator.

Pulse oscillator
This circuit is used to make the pulse signal that determines the degree of rotation and rotational speed of the stepping motor. The stepping motor rotates when it is synchronised with the pulse signal from the pulse oscillator. The degree of rotation is dependant on the frequency of the pulse.



Stepping Motor Basic Drive Structure

Component Key

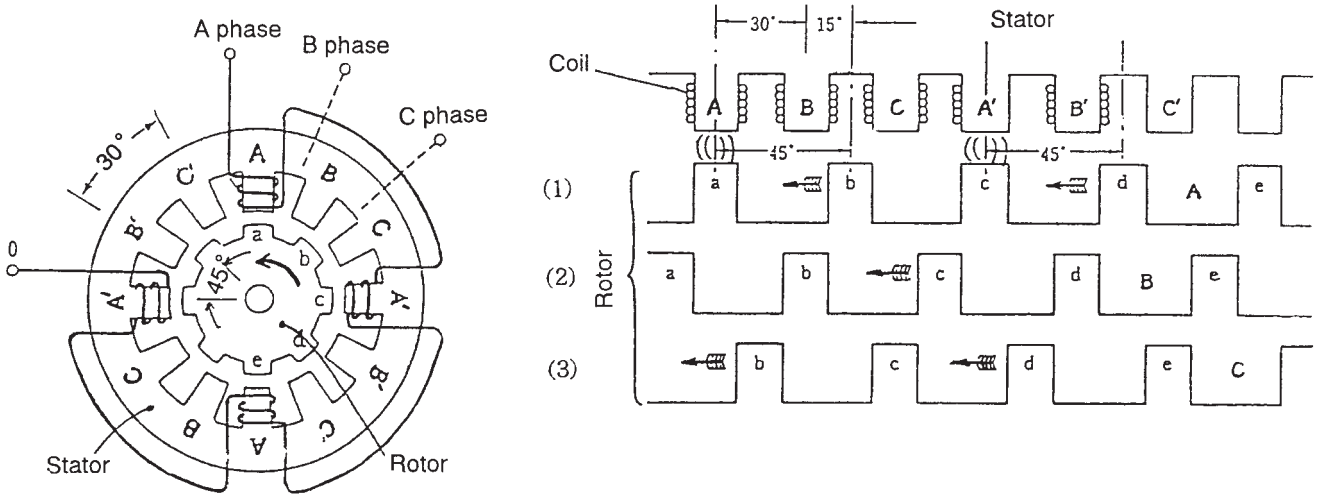
A Pulse oscillator (pulse signal)
B Logic part (phase splitting circuit)
C Amp
D Direct current
E Drive circuit (driver)
F Stepping motor

Stepping Motor *(continued)*

Driver Circuit (driver)

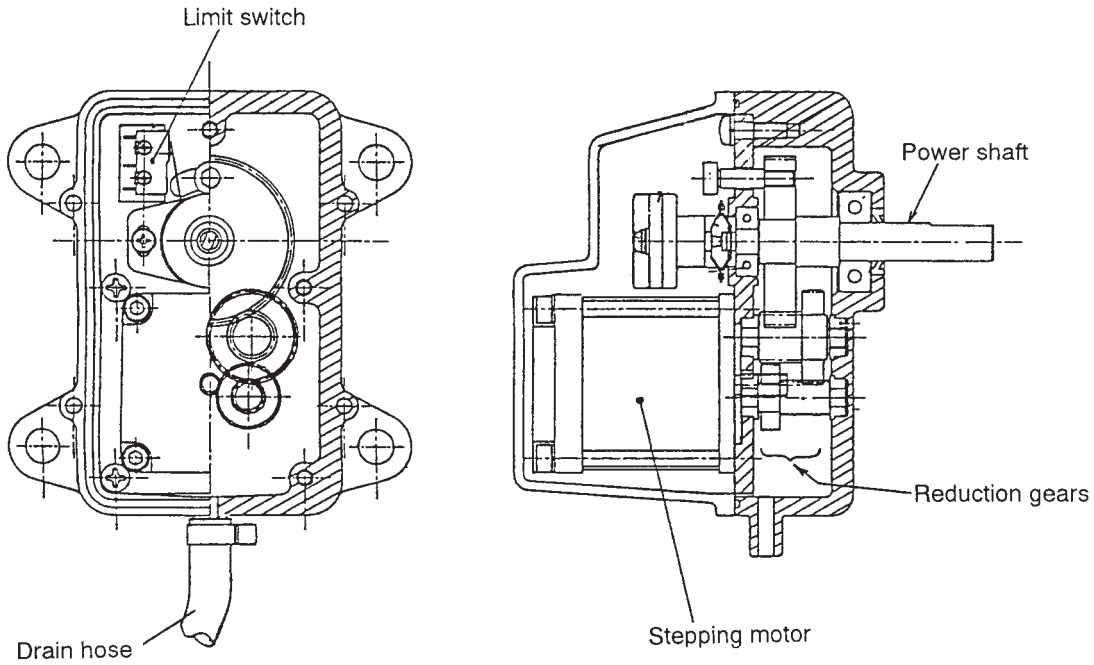
The driver circuit of a stepping motor consists of a logical section which forms and distributes a pulsed signal from an oscillator and an amplifying section which amplifies and supplies the signal to the motor.

Stepping motor principle (if 1st - phase is on drive)



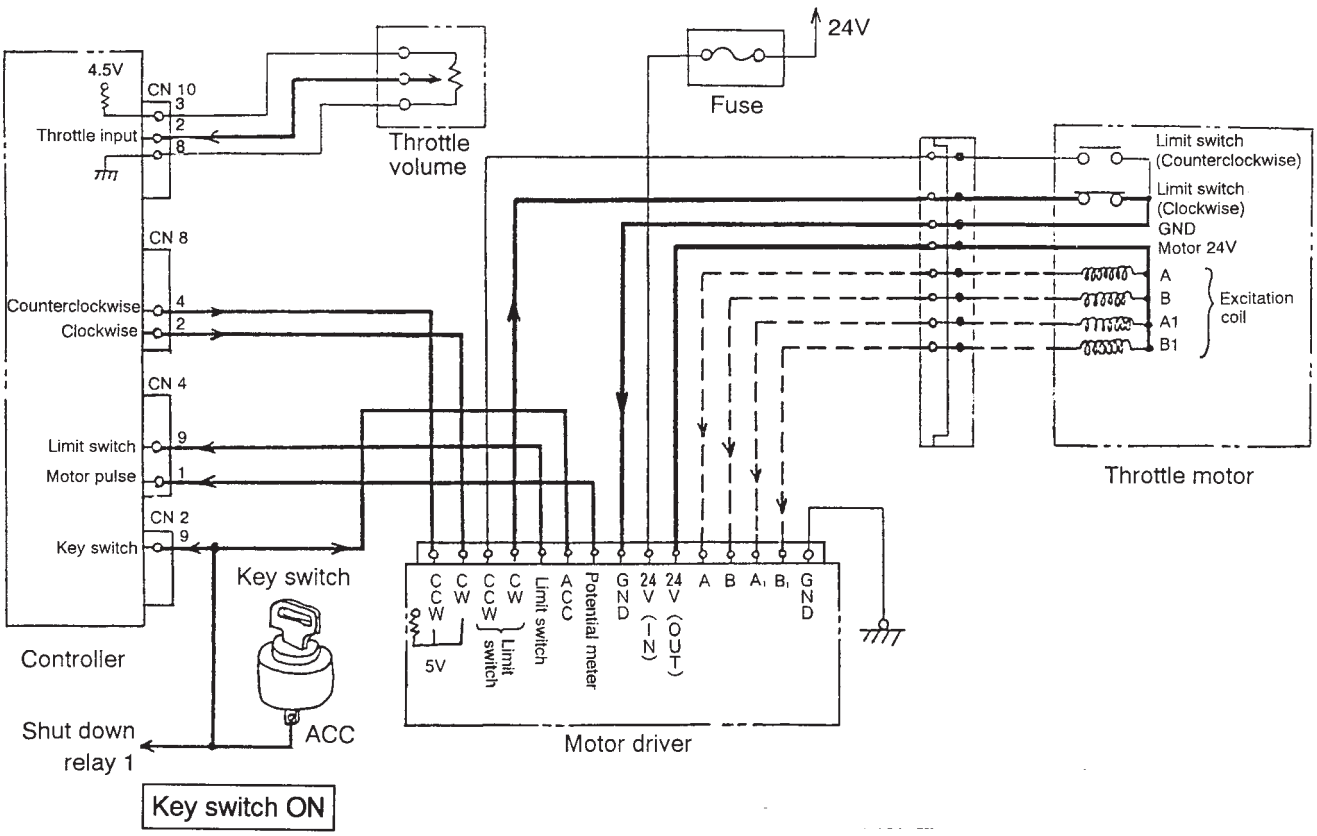
The wound phases of **A**, **B** and **C** are rolled on the stator.

When a pulse enters **A** phase, rotor is in (1) condition and A-a, A-c are energised. The excitation of **A** phase breaks down and then the pulse of **B** phase enters, B-b, B-d are energised and results in (2) condition. When the rotor rotates in a counter clockwise direction it sets up the condition (**A-B-C**). When a pulse is registered in the order (C-B-A) the rotor is rotating clockwise.



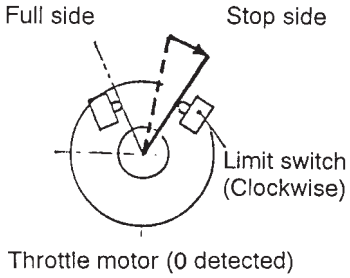
Throttle Motor Structure

Throttle related function



A signal enters CN2-9 of the controller and ACC of the motor driver from ACC key switch. (24V) The controller and the driver sense that the key switch is **ON**, when this signal enters. The controller sends a clockwise rotation instruction (CN8-2) to the driver, and the driver sends a pulse clockwise rotation (ABA1B1) to the throttle motor. When the throttle motor rotates clockwise, the limit switch is depressed, and a signal is then sent to the controller (CN4-9) through the driver, to inform the controller that the 'O point detection' of the throttle motor has been achieved. (O pulse)

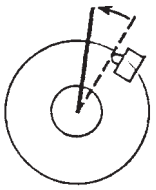
After 'O point detection' has been achieved, in order for the controller to confirm the throttle volume position, the voltage (CN10-2) from the throttle volume control is converted to a pulse number.



Throttle related function *(continued)*

For the Throttle motor to rotate to the position required by the throttle volume, an instruction from (CN8-4) to rotate counter clockwise is sent from the controller to the motor driver, and when received, sends a counter clockwise pulse from the motor driver the throttle motor. Confirmation of the received pulse by the motor driver is achieved by a feedback signal pulse sent back to the controller, at (CN4-1).

When the throttle motor pulse (that is the pulse which is converted by controller voltage from the throttle volume) eventually becomes equal to the pulse which is sent to the controller as a feedback signal from the driver, the throttle motor will stop rotating.



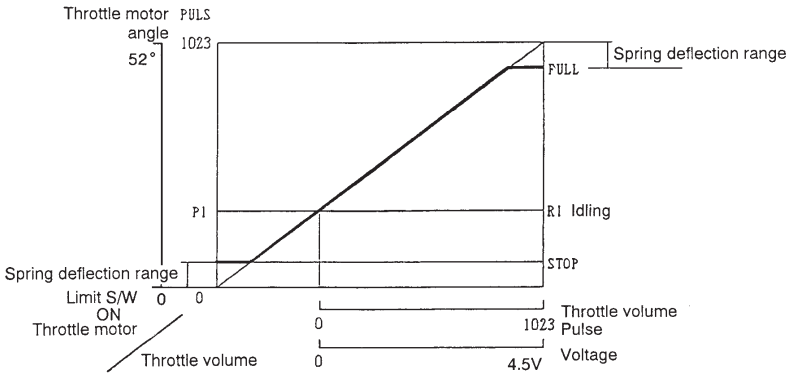
Throttle motor

(Stops at pulse position of throttle volume)

Revolution increase

When the throttle volume control is rotated clockwise, the voltage of the throttle input increases, because of this the controller sends a counter clockwise revolution signal to the driver, and the driver sends a counter-clockwise pulse to the throttle motor, again the controller gets confirmation by a feedback signal pulse sent from the driver.

When the throttle motor pulse (that is the pulse which is converted by the controller voltage from throttle volume) eventually becomes equal to the pulse which is sent to the controller as a feedback signal from the driver, the throttle motor will stop rotating.



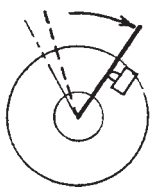
Engine Stop

When turning the key switch to **OFF**, the signal of the **ACC** line of the motor driver switches to **OFF**. When this signal is turned **OFF**, the driver sends a pulse to the throttle motor until the limit switch of clockwise rotation is turned **ON**.

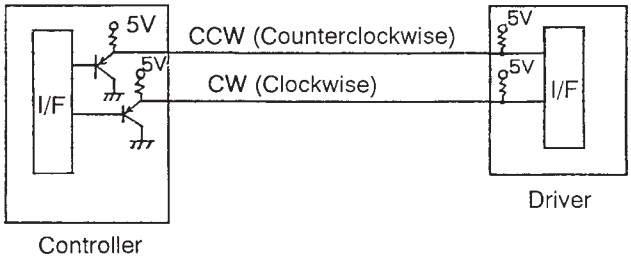
The governor lever moves to the stop side, causing the engine to stop, at the same time another circuit operates and moves the fuel cut lever to the stop position.

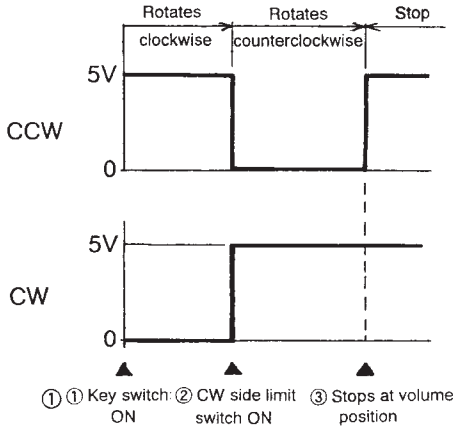
Engine stop

Stop side



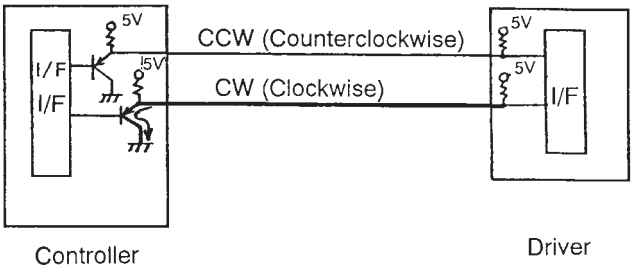
Controller rotational instructions





1. After key switch ON

When the transistor on the **CW** side of the controller is turned **ON**, **5V** from a driver circuit drops to ground. At this point the **CW** line is **0V** and **CCW** line is **5V** at the driver side.

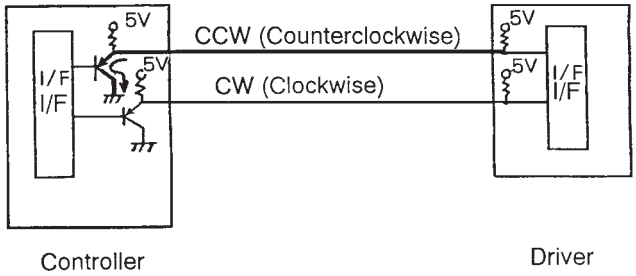


CCW5V
CW0V

⇨ Rotation instruction of clockwise direction is set.

2. After CW side limit switch ON

The controller turns **OFF** the transistor on the **CW** side, and turns **ON** the **CCW** side on the driver. **CW** line is **5V** and **CCW** side is **0V**.



CCW0V
CW5V

⇨ Rotation instruction of counterclockwise direction is set.

3 . The stop status in volume position

CCW and **CW** of a transistor are turned **OFF**, and both lines at the driver side are **5V**.

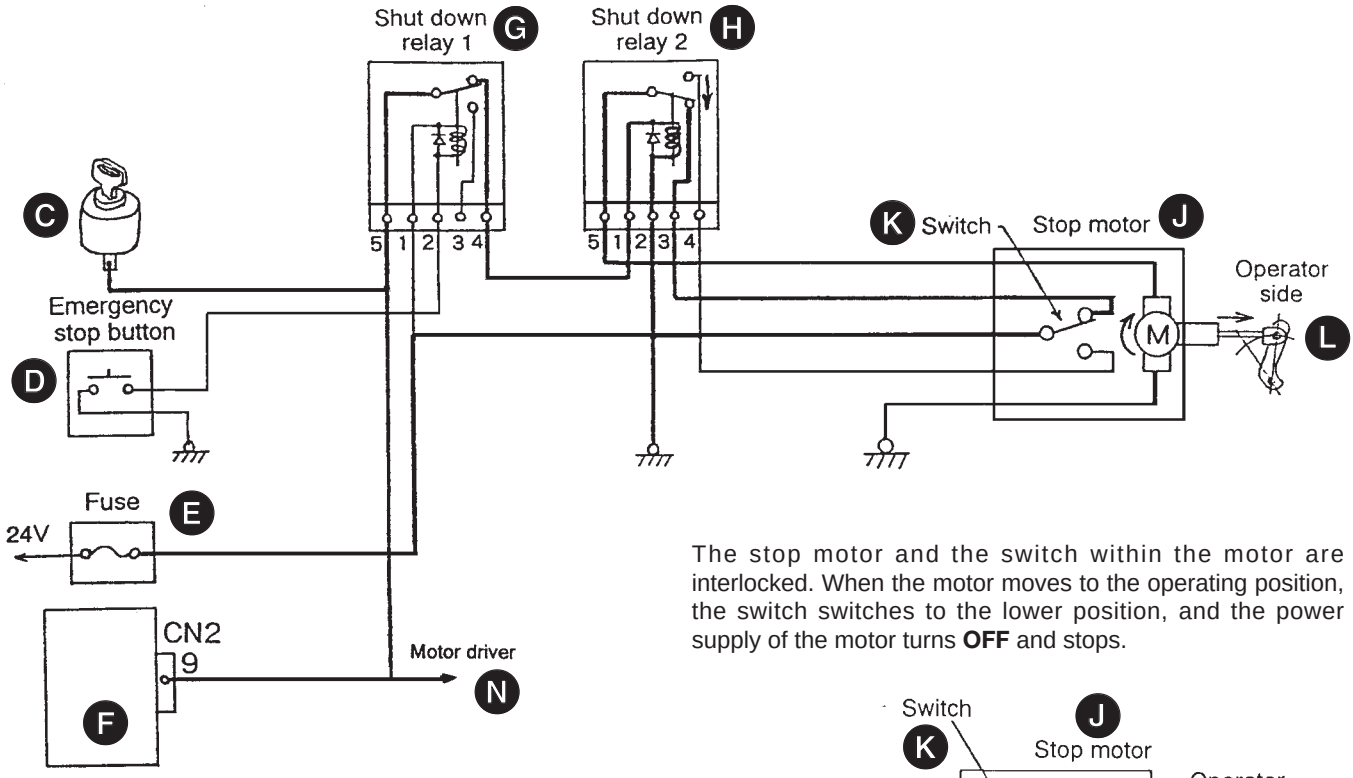
CCW5V
CW5V

⇨ Motor rotation stops.

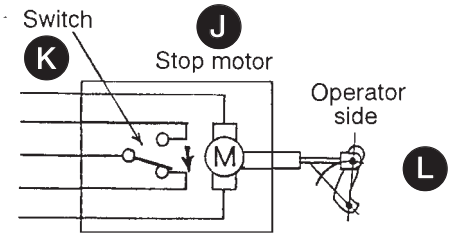
Stop Motor Function

A Key Switch ON

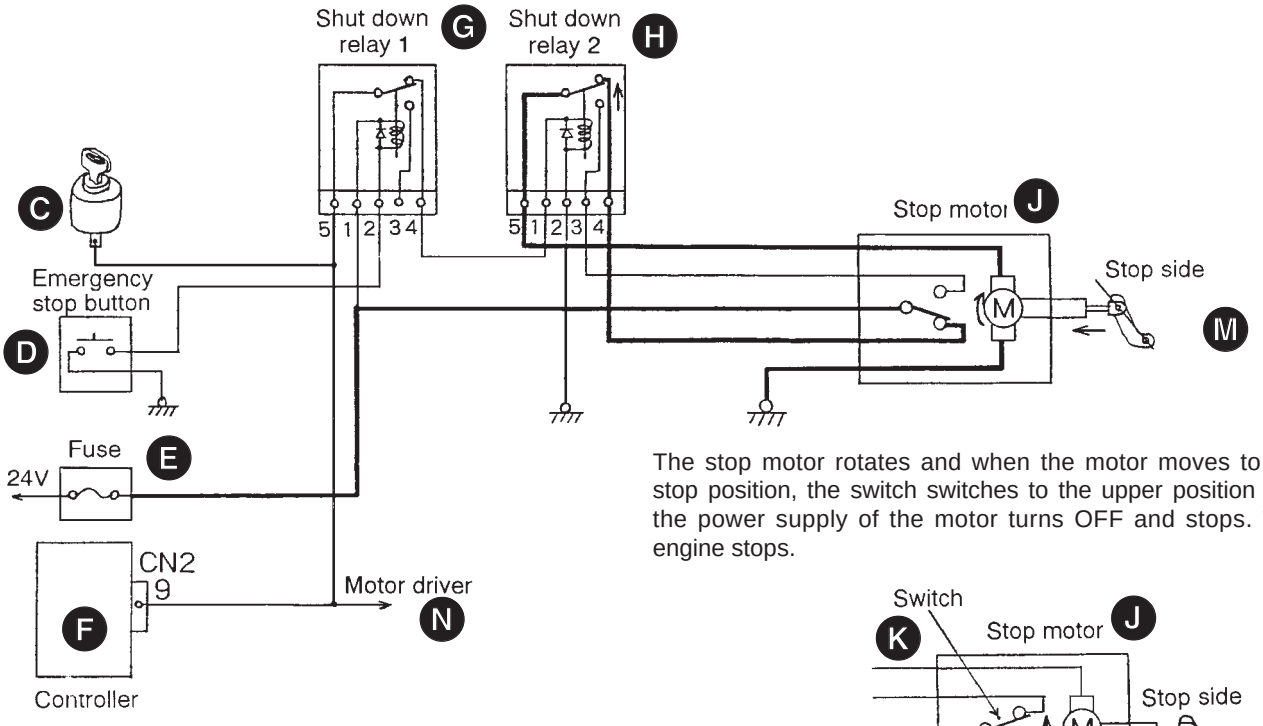
With the key switch in the **ON** position, the power flows through relay and energises the actuating coil of relay 2 which supplies current to rotate the stop motor.



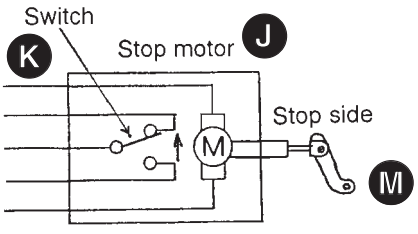
The stop motor and the switch within the motor are interlocked. When the motor moves to the operating position, the switch switches to the lower position, and the power supply of the motor turns **OFF** and stops.



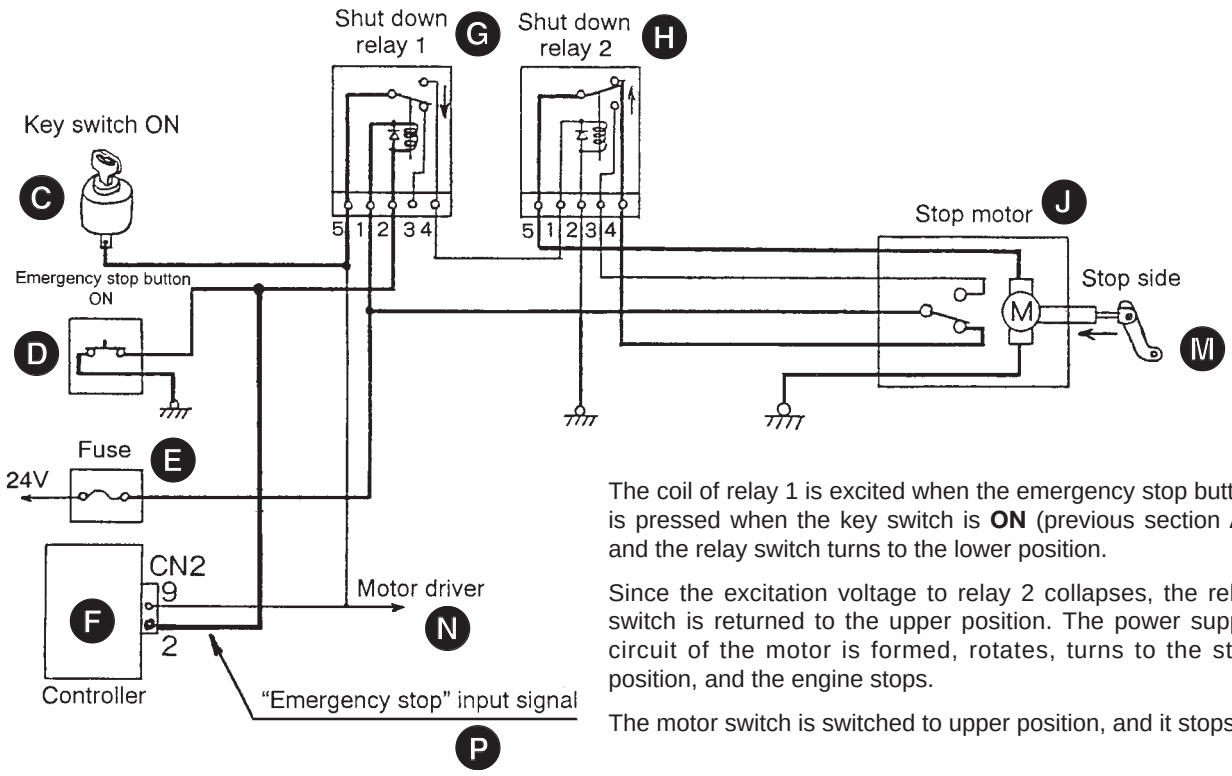
B Key Switch OFF



The stop motor rotates and when the motor moves to the stop position, the switch switches to the upper position and the power supply of the motor turns OFF and stops. The engine stops.



Emergency stop button ON



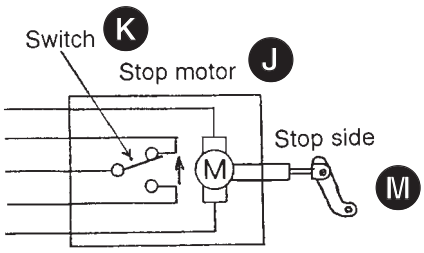
The coil of relay 1 is excited when the emergency stop button is pressed when the key switch is **ON** (previous section **A**), and the relay switch turns to the lower position.

Since the excitation voltage to relay 2 collapses, the relay switch is returned to the upper position. The power supply circuit of the motor is formed, rotates, turns to the stop position, and the engine stops.

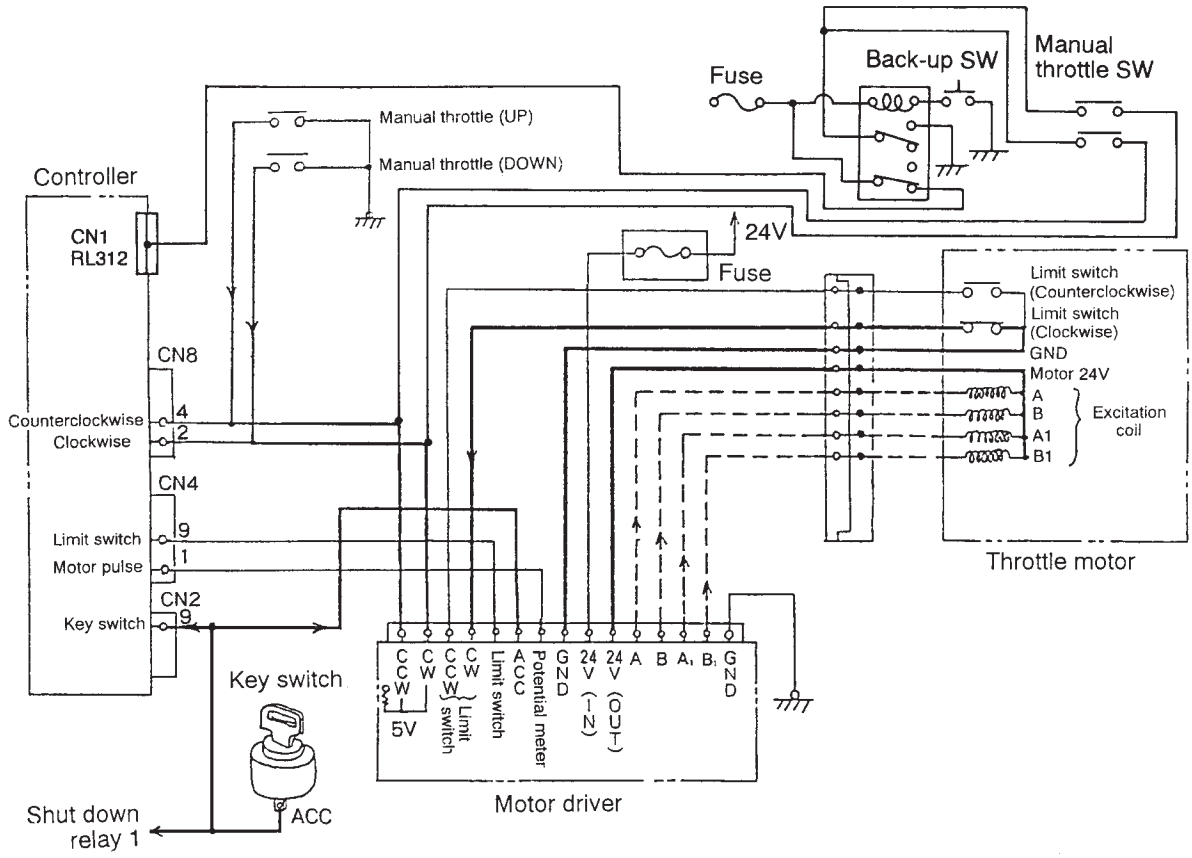
The motor switch is switched to upper position, and it stops.

Component Key (Pages 4-6 and 4-7)

C Key switch
D Emergency stop button
E Fuse
F Controller
G Shut-down relay 1
H Shut-down relay 2
J Stop motor
K Switch
L Motor control - operating position
M Motor control - stop position
N To motor driver
P Emergency stop signal



Redundancy (Back-up) throttle control



If the throttle control does not operate due to a controller defect, press the redundancy switch. Throttle control is then taken over by the manual throttle buttons.

When pressing a redundancy switch, control power supply to the controller is turned **OFF**, and the manual throttle circuit is activated. There is a signal of **5V** on the motor driver side. When pressing manual throttle, instruction of a rotational direction is sent to a motor driver, same method as in previous section Controller rotational instructions.

To stop engine, manual throttle is pressed **DOWN**, or the key switch is turned **OFF**.

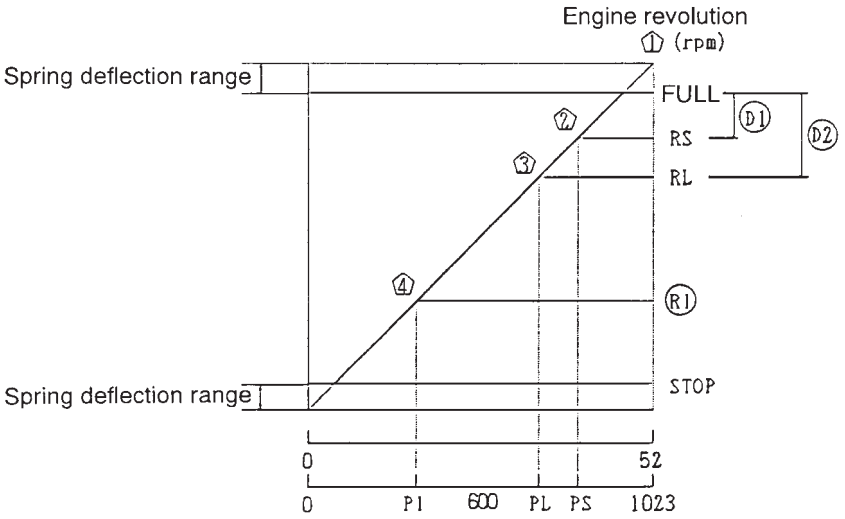
While running the engine, if the redundancy switch is turned **OFF** (normal status), the engine stops so that the **0** position of throttle motor is detected.

Automatic Engine Adjustment

* There is a variation in engine RPM depending on each machine. To finely control, in each mode or to eliminate wide variation in idling RPM, store the setting RPM to the controller at an early stage. This is called automatic adjustment.

* When replacing a new controller or a throttle motor or adjusting and replacing control link between the engine and throttle motor, automatic adjustment must be done.

* **Note:** If a new throttle motor is fitted or the cable/linkage adjusted, the controller must have its memory wiped before programming can commence.



FULL : H MODE MAX Revolutions
RS : S MODE MAX Revolutions
RL : L MODE MAX Revolutions
RI : IDLE Revolutions

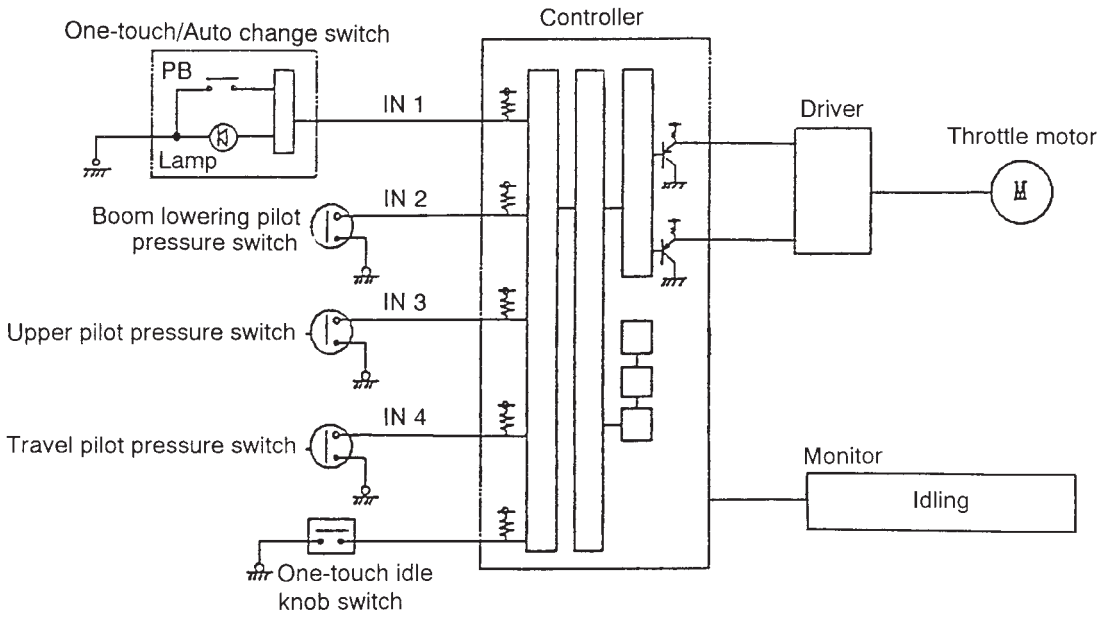
	* **RPM**
D1	100
D2	200
R1	900

Automatic adjustment explanation

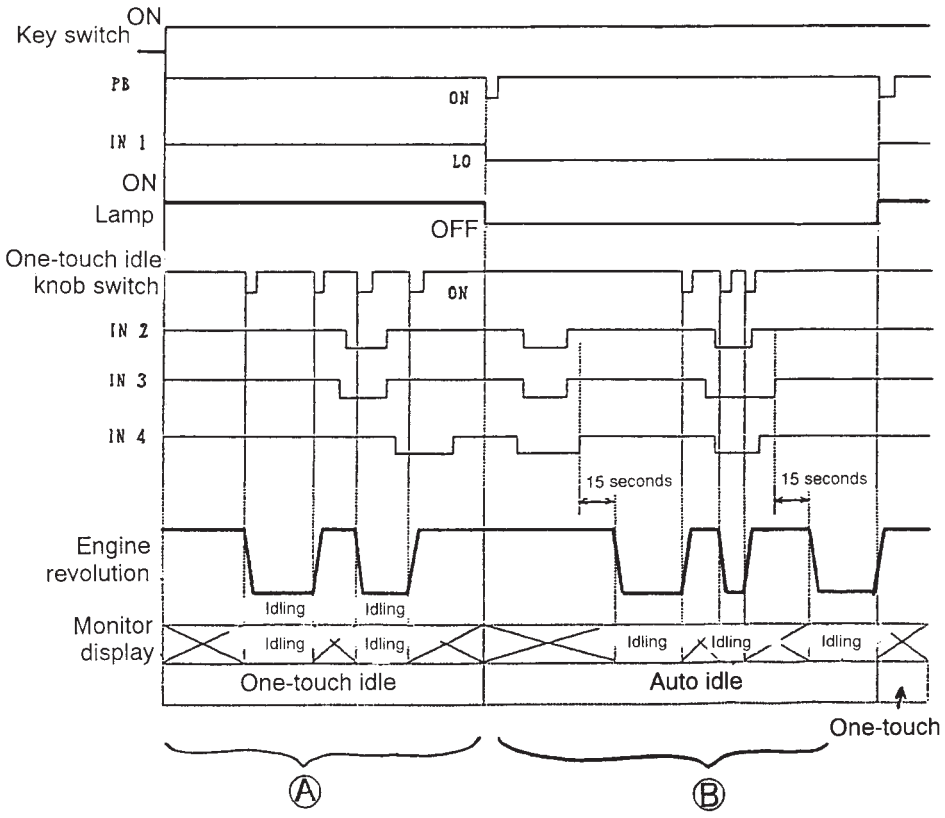
1. Engine **RPM** at the time of full throttle: **FULL** is read.
   (H mode **MAX**)
2. While monitoring engine **RPM**, **RPM** is decreased automatically.
   RS = FULL-D1
   RL = FULL-D2
   RI = Idling revolutions = 900 rpm
   When each **RPM** is reached, position of a throttle motor, PS, PL and PI are read.
* 3. **PS**, **PL** and **PI** are stored by the controller.

Refer to adjustment instructions for automatic adjustment method.

Idling Control



Time Chart



With the key switch **ON** pressing the one-touch switch causes the switch lamp to come on.

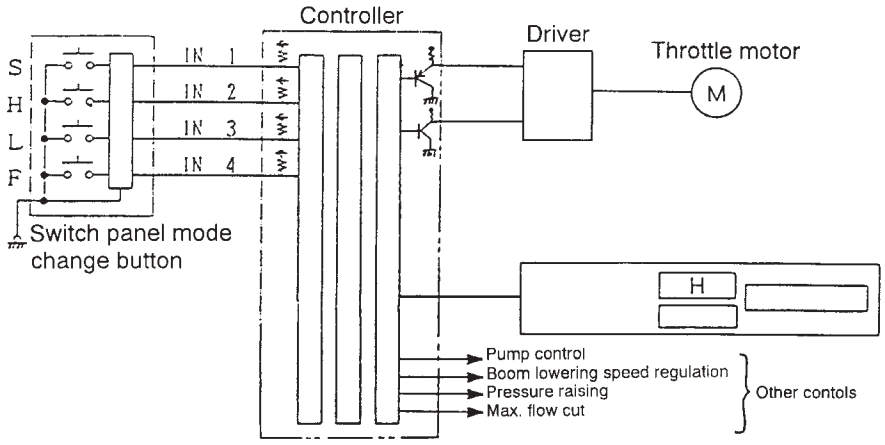
A. One-touch idle operation is possible when in one-touch idling mode regardless of whether the pilot pressure switches of IN2, IN3, IN4 are **ON** or **OFF**.

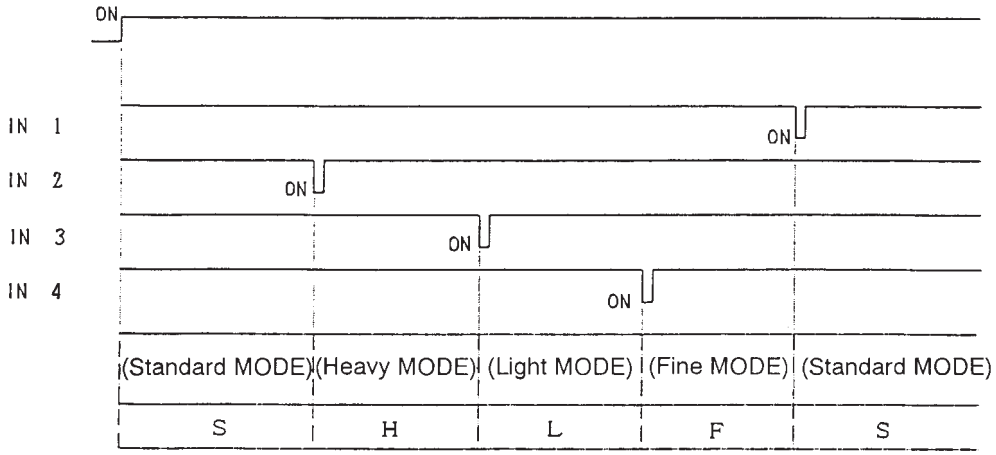
B. When pressing the change switch, (lamp goes off) the Auto idle mode is activated.
When changing to Auto idle, and with all IN2, IN3, IN4 switches turned **OFF** the engine automatically goes into the idle mode after 15 seconds have elapsed.

To exit from the idle mode, this is only possible by pressing the idle switch, regardless of the position of the switches IN2, IN3, IN4.

When the engine key is turned **OFF** during auto idle, if it is turned on again, auto idle is disengaged, and results in a one-touch idle status.

Revolution Control for Each Mode

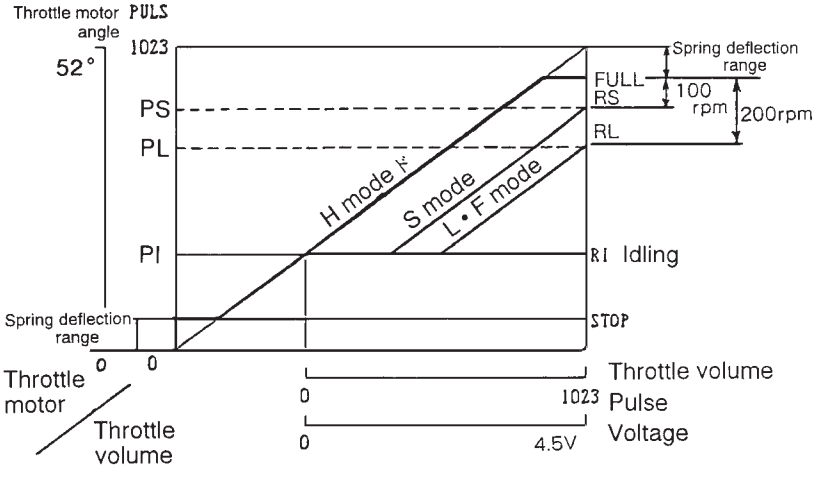




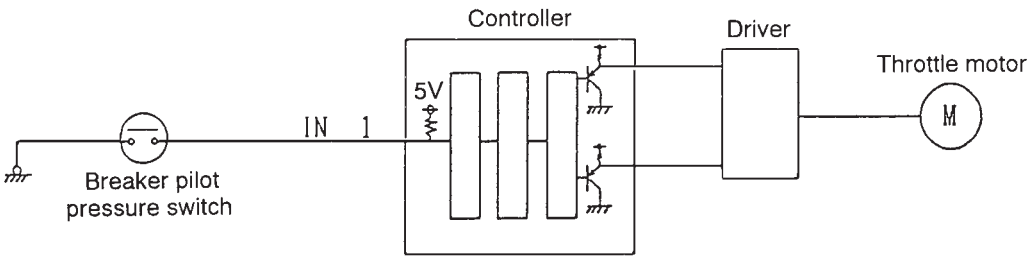
The machine is in the standard mode when the key switch is **ON**. This position is 100 rpm less than the **FULL** rotational position (H mode). Also note the position where it has decreased by 200 rpm from **FULL** rotation in **L** and **F** modes.

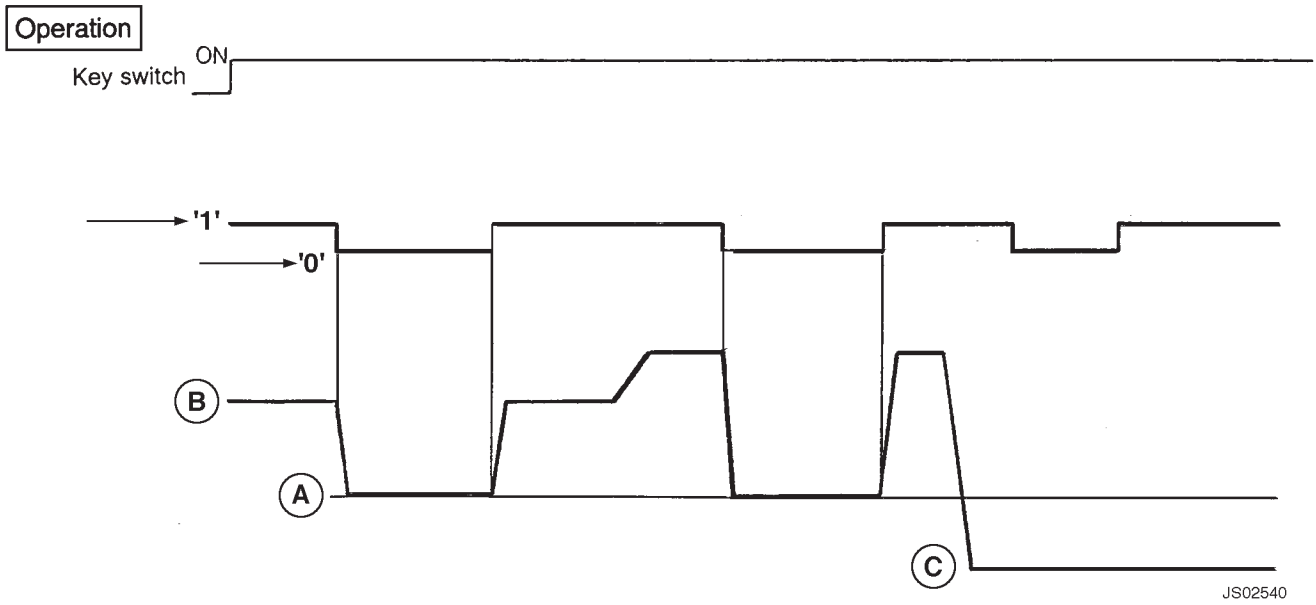
Relation of throttle volume and pulse are shown in diagram below. Even though the position of throttle volume is the same, engine RPM varies with each mode.

However, when pressing a mode switch button, the above four modes can be selected together with their corresponding engine RPM.



* Control of Engine Speed for Breaker Operation



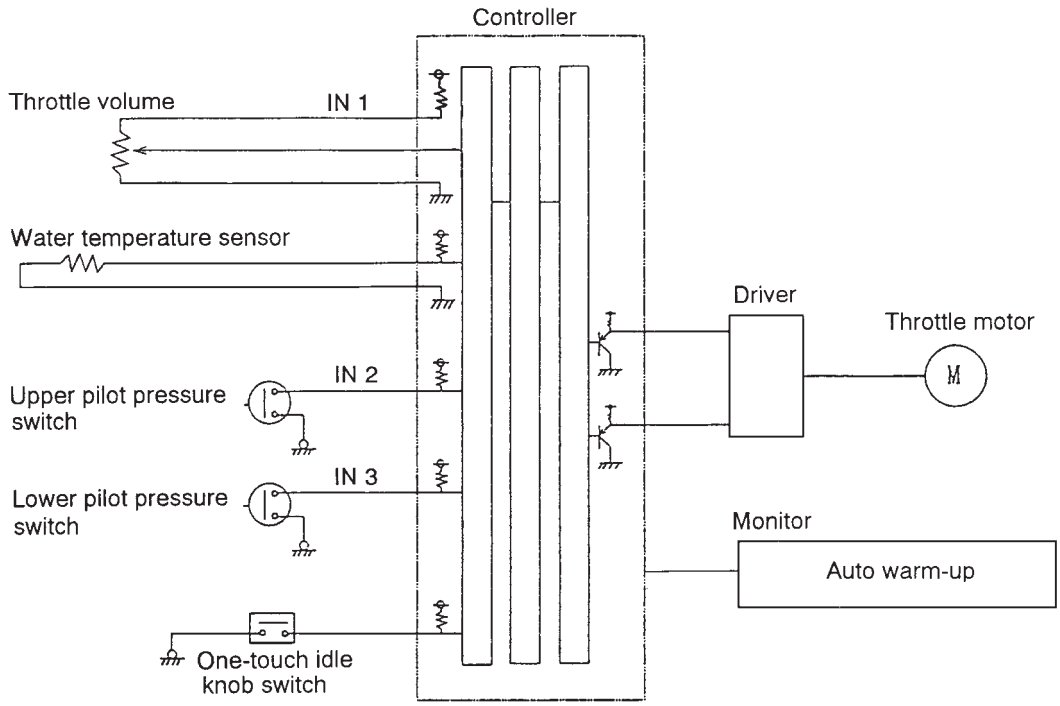


* **Note:** It is necessary to preset the engine r.p.m. to a speed which delivers the flow rate required for breaker operation (see **Setting Function** under **Self Test Function**).

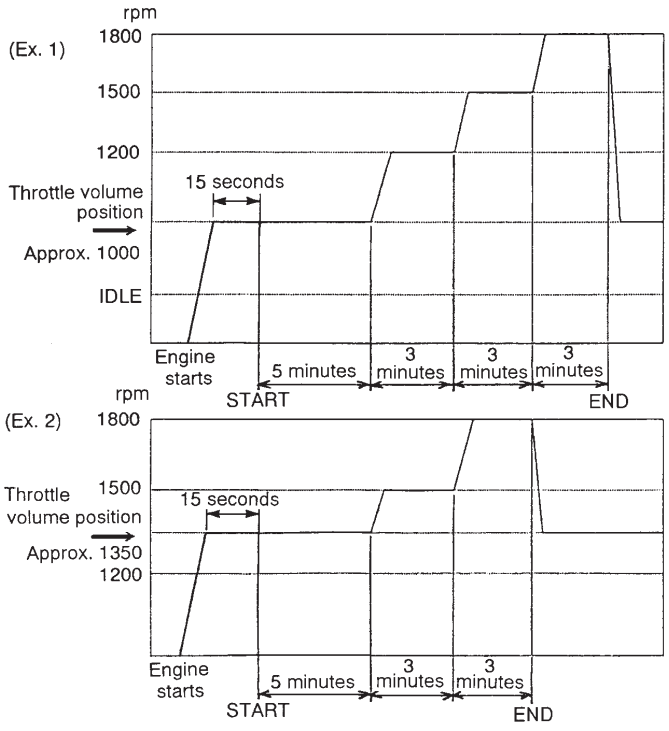
* The breaker can only be operated when the throttle control lever is set to give a higher engine speed (condition **B**) than that required for breaker operation (condition **A**). The following brief explanation assumes that this criteria has been met. If the throttle control lever setting gives an engine speed lower (condition **C**) than condition **A** the breaker circuit is inhibited.

* When the breaker foot pedal is pressed, the breaker pilot switch closes to apply a logic ‘1’ signal to the controller. The controller output causes the throttle motor to reduce the engine speed to the breaker pre-set speed. When the foot pedal is released the logic ‘1’ signal is disconnected and the controller, via the throttle motor, causes the engine speed to revert (increase) to that set by the throttle control lever.

Engine Auto Warm-up



Time Chart



Conditions for automatic warming up

1. Water temperature is less than 50°C.
2. Upper Pilot pressure switch is **OFF.** (attachment is not operating.)
3. Lower Pilot pressure switch is **OFF**. (travel is not operating.)
4. One-touch idle is turned **OFF**.
5. 12 seconds after engine start.

* 6. Throttle dial not moved.

* **Note:** The automatic warming up sequence will function only when the above conditions are adhered to.

Detection of Throttle Motor Assembly Defect (Out-of-step)

Fault

When the pulse signal cannot be interrupted by the driver, and deviates from regular rotation.

Possible Factors

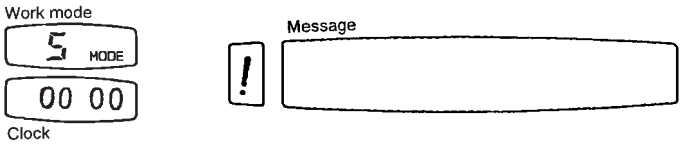
1. If the adjusting screw of the throttle link is loosened, and the length of the link is changed more than the deflection of the spring.
2. If the key switch is **ON** (also during running), and the throttle motor rotates by abnormal external force and shifts to the stop position.

Out of step detection

(Safety device works to protect throttle motor from breakage when above problem occurs.)

1. After the key switch is **ON**, the limit switch of clockwise direction (stop position) is not turned on after 2 seconds.
2. After the key switch is **ON**, the clockwise limit switch is turned on and afterwards even though the key switch is not turned **OFF** or the emergency stop switch is not pressed, the clockwise limit switch is turned **ON** again.

   Any of the above conditions will stop the drive of the throttle motor, and 'electric system abnormality' is displayed on the message and '0000' is displayed on the clock.

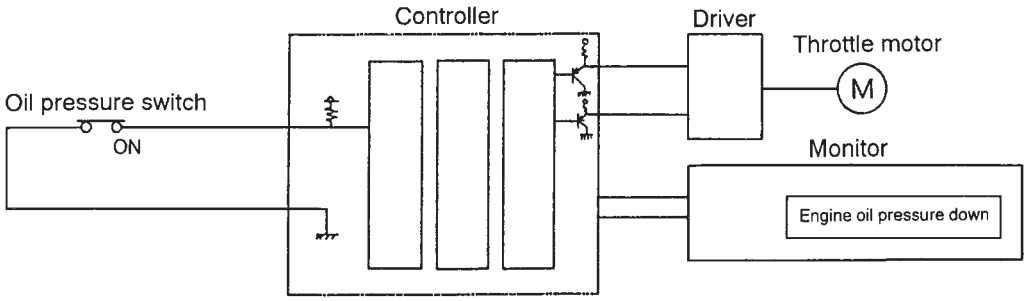


Check the throttle link position first if the above is displayed. Refer to throttle link installation procedures.

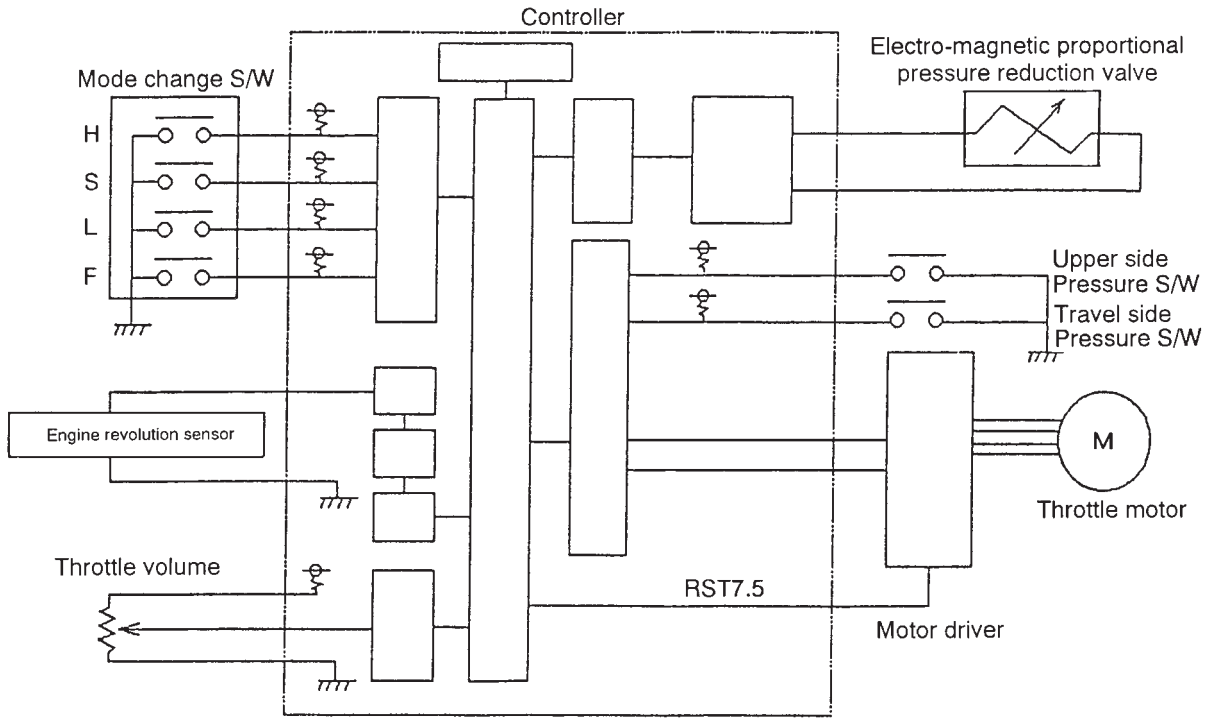
Engine Reverse Rotation Prevention

If the engine goes into a reverse rotation, this feature will stop the engine in order to protect it and the hydraulic circuit.

When the engine changes to reverse rotation from forward rotation, the engine oil pressure decreases. Twelve seconds after the engine has been started, the pressure switch turns on for 3 seconds and the throttle motor is moved to the engine stop position.



Schematic



* Current is sent to electromagnetic proportional pressure reducing valve of the pump in each mode to control pump flow rate.

* In the H mode, engine RPM is raised and current value is variable between Imax and Imin. This utilises maximum output of the engine.

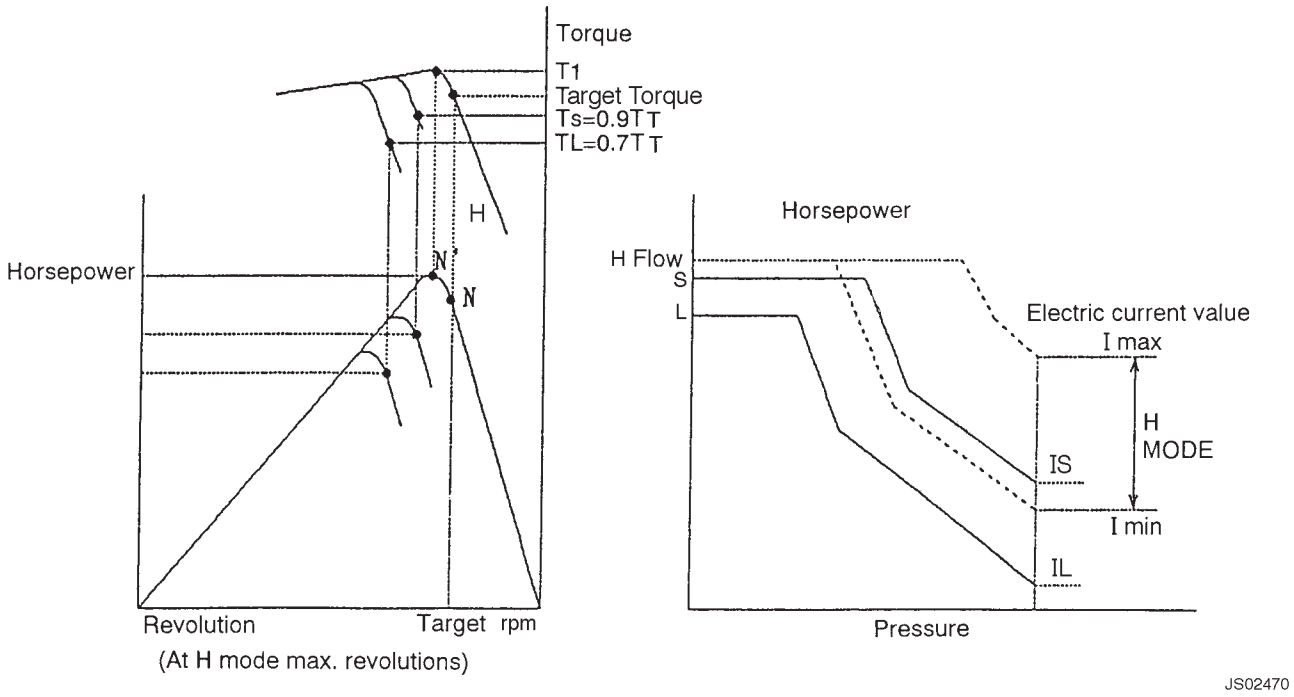
* The S,L, and F modes have fixed current values.

* Current value of each mode

*

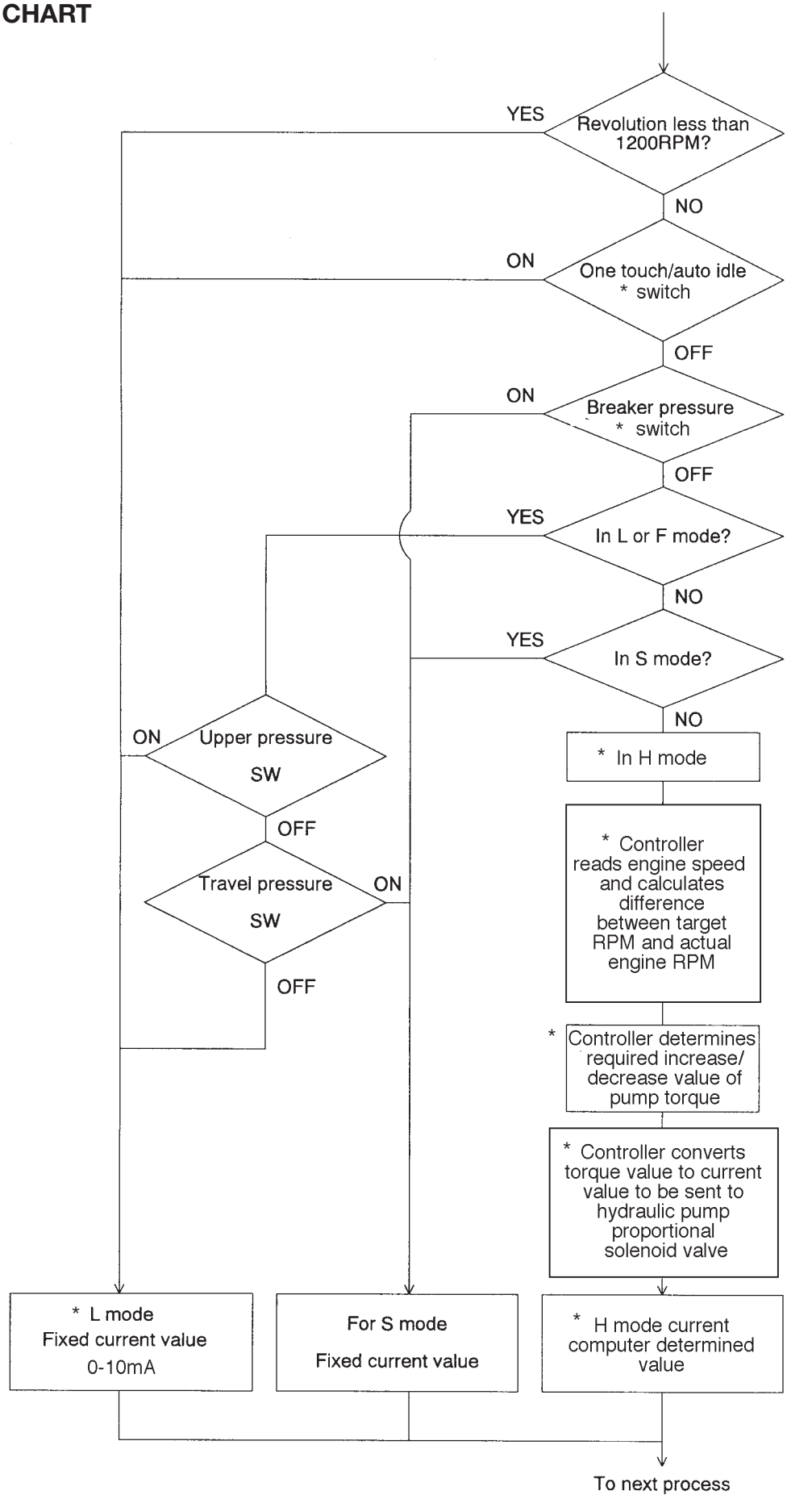
Mode / Machine Type	H		S	L	F
	Imax	Imin	IS	IL	IF
JS200	495 mA	300 mA	305 ± 20 mA	0 + 10 mA	0 + 10 mA
JS240	520 mA	325 mA	330 ± 20 mA	0 + 10 mA	0 + 10 mA

Schematic *(continued)*



* **S MODE**: Pump torque equals 90% of engine target torque **T**, IS is the constant current value.
* **L MODE**: Pump torque equals 70% of engine target torque **T**, IL is the constant current value. (Same as **F** mode).
* If engine **RPM** is less than 1200 rpm: the current is the same as **L MODE** irrespective of mode selection.
* When **L** or **F MODE** are selected at the same time as travel (upper side pressure **SW OFF**, travel pressure **SW ON**) the current is the same as **S MODE** providing engine speed is greater than 1200 rpm. (Purpose; travel smoothness.)

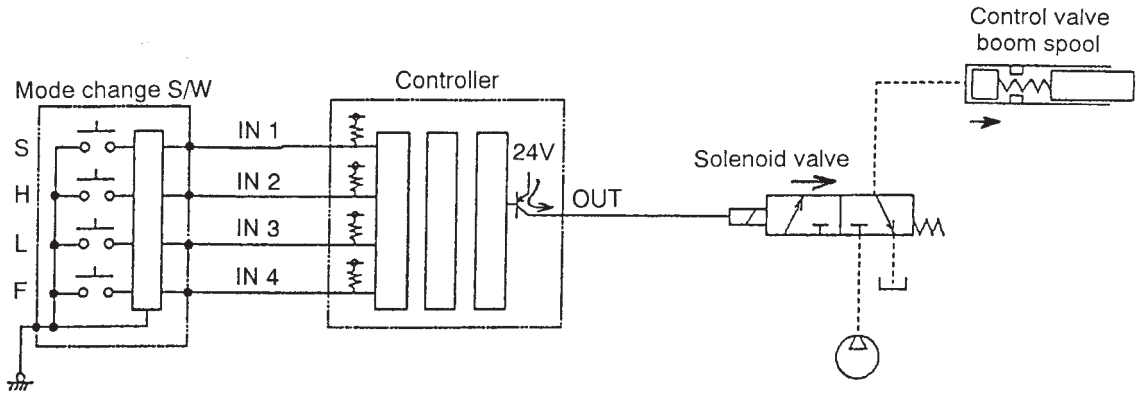
FLOW CHART



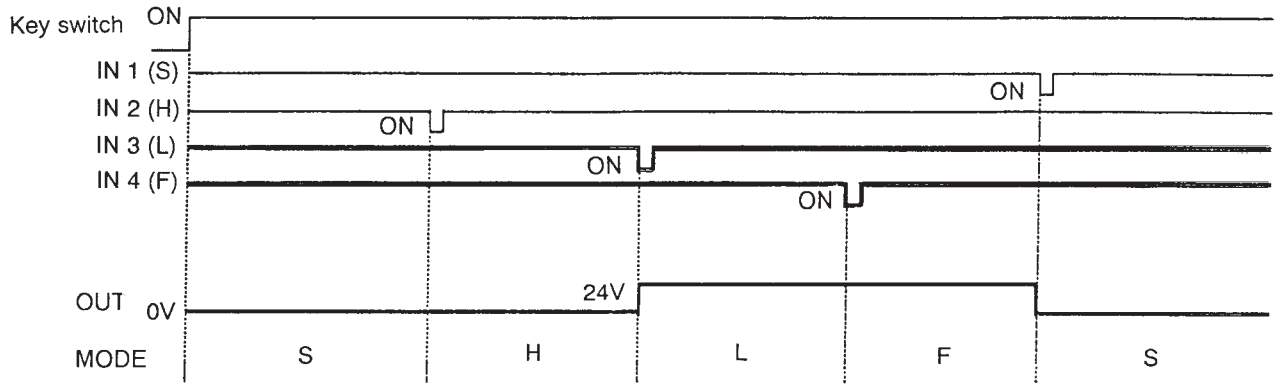
JS02530

Boom Lowering Speed Regulation

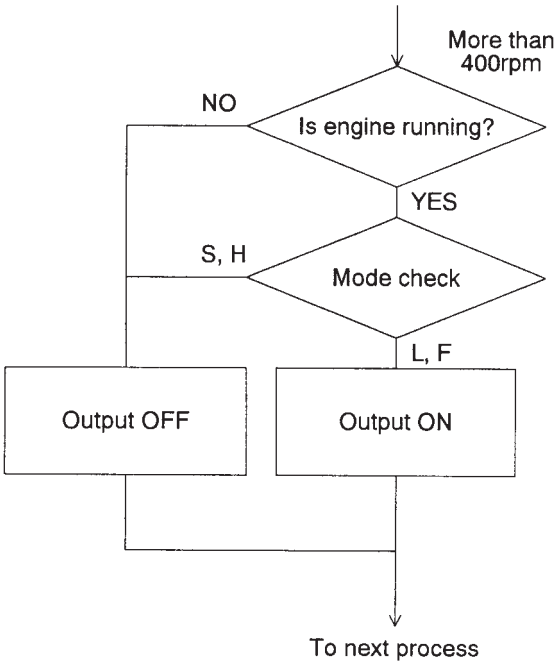
Circuit Diagram



Time Chart



Flow Chart - Boom Lowering Speed Regulation

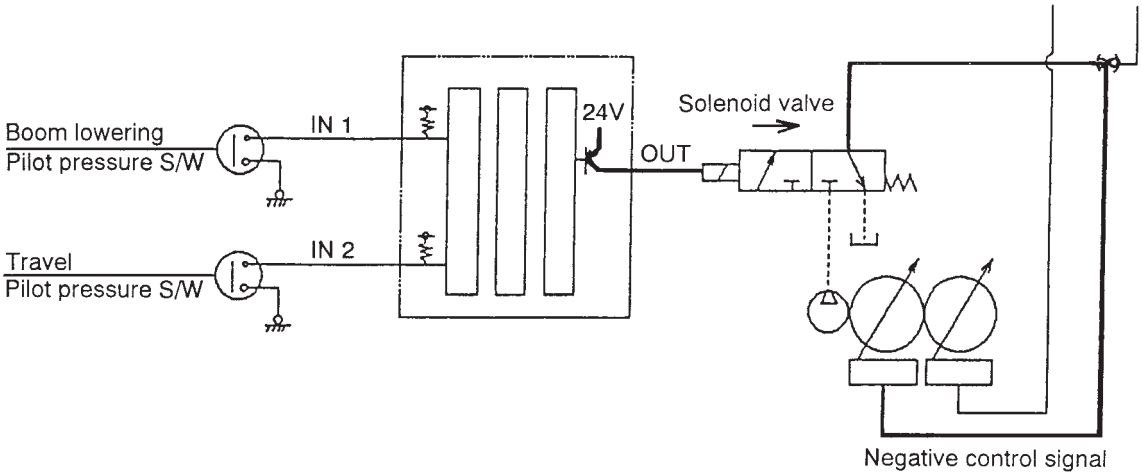


Regulating the speed of the boom lowering procedure is activated only in L, F mode.

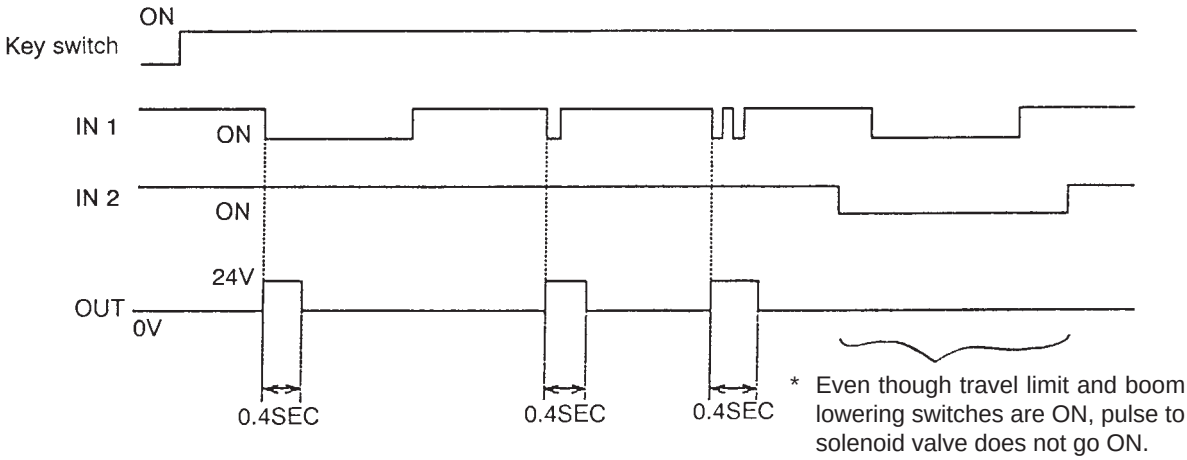
When changing to L, F mode, a transistor in the controller turns **ON**, and switches a solenoid valve.
Pilot pressure is sent on the raising side of the boom spool on the control valve, and the movement of the spool is regulated.

Cushioned Boom Starting

Circuit Diagram



Time Chart

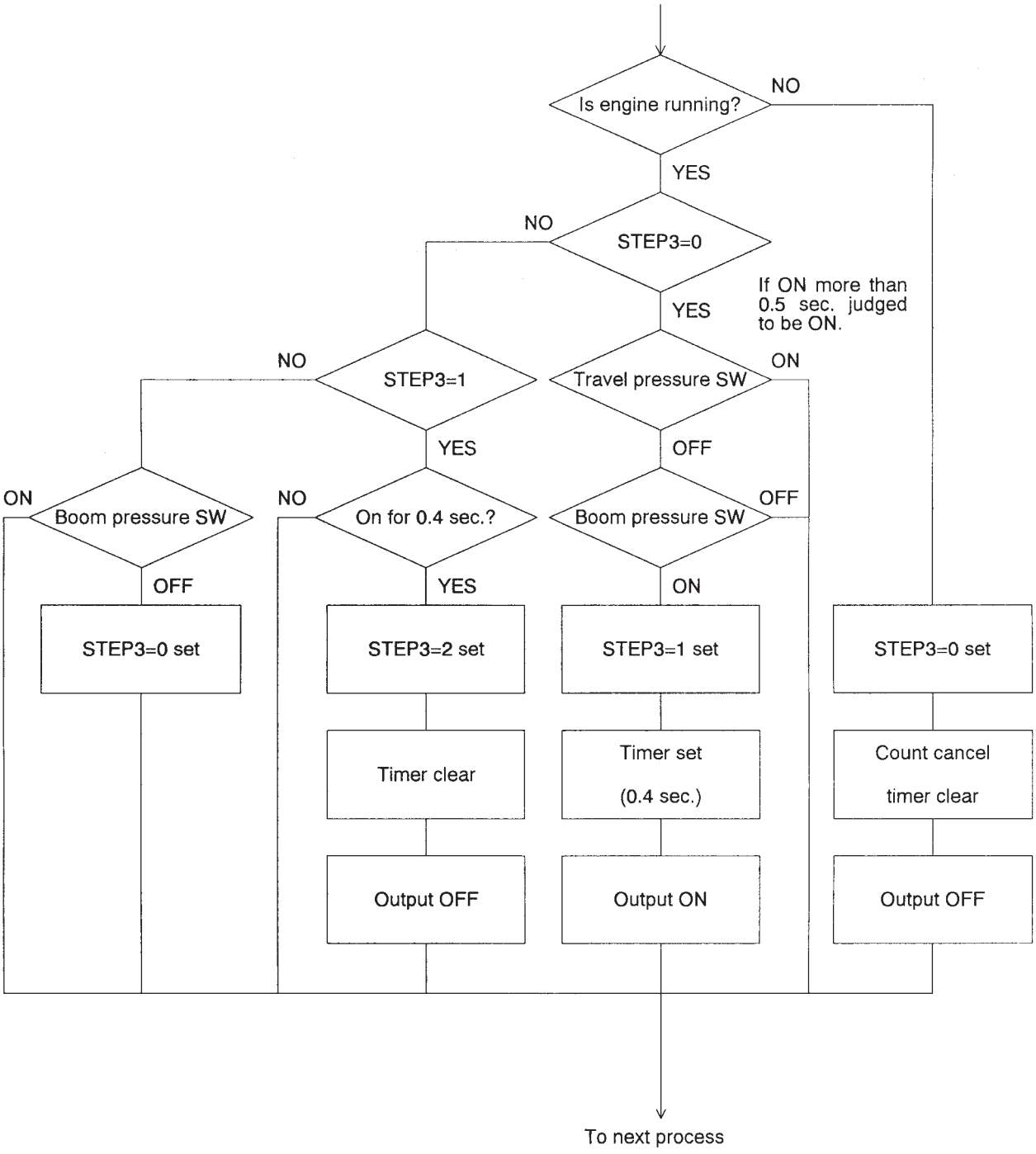


* When the boom lowering pressure switch turns **ON**, the solenoid valve switches on for 0.4 sec, and pilot pressure is sent to the negative control signal port of the pump. This pilot pressure adjusts the pump swashplate angle to temporarily reduce the output flow and thereby initially slow down (cushion start) the boom lowering facility.

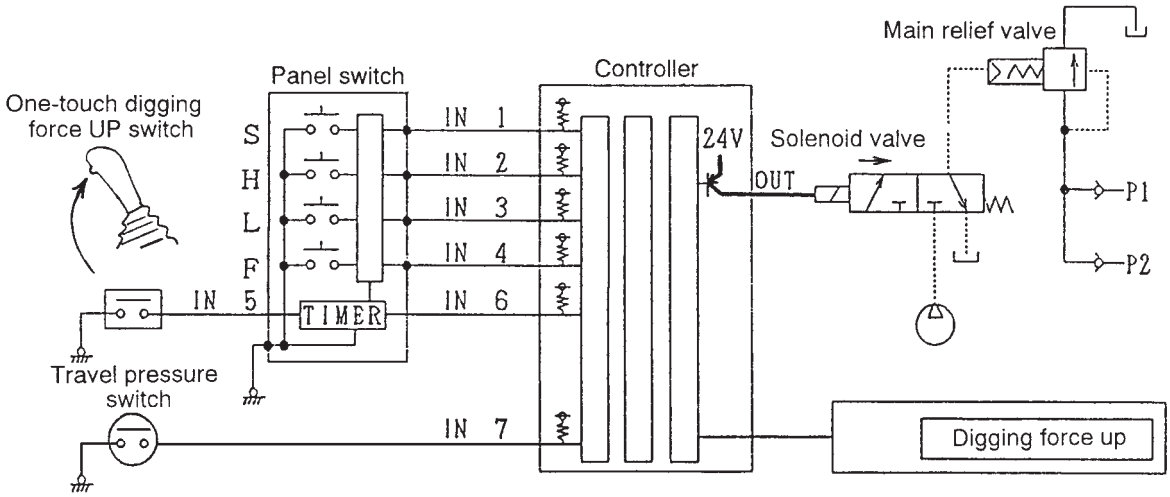
* If travel and boom lowering procedure are initiated together, the boom cushioned start facility is not available, because the travel pilot pressure is monitored to ensure smooth travel.

Cushioned Boom Starting *(continued)*

Flow Chart

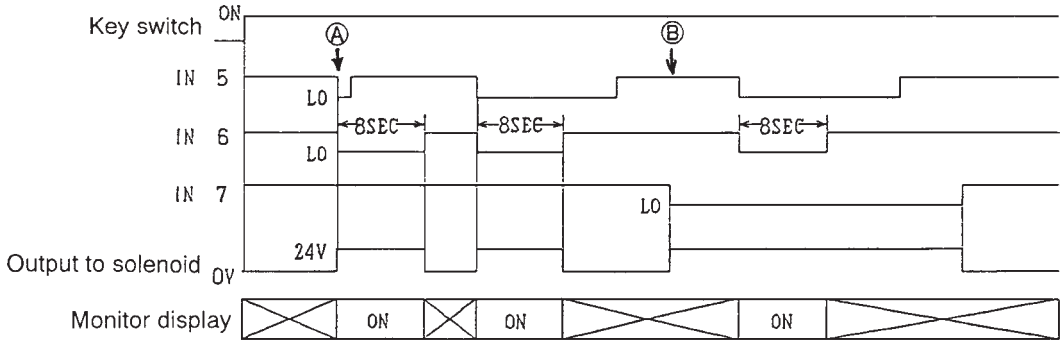


Pressure Increasing System (One-touch digging force UP, Travel power UP)



H • S mode

Time Chart

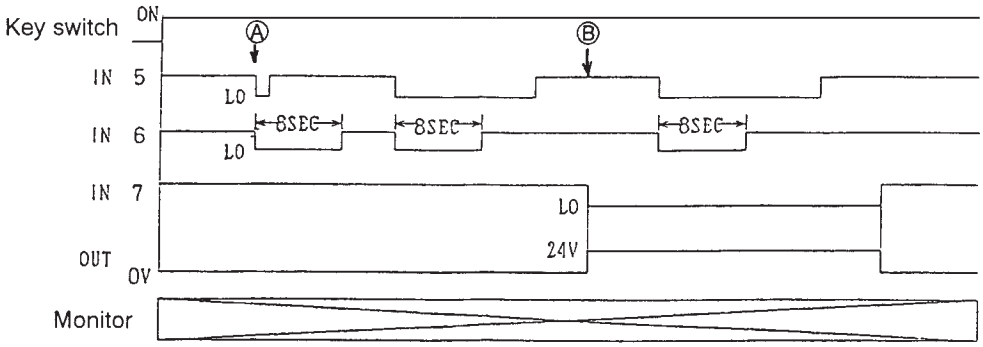


* **A** In only **H** or **S** modes, when the one-touch digging force **UP** switch is turned **ON** (IN5), the signal enters the controller through the timer in the panel switch and remains for 8 sec, 24V is output from the controller to the now activated solenoid valve. Pilot pressure enters the main relief valve, and pressure setting increases. IN6 switches for 8 seconds after one-touch digging force **UP** switch is turned **ON**. 'One-touch digging force **UP** is displayed on the monitor at the same time. If the one-touch digging force **UP** switch is pressed for a long period the pressure setting increases only for 8 seconds.

* **B** Always in the **F** mode or when the travel pressure switch is turned on, 24V is output to the solenoid valve and pressure setting increases. It increases while travel pressure switch is **ON** (no timer setting). It is not displayed on the monitor. In turning **ON** the one-touch digging force **UP** switch in this condition, digging force **UP** appears on the monitor for 8 seconds. Though it is in the travel plus an attachment condition (one-touch digging force **UP** switch **OFF**) the pressure setting increases, and the pressure setting of the attachment also increases its pressure.

Pressure Increasing System *(continued)*

L Mode



A Even though the one-touch digging force **UP** switch is pressed, the voltage is not output to the solenoid valve, and a pressure increase is not obtained.

B Pressure raising is performed in **H**, **S** mode when travel pressure switch is **ON**. A pressure increase is obtained in travel plus an attachment function.

F Mode

When **F** mode is set, voltage is output to the solenoid valve regardless of one-touch digging force **UP**, and results in pressure raising condition.

Result

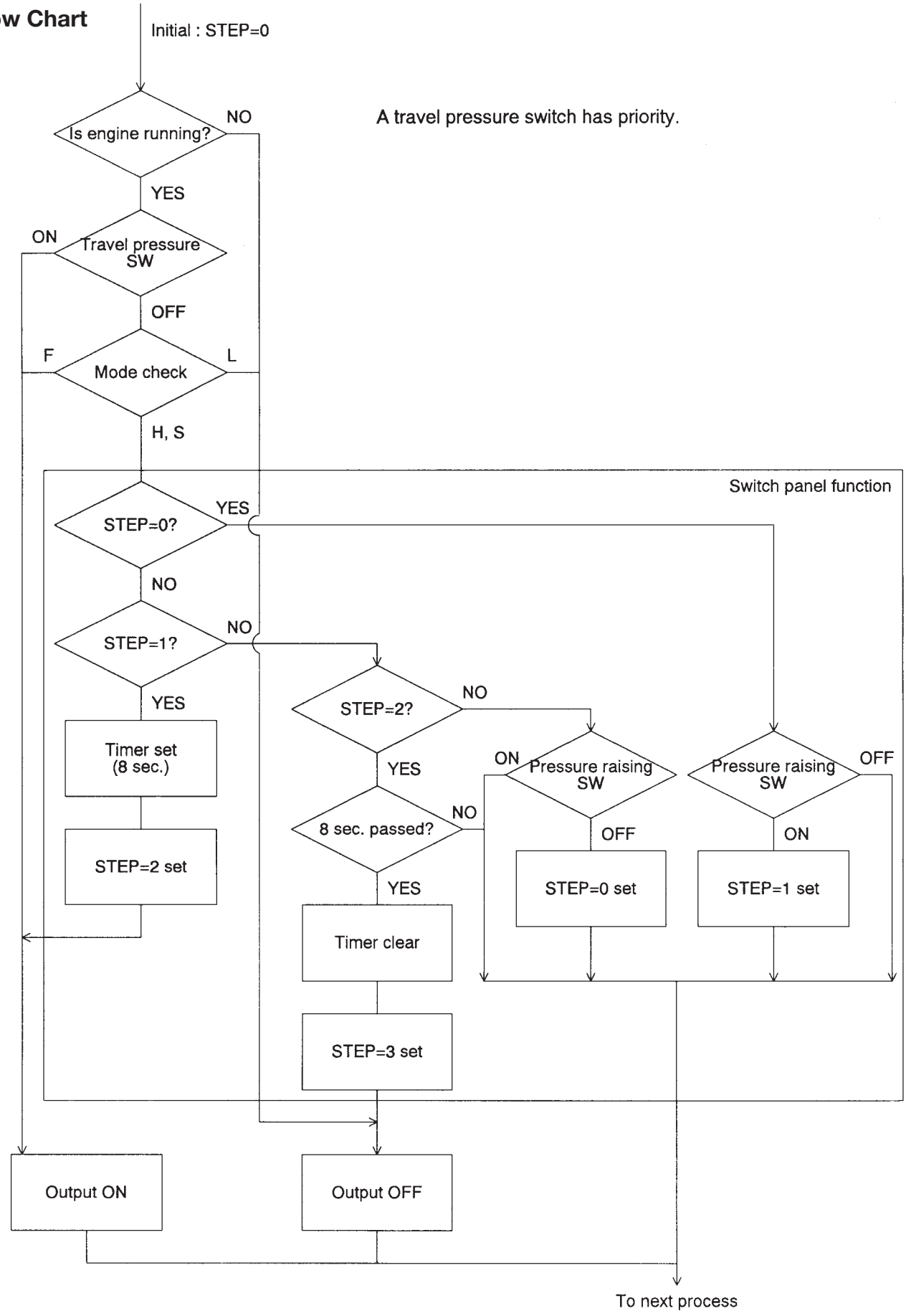
1. A pressure increase is obtained when the travel lever is moved (not displayed on the monitor).

2. There is a pressure increase when travel and an attachment function is called for, even though the digging force **UP** switch is not pressed.

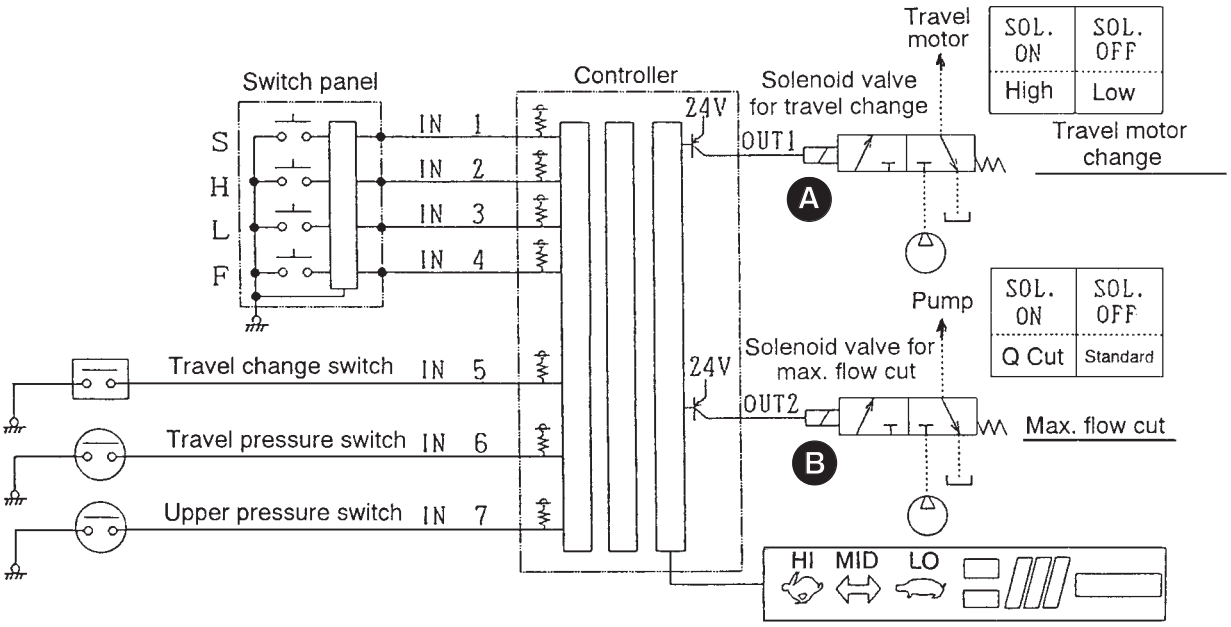
3. **H**,**S**,**F** mode: pressure increases during an attachment function. However, in **H**, **S** mode digging force **UP** switch must be pressed. It is displayed on the monitor. In **F** mode, the pressure will always increase for improvement of lifting work ability. It is not displayed on the monitor.

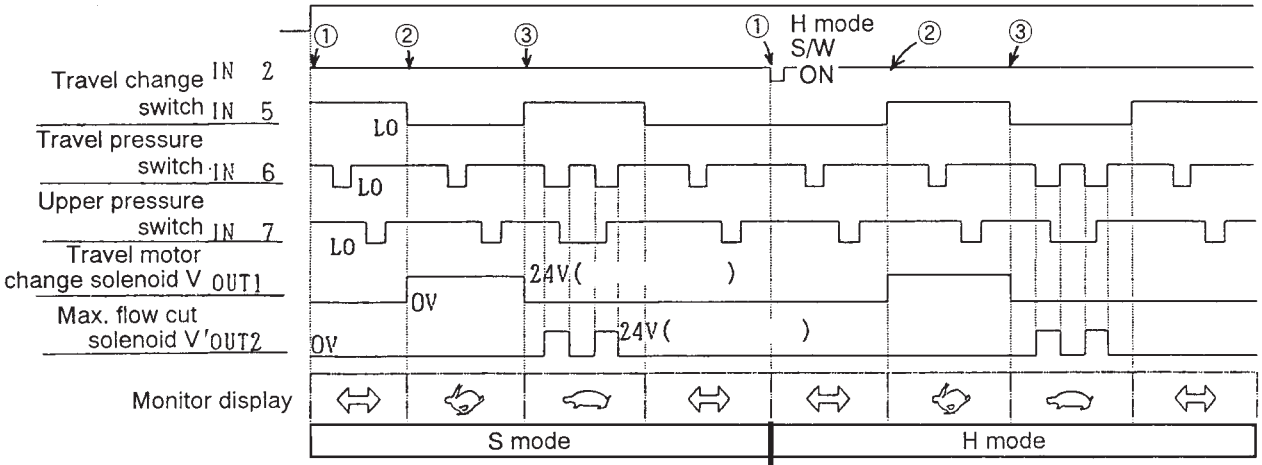
Pressure Increasing System *(continued)*

Flow Chart



3-Speed Travel and Max. Flow (Q) Cut



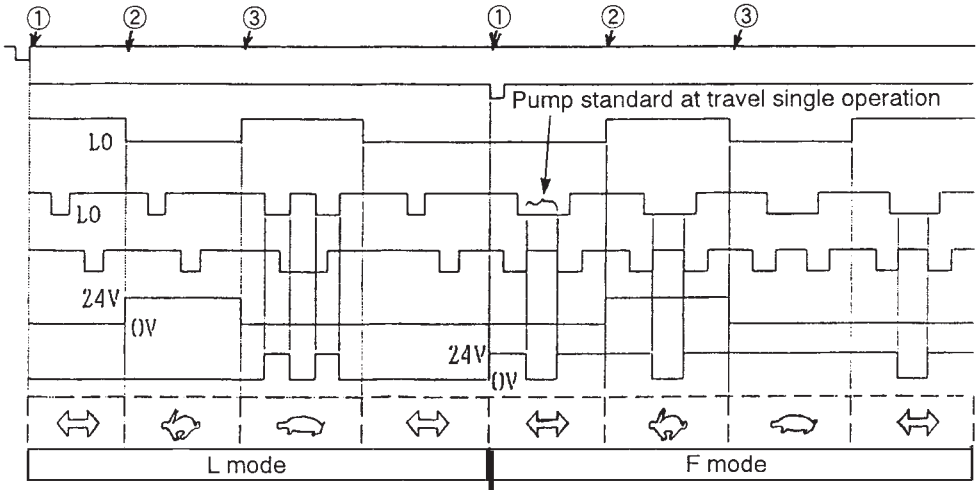


1. **Travelling at middle speed** (always middle speed as the key is switched **ON**).
   Even though travel and upper pressure switches are ON, there is no output to solenoid valves **A** and **B**.
   Travel motor swash plate is in low speed position.
   Pump: Standard flow.
2. **Travelling at high speed** (pressing IN5 switch once when travelling at middle speed, shifts to high speed.)
   The travel motor switching solenoid valve turns ON and swash plate of the motor shifts to high speed position.
3. **Travelling at low speed** (pressing IN5 switch once when travelling at high speed, shifts to low speed.)
   When a travel pressure switch is switched, the max. flow cut solenoid valve turns ON and flow (Q) is cut. Swash plate of the motor shifts to low speed position.
   Pump flow is cut.
   When upper pressure switch is turned on, max. flow rate cut solenoid valve is de-energised to prevent excavator circuits being slowed

1. **At middle speed travel**
   Travel motor swash plate: low side
   Pump: Standard
2. **At high speed travel**
   Travel motor swash plate: Upper side
3. **At low speed travel**
   Pump: Q cut

Same as in S mode.

3-Speed Travel and Max. Flow Cut *(continued)*



1. **At middle speed travel**
   Travel motor swash plate: low side
   Pump: Standard
2. **At high speed travel**
   Travel motor swash plate: Upper side
3. **At low speed travel**
   Pump: Q cut

Q cut is done by **F** mode using the **ON** signal of upper pressure S/W for the first time.

1. **At middle speed travel**
   - Travel only operation → Travel motor swash plate: Low side; Pump: Standard
   - Upper only operation → Pump: Q cut
   - Travel + upper combined → Travel motor swash plate: Low side; Pump: Q cut
2. **At high speed travel**
   - Travel only operation → Travel motor swash plate: Upper side; Pump: Standard
   - Upper only operation → Pump: Q cut
   - Travel + upper combined → Pump: Q cut
3. **At high speed travel**
   - Travel only operation → Travel motor swash plate: Low side; Pump: Standard
   - Upper only operation → Pump: Q cut
   - Travel + upper combined → Travel motor swash plate: Low side; Pump: Q cut

3-Speed Travel and Max. Flow (Q) Cut *(continued)*

Relation of Travel Mode and Motor Swash Plate, Pump Quantity Cut

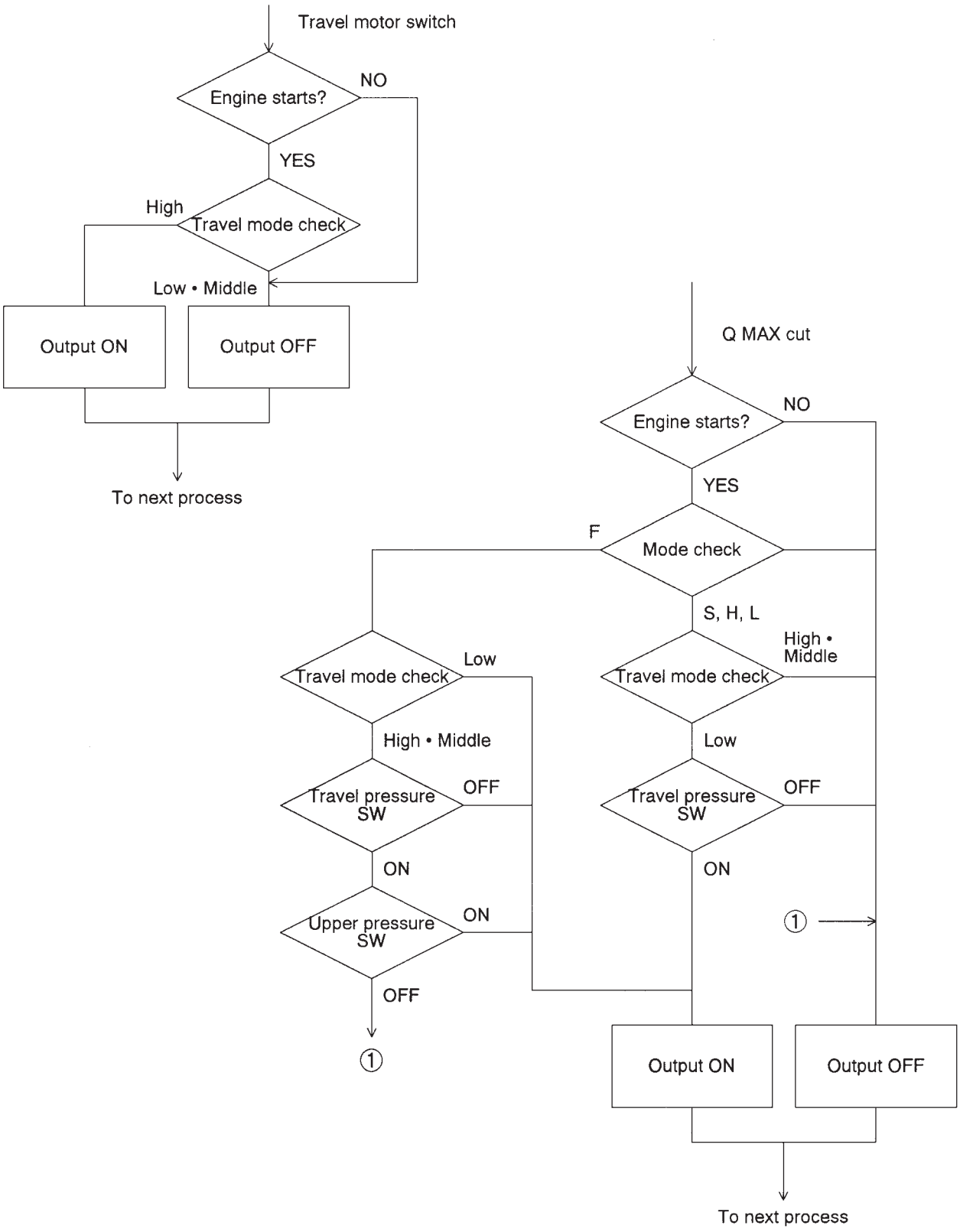
	High Speed	Middle Speed	Low Speed
Travel motor	Upper side	Low side	Low side
Pump output quantity	Standard	Standard	Q cut

Relation of Travel Mode and Motor Swash Plate, Pump flow (Q) Cut

Work mode is independent.
However, since **MAX**. rotation changes by the working mode, the travel speed changes by travel mode, and working mode.

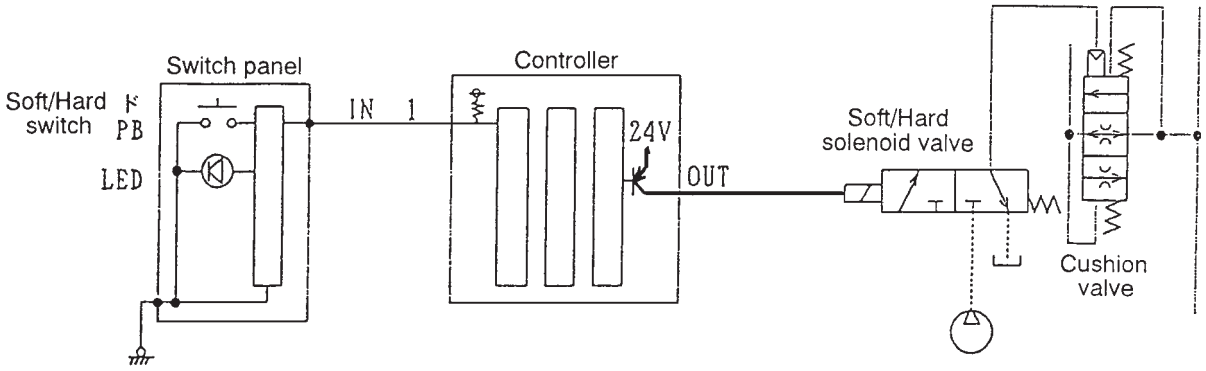
3-Speed Travel and Max. Flow Cut *(continued)*

Flow Chart

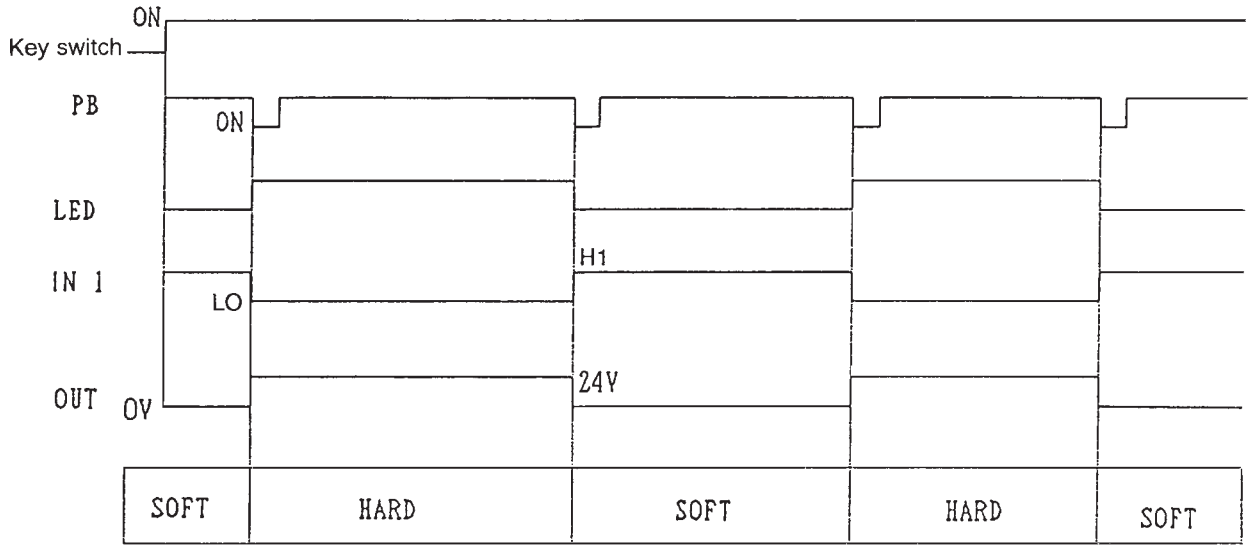


Cushion (Soft/Hard) Switch

Circuit Diagram



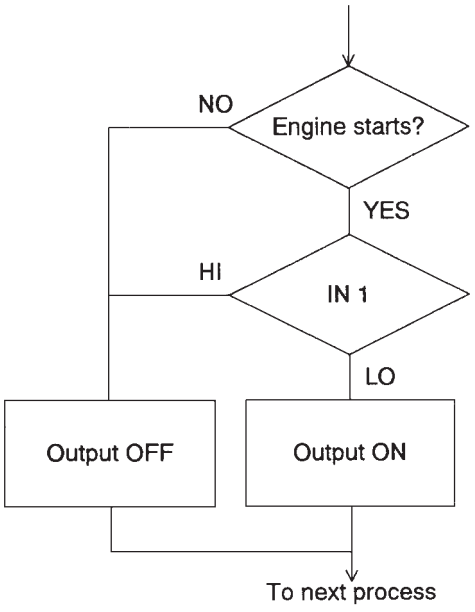
Time Chart



Flow Chart - Cushion (Soft/Hard) Switch

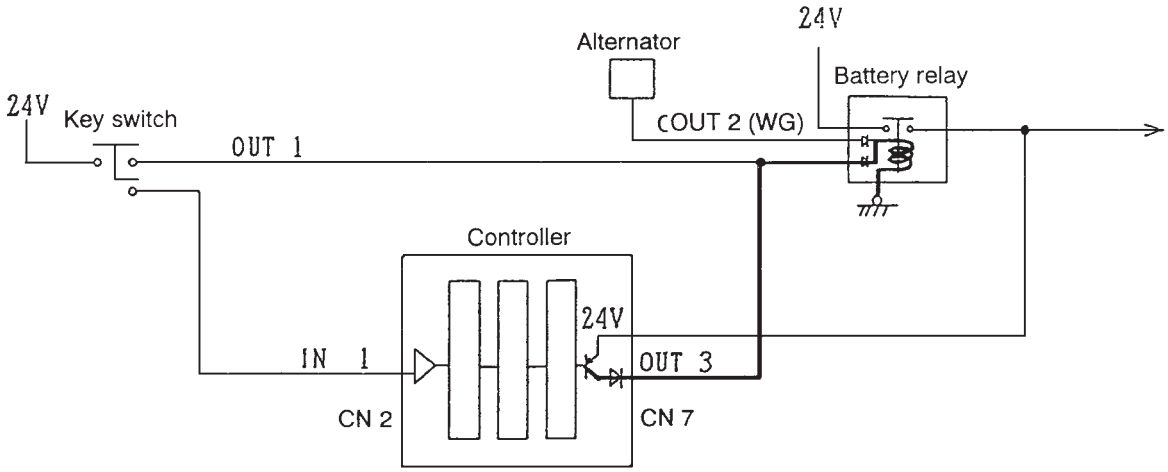
Output to the soft/hard solenoid valve is **OFF** when key switch is **ON**. This is its SOFT status

After the engine is started, the signal received from the panel switch is altered. The signal of IN1 turns to LO, and 24V is output to the solenoid valve from the controller. When the solenoid valve switches, the hard condition exists.

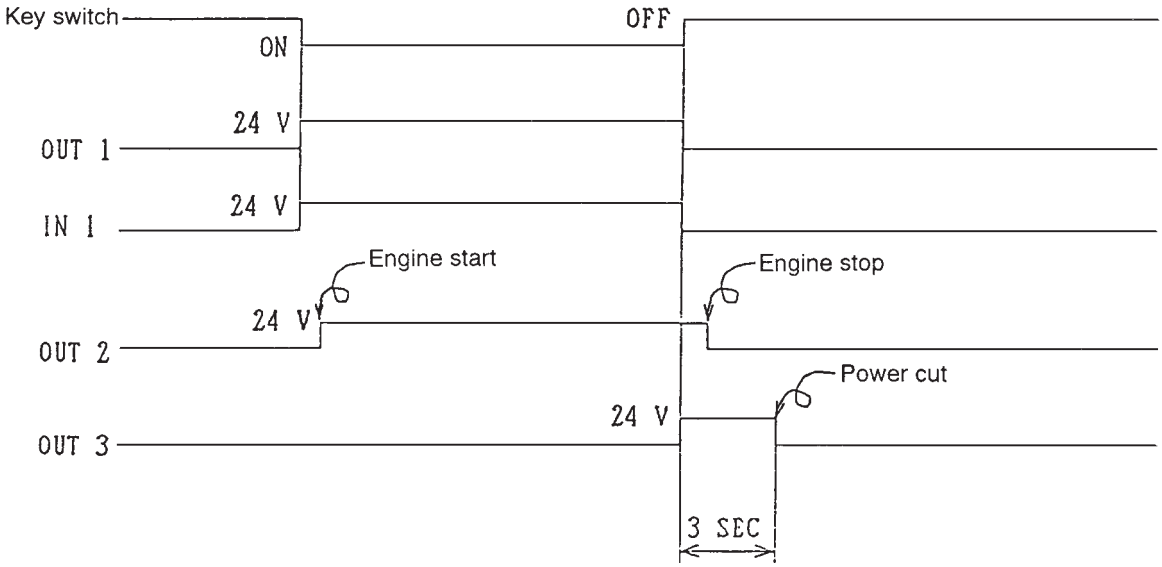


Power Supply Cut Delay

Circuit Diagram



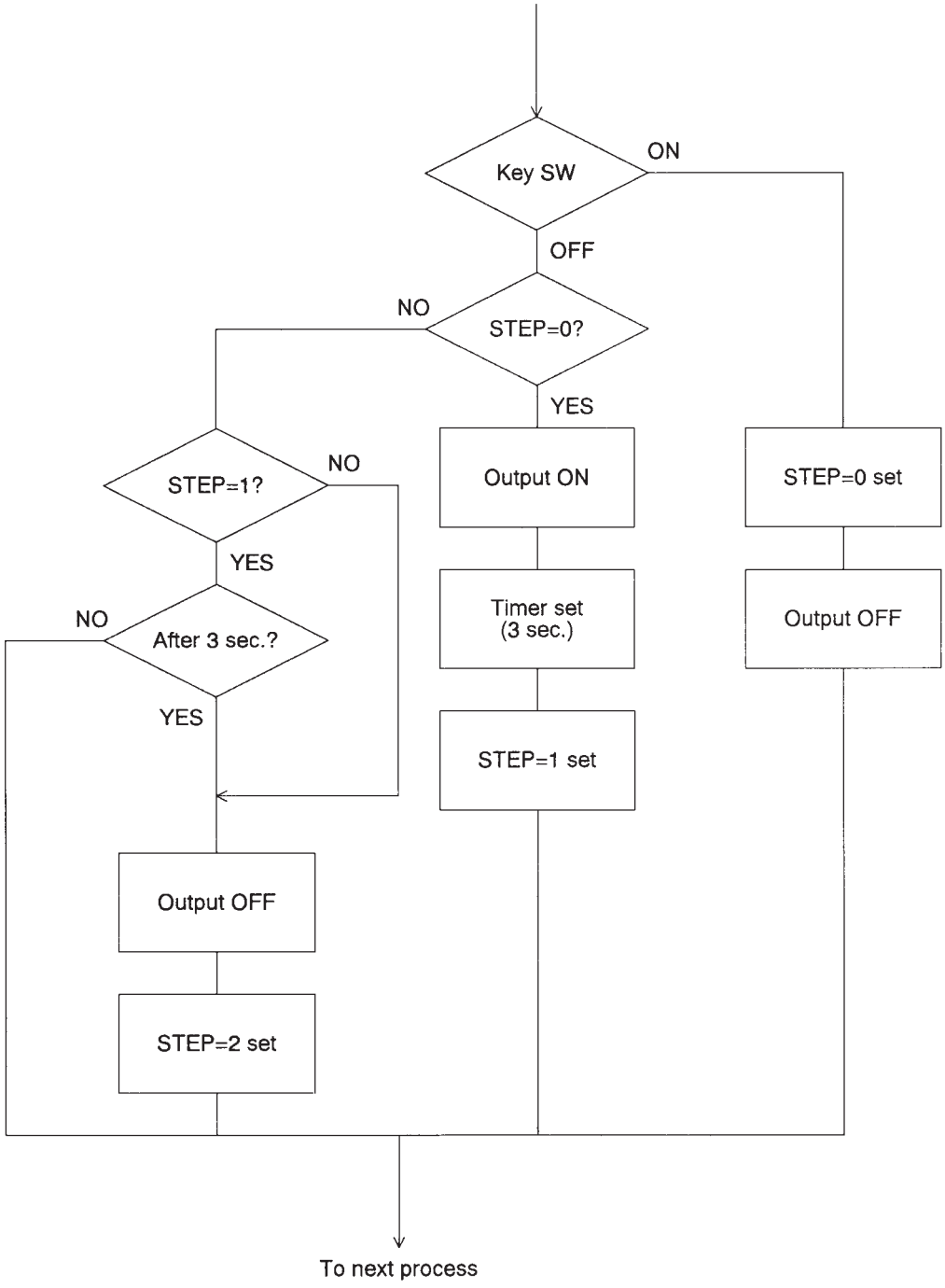
Time Chart



When the signal (IN1) from the key switch is turned **OFF**, 24V from OUT 3 is output from the controller for 3 seconds. After 3 seconds the output of OUT 3 stops, and power to the coil from the electric battery relay is cut, contacts on the electric battery relay break, and the power supply is cut.

Power Supply Cut Delay

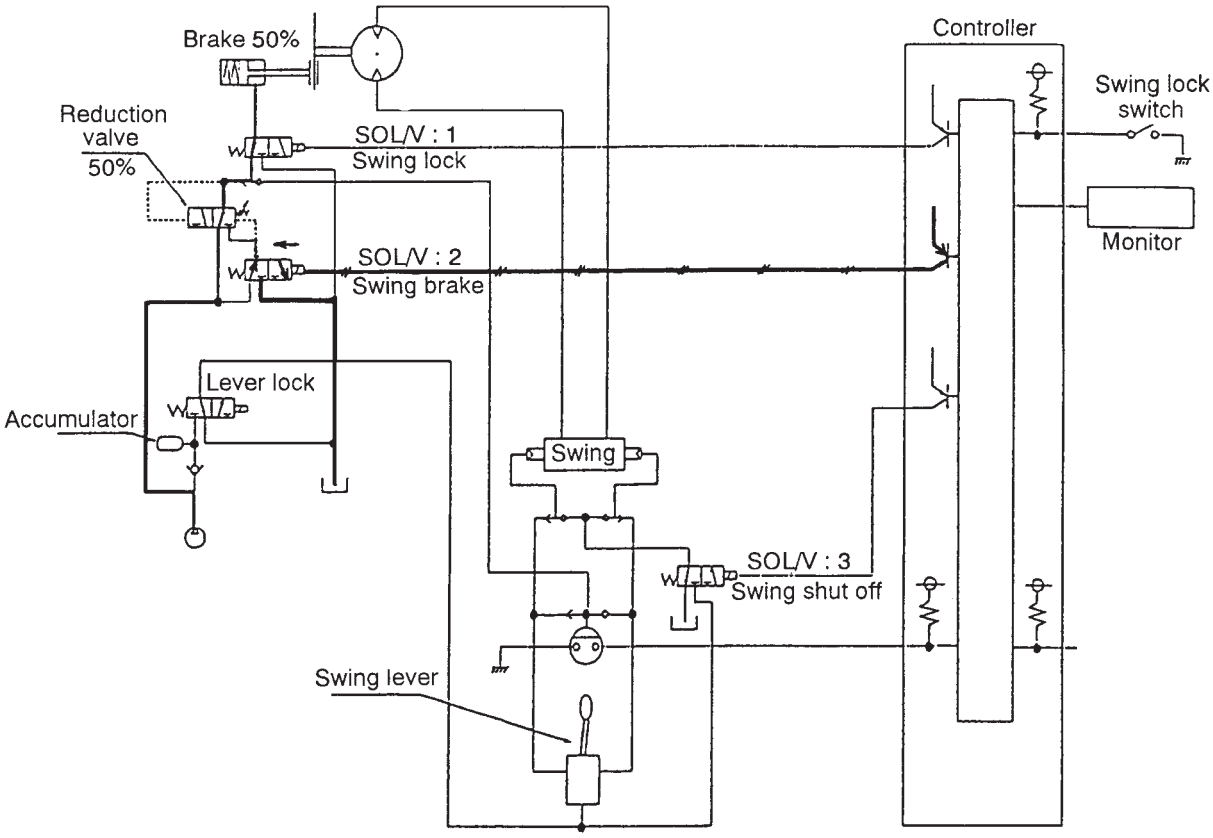
Flow Chart



Swing Brake/Swing Lock

(1) Swing Brake

1) Engine is running and swing lever is in neutral (50% brake).

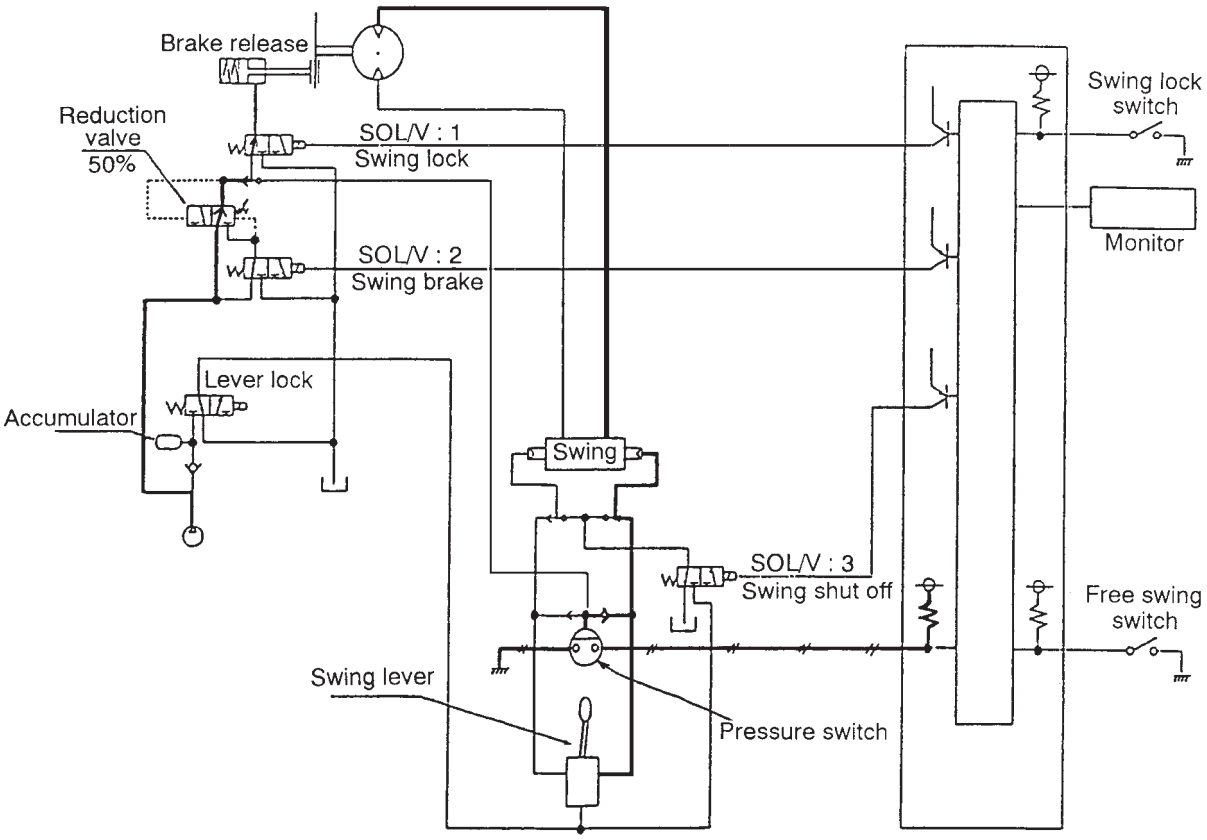


Swing lever	Swing lock SW	SOL:1 100% lock	SOL: 2 50% brake	SOL: 3 Shut off	Monitor (Ⓟ)
OFF	OFF	OFF	**ON**	OFF	

24V is output to the swing brake solenoid valve (SOL:2), the pilot pressure which ran through the pressure reducing valve enters the swing motor, and operates with a braking force of 50%.

Swing Brake/Swing Lock *(continued)*

2) Engine is running and swing lever operation (brake release)



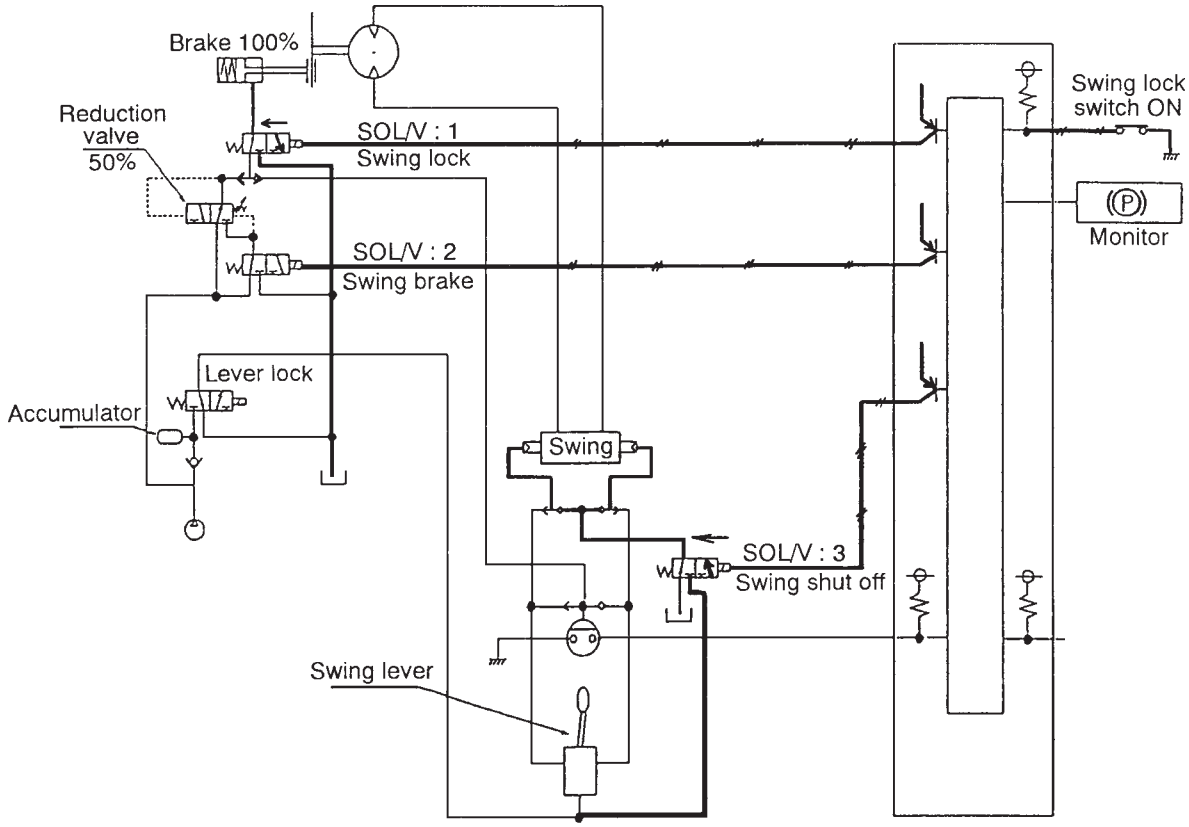
	Swing lever	Swing lock SW	SOL:1 100% lock	SOL: 2 50% brake	SOL: 3 Shut off	Monitor (Ⓟ)
	OFF ↓	OFF	OFF	**ON** ↓	OFF	
a.	**ON** ↓	OFF	OFF	OFF ↓	OFF	
b.	OFF ↓	OFF ↓	OFF	5 sec. after lever in neutral **ON**	OFF ↓	

a. In operating the swing lever, the signal of the pressure switch enters the controller, and the output to the swing brake solenoid valve (SOL: 2) is turned **OFF**. Pilot pressure enters directly, and the brake is fully released.

b. In returning the swing lever to neutral, the signal of the pressure switch goes **OFF**. The computer then outputs 24V on the swing brake solenoid valve (SOL: 2) and after the 5 seconds delay the brake operates at 50%.

Swing Brake Swing Lock *(continued)*

(2) Swing Lock (Swing Lock Switch ON, 100% Brake)



Swing lever	Swing lock SW	SOL:1 100% lock	SOL: 2 50% brake	SOL: 3 Shut off	Monitor (Ⓟ)
OFF	**ON**	5 sec. after lever in neutral **ON**	**ON**	**ON**	**(Ⓟ)**

When the swing lock switch is turned on

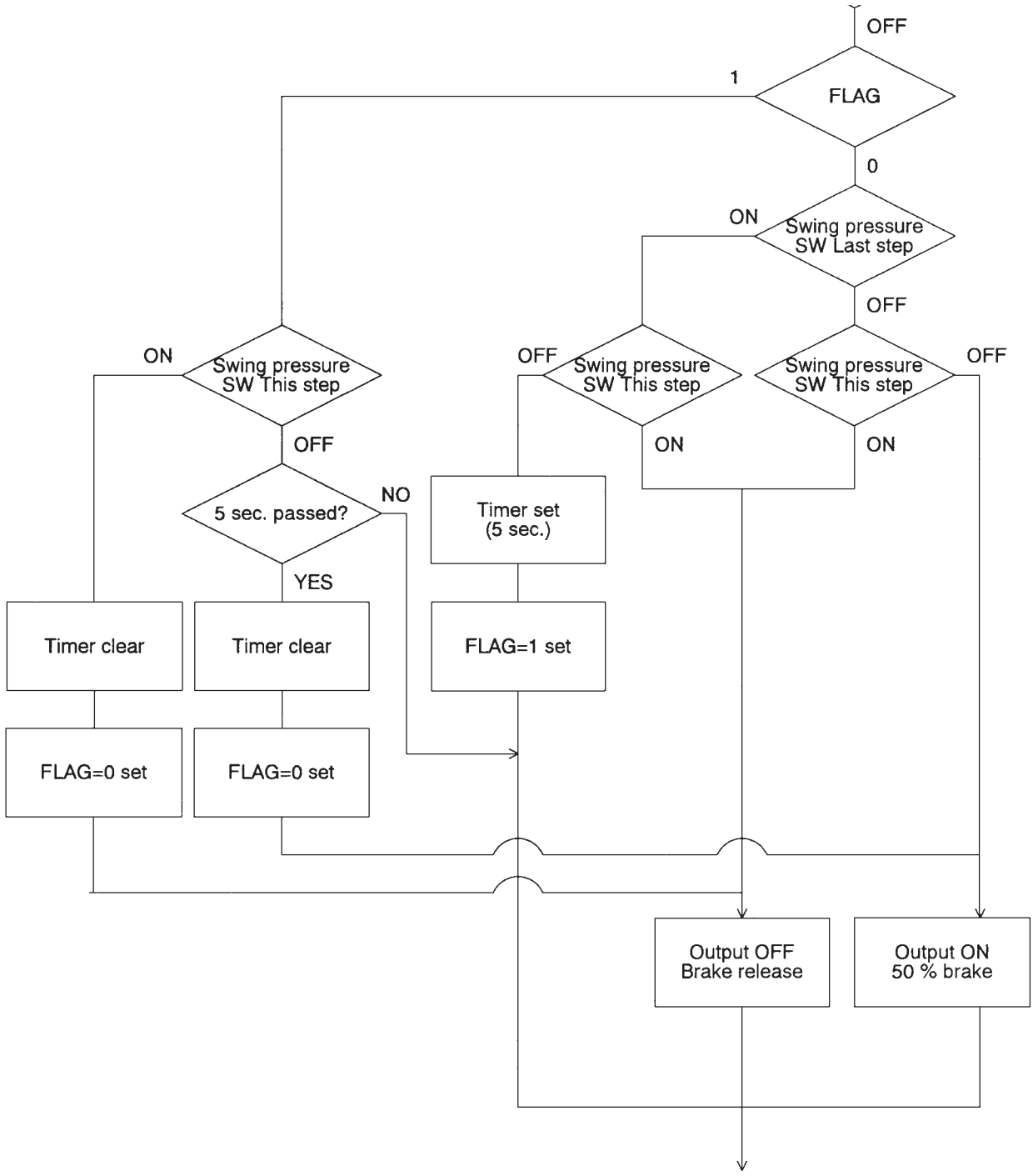
a. 24 V is output to the swing shut off solenoid (SOL:3) and the solenoid valve shifts. Pilot pressure enters both ends of the swing section of the control valve, and the pilot pressure is then shut off instantly (spool of control V does not move).

b. After 5 seconds, 24V is output to the swing lock solenoid valve (SOL: 1) and the solenoid valve shifts. Oil within the brake piston of the motor flows to the tank. The brake locks by torque at 100%.

c. Also 24V is output on the swing brake solenoid valve (SOL; 2) and the solenoid valve shifts.

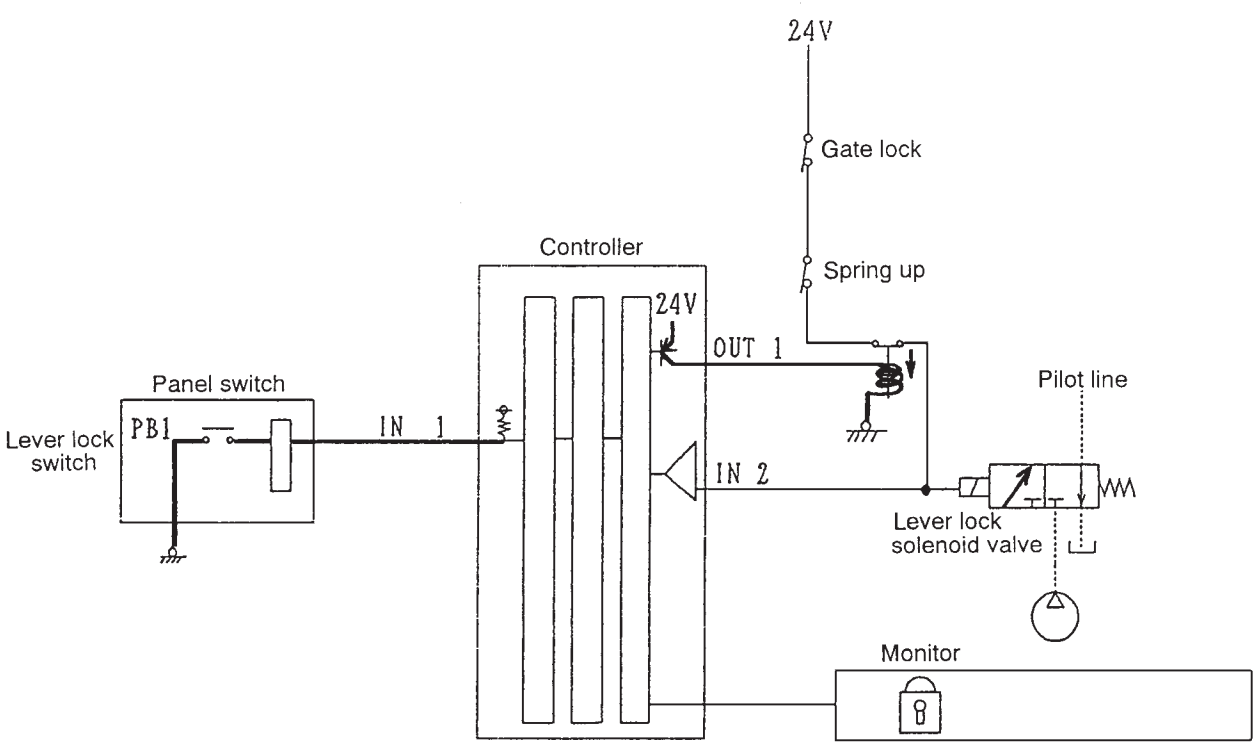
Swing brake/Swing lock *(continued)*

Flow Chart

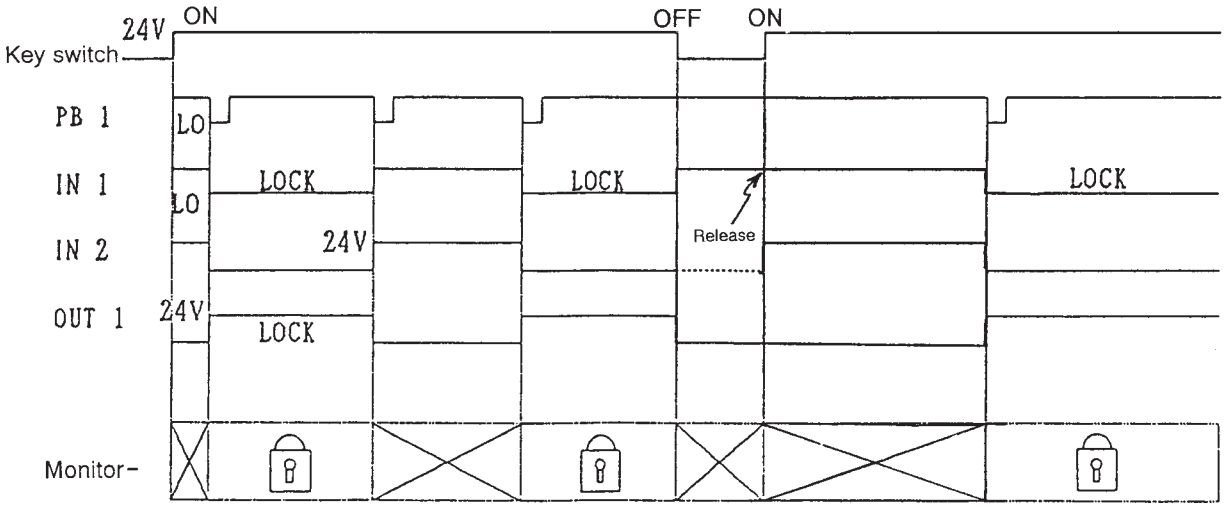


Lever Lock

Circuit Diagram

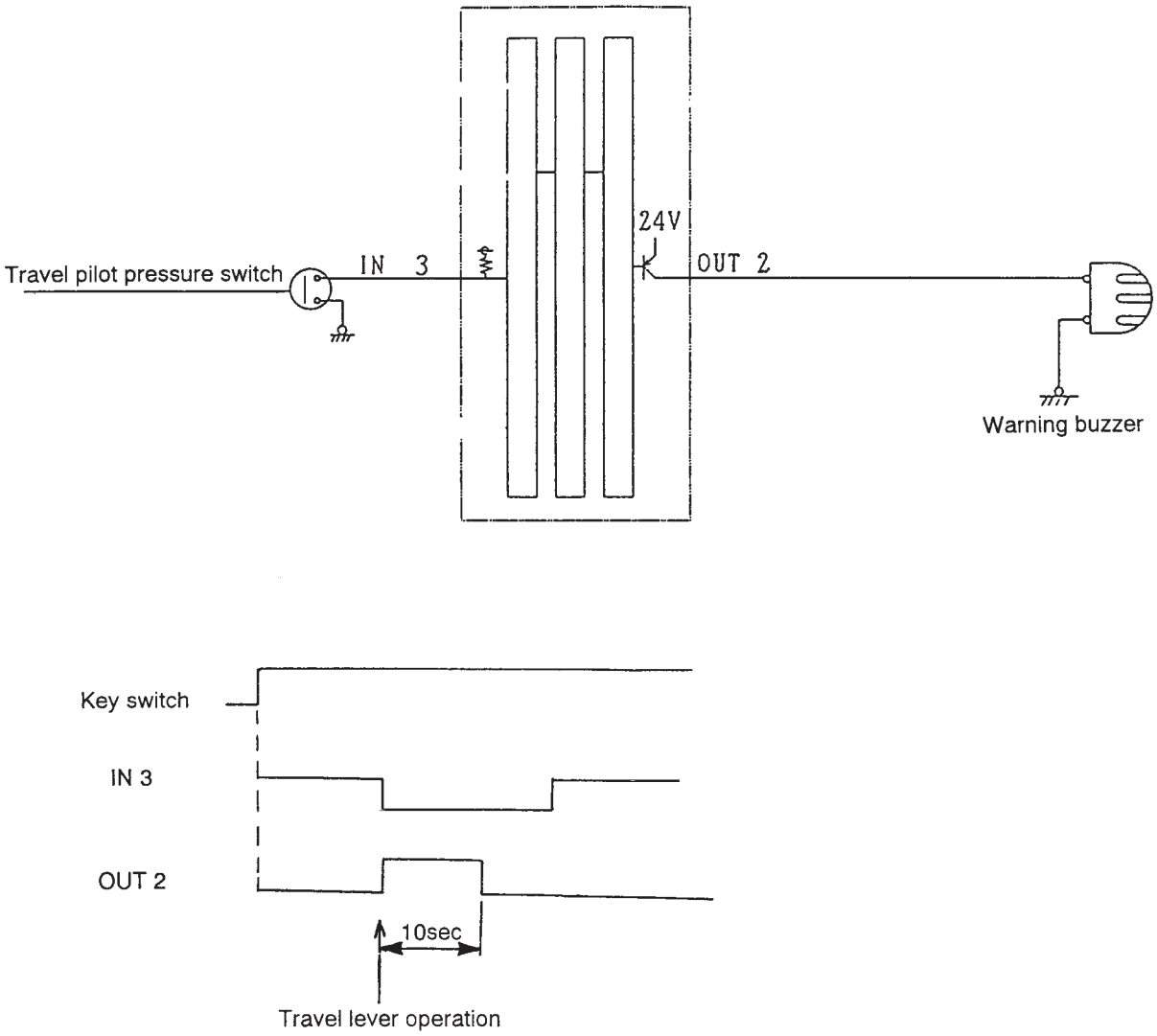


Time Chart



Travel Warning

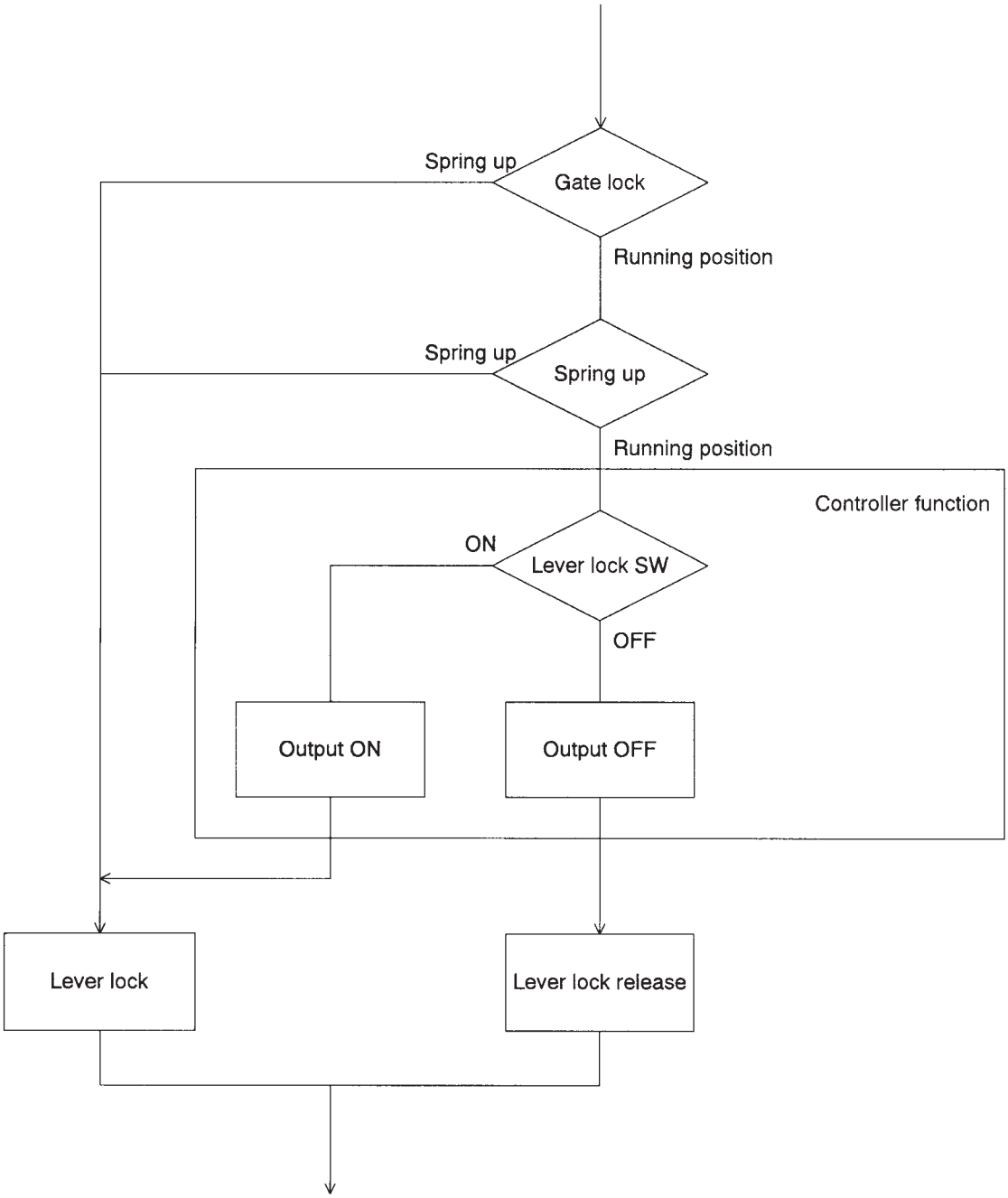
Circuit Diagram



A travel pilot pressure switch is turned **ON** by travel lever operation and 24V is output for 10 seconds to the buzzer.

Lever Lock *(continued)*

Flow Chart



Power Transistor Protection

Controller

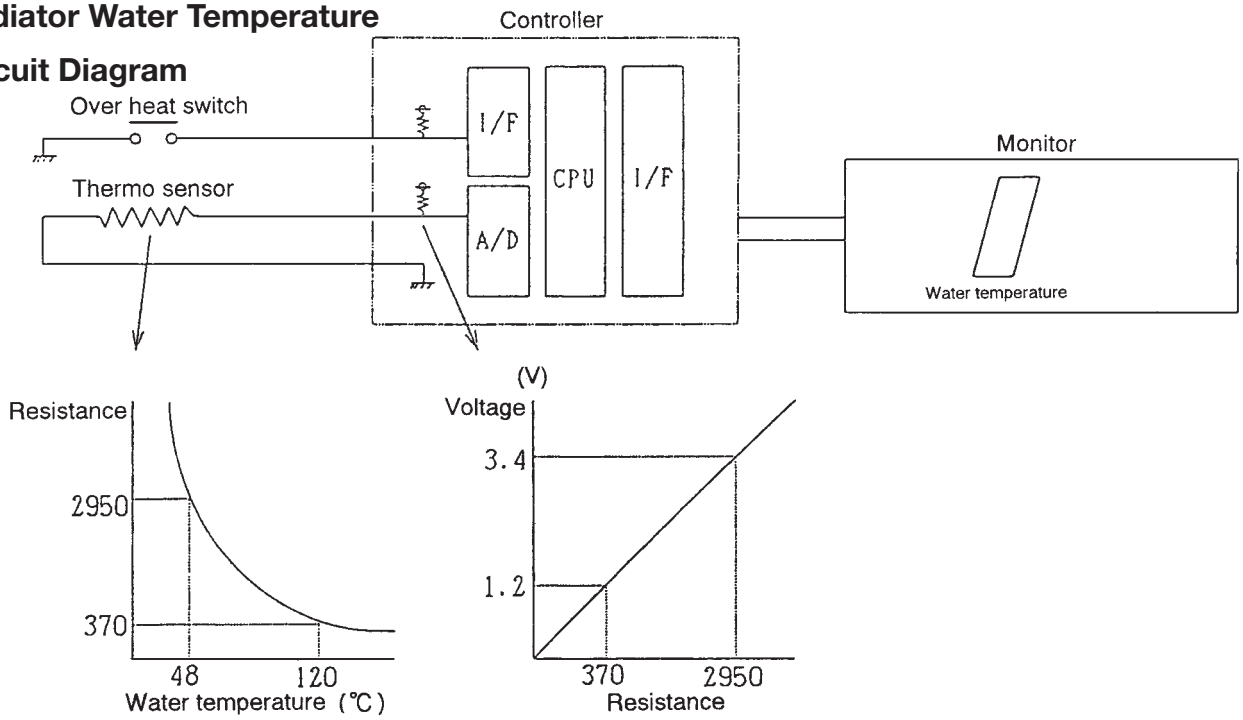
Position	
8	Spare
7	Spare
6	Spare
5	Swing shut off solenoid V
4	Lever lock solenoid V
3	Travel alarm
2	Pressure raising solenoid V
1	Free swing solenoid V
16	Negative control solenoid V
15	Spare
14	Spare
13	Soft/Hard change solenoid V
12	Max. flow cut solenoid V
11	Swing lock solenoid V
10	Warning lamp
9	Boom lowering speed regulation solenoid V
20	Travel 2-speed change solenoid V
19	Swing brake solenoid V
18	Heating relay
17	Battery relay

If a solenoid valve or relay is shorted, it stops the output of a power transistor, in order to protect the controller. 'Electric system abnormality' is indicated at this time in message display. By performing a self check, the position of the abnormality is indicated. Check wiring and components of the relevant circuit.

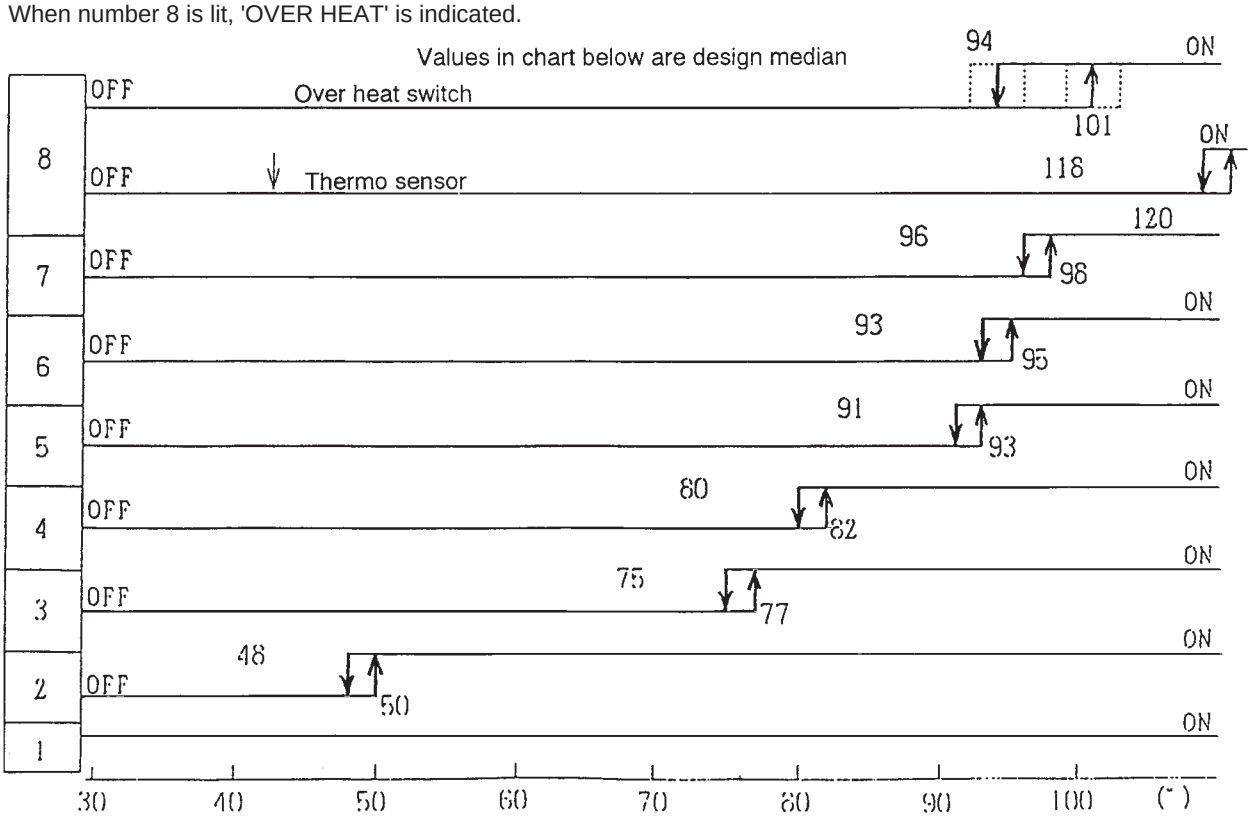
Display Monitor

Radiator Water Temperature

Circuit Diagram



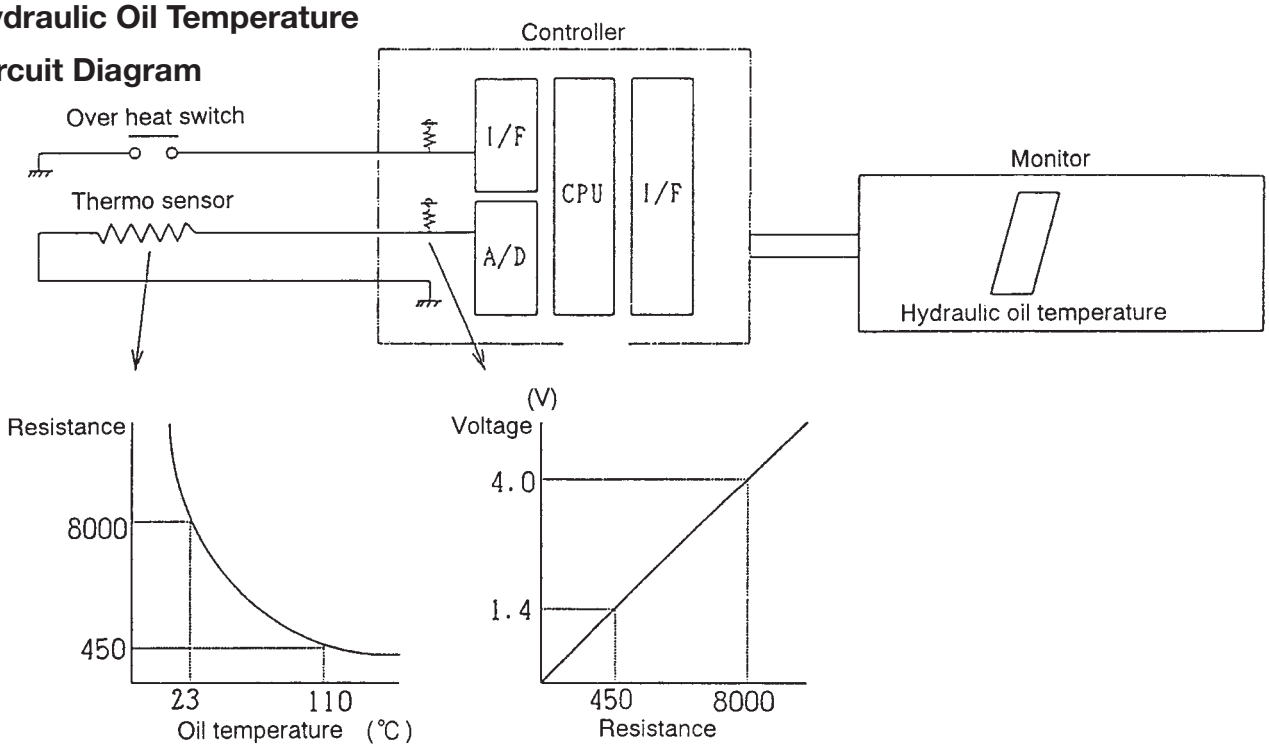
1. Overheat switch position and the **ON** signal of the thermostat sensor are OR processed and number 8 is lit.
2. Overheat switch position and the **OFF** signal of the thermostat sensor are AND processed and number 8 turns off.
3. Number 8 is lit on the condition that numbers 1-7 are lit.
4. When numbers 1-7 are off and the signal for number 8 is transmitted, they light-up in numerical sequence after a 30 second delay.
5. Number 7 is put out on the condition that number 8 is turned out.
6. If the signal to switch off number 7 is transmitted when number 8 is lit, the lights-out signal of the Thermostat sensor must also occur.
7. When number 8 is lit, 'OVER HEAT' is indicated.



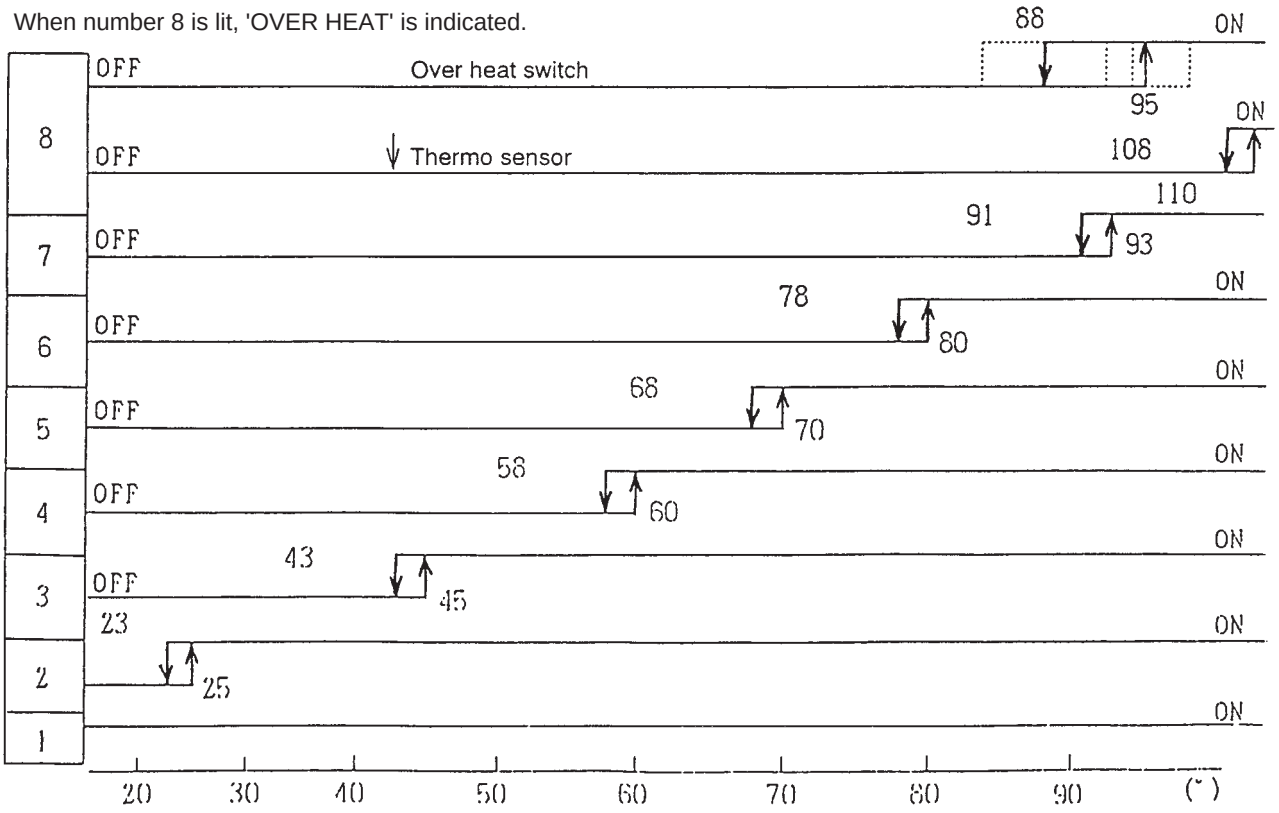
Display Monitor *(continued)*

Hydraulic Oil Temperature

Circuit Diagram



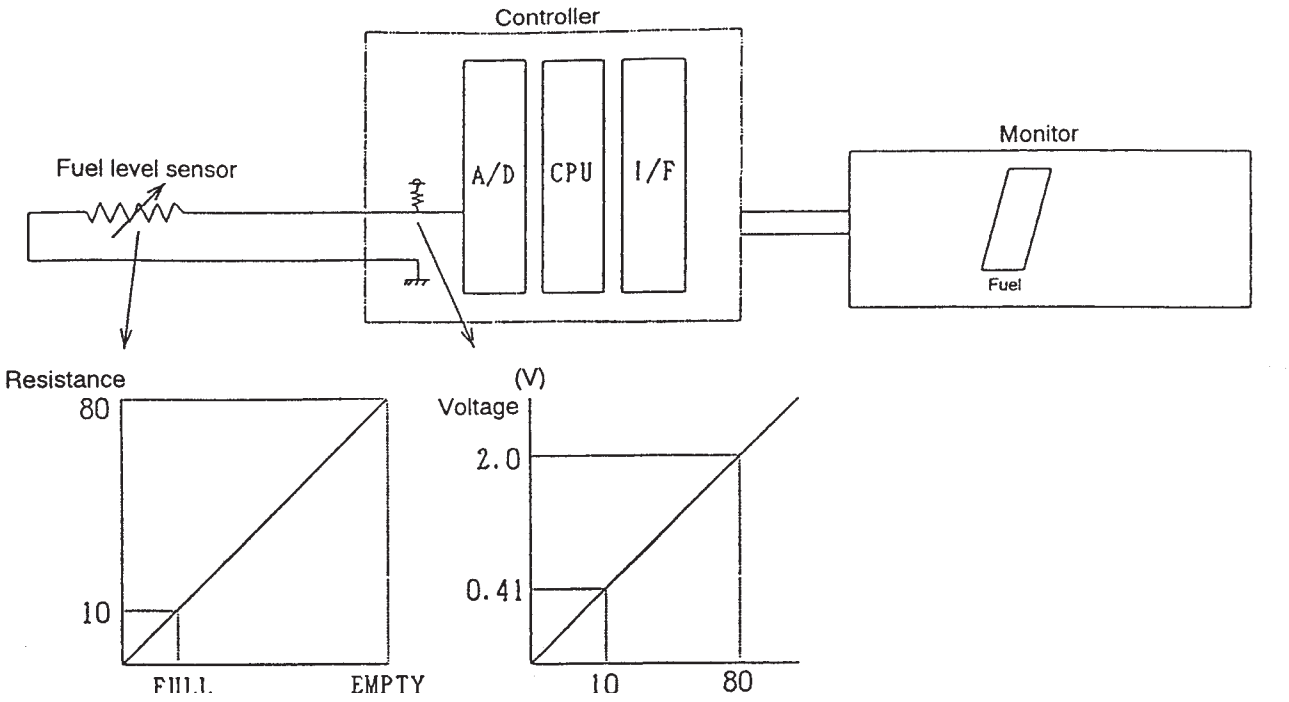
1. Overheat switch position and the **ON** signal of the thermostat sensor are OR processed and number 8 is lit.
2. Overheat switch position and the **OFF** signal of the thermostat sensor are AND processed and number 8 turns off.
3. Number 8 is lit on the condition that numbers 1-7 are lit.
4. When numbers 1-7 are off and the signal for number 8 is transmitted, they light-up in numerical sequence after a 30 second delay.
5. Number 7 is put out on the condition that number 8 is turned out.
6. If the signal to switch off number 7 is transmitted when number 8 is lit, the lights-out signal of the Thermostat sensor must also occur.
7. When number 8 is lit, 'OVER HEAT' is indicated.



Display Monitor *(continued)*

Fuel Remaining

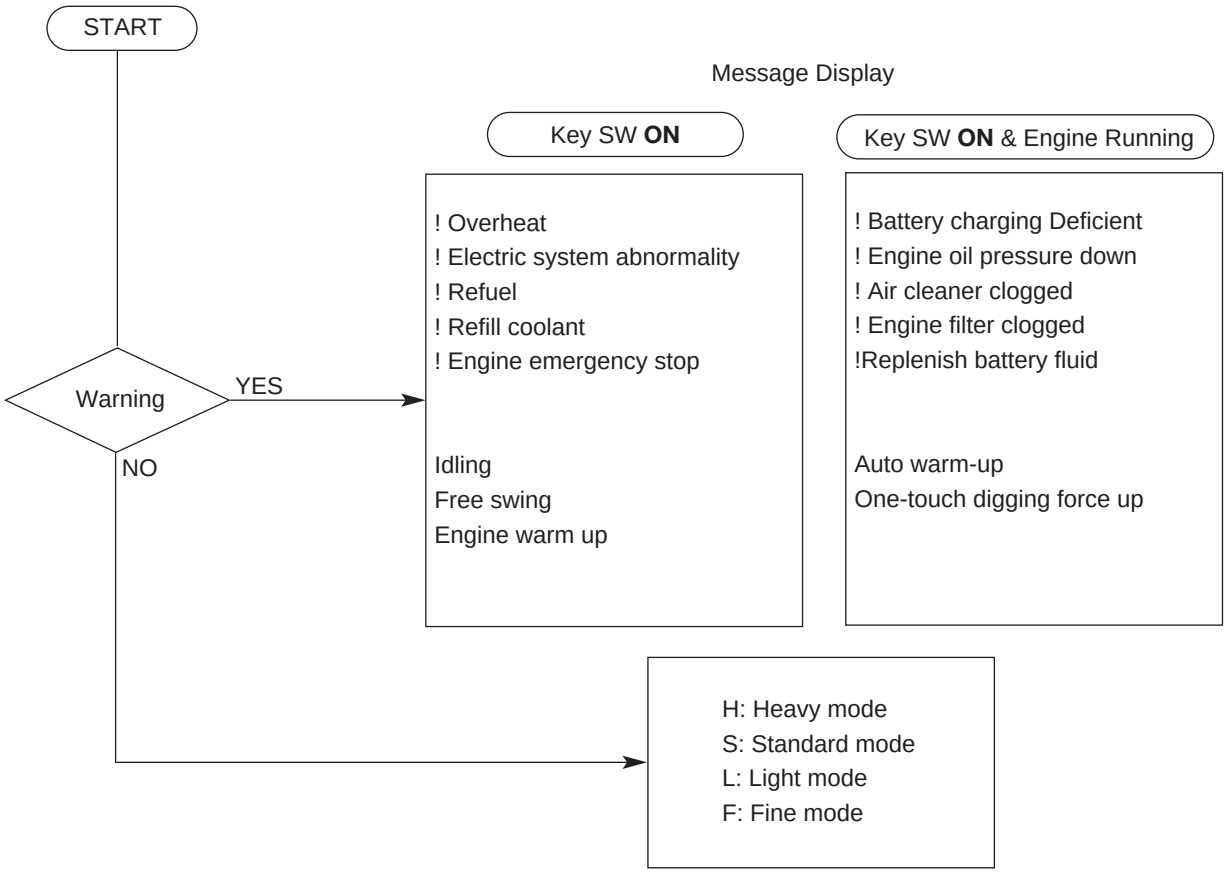
Circuit Diagram



FUEL REMAINING (litres)	RESISTANCE (OHM)	MONITOR
284~	13~10	8
243~284	21~13	7
200~243	27~21	6
158~200	34~27	5
115~158	44~34	4
72~115	59~44	3
39~72	78~59	2
39	80~78	1 (1 hour left - Refuel)

Display Monitor *(continued)*

Warning Display (Message Display)



Note 1: If several instructions are displayed they appear alternately every 5 seconds.

Note 2: When AUTO GLOW warm-up is finished, buzzer is sounded for 3 seconds.

!	Engine emergency stop	Engine emergency stop (emergency stop switch **"ON"**) is displayed.
!	Refuel	Fuel amount indicated if low. Check, and supply fuel.
!	Refill coolant	Coolant level is low. Check and supply cooling water.
!	Replenish battery fluid	Battery liquid level sensor is not fitted. Fault should not be displayed.
!	Air cleaner clogged	Air cleaner element is clogged. Wash or replace element.
!	Engine oil pressure down	Pressure of engine oil low. Check engine oil quantity, and replenish if low.
!	Engine filter clogged	Engine oil filter is clogged. Replace engine oil filter. (When replacing engine oil filter, also replace engine oil).
!	Over heat	Engine coolant or hydraulic oil temperature is high. Turn engine to low idling, to lower the water or oil temperature. (Check radiator, and clean it.)
!	Battery Charging Deficient	Abnormal charging system is displayed. Check the electric circuit.
!	Electric system abnormality	Abnormal electric system (short and disconnection) is displayed. Check the electric circuit.

Throttle Motor and Throttle Link Replacement

1. **Prepare the machine**
   Position the machine on level ground.
   Stop the engine and remove the starter key.

2. **Locate the throttle motor and link**

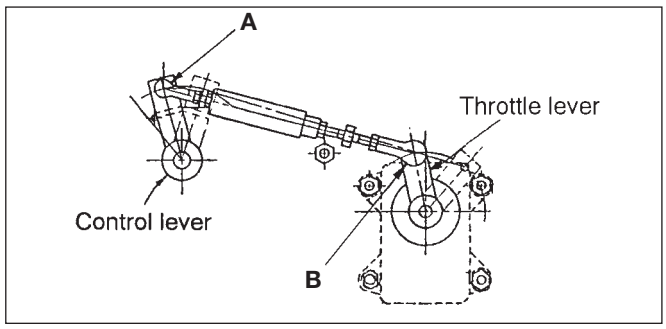
   *See **Component Location Diagram in Routine Maintenance**.*

Note: *Upon delivery of the Throttle motor the position of the output axis shaft is in a random position, so it needs adjusting.*

3. **Throttle motor replacement**
   Connect the wiring of the Throttle motor and switch it to the redundancy position.

   Position the motor so that the output shaft is rotated counter clockwise.

4. **Removal of Throttle Link**
   Remove the nuts of the throttle link at the control lever **A**, then remove the nuts on the opposite end of the throttle link at the throttle lever end **B**. Then remove the link without disassembly.



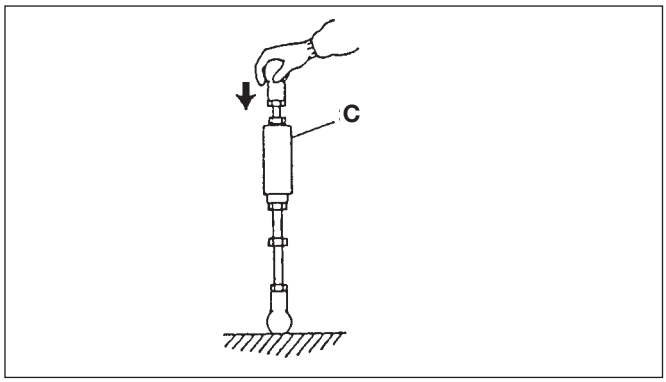
5. **Checking operation of Throttle Link**

   a. Confirm whether the Spring chamber **C** of the link operates normally before installing the throttle motor.

   b. Stand the link and press on it from the top, and confirm that the spring has compressed (approx 20 mm).

   c. If using the throttle link when the spring does not compress because of its internal corrosion, the motor will be damaged.

   d. If the spring does not compress, replace it.

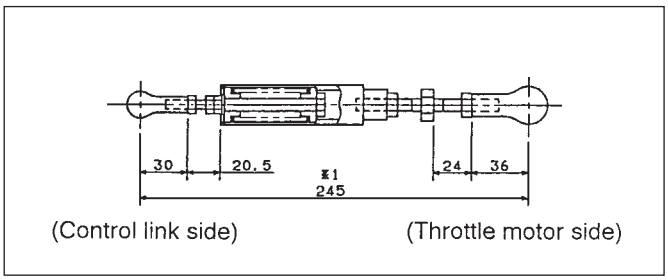


6. **Disassembly of throttle link**

   a. While it is possible to disassemble the link it is advisable to replace the unit with a new one.

   b. If it is disassembled, reassemble the unit to the dimensions shown opposite.

Note: *The overall dimensions shown are not fixed as each installation may vary.*

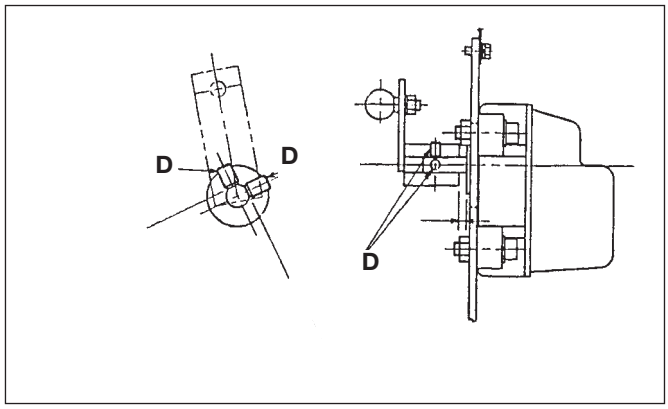


Throttle Motor and Throttle Link Replacement *(continued)*

7. Installation of the throttle link lever

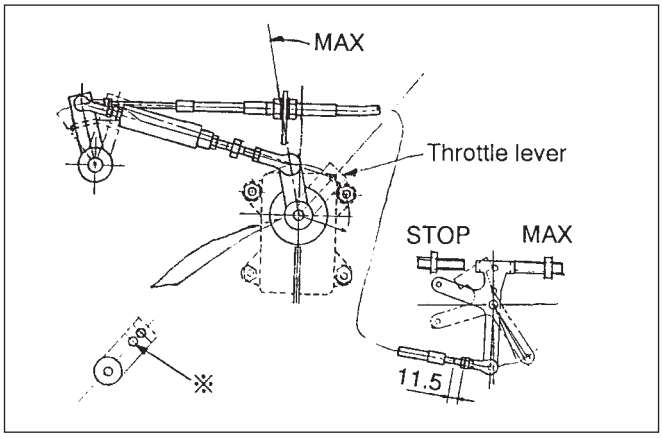
a. Install the lever on the new throttle motor without forcing it.

b. Coat the screws **D** with loctite before fastening.



8. Installation of the throttle link

a. After installation of the throttle motor, install the throttle links to the throttle lever and the control link.



9. Adjustment of Throttle Link

a. Switch it to redundancy.

b. Adjust the link of the engine side of the governor so that it hits the stopper bolt on the Max side of the throttle **UP** switch.

c. After checking that it does hit the screw, rotate the spring chamber out 3 Complete rotations (counter clockwise) from that position.

d. Adjust the length of the link so that the stroke of the spring chamber is 1.5-5mm.

10. Confirmation of Throttle Motor Operations

a. Confirm that the 'electric system abnormality' is not displayed in the monitor when the key switch is **ON**.

b. With the throttle volume at engine **MAX** position, confirm that the spring chamber contracts, after the link of the engine side governor hits the stop.

c. At the **STOP** side, with the throttle volume knob at the engine **MIN** position, confirm that the spring chamber contracts after the key switch is **OFF**.

Note: *Perform the automatic adjustment after confirmation of the above adjustment.*

Automatic Adjustment

Always perform the automatic adjustment when the controller and or the throttle motor or linkage is replaced. The controller must be programmed to suit the machine model. There are differences in the controller's programming for various models and territories.

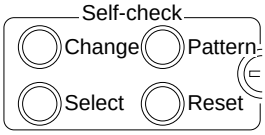
Initial Set-up of the Controller for Machine Identification

To set the machine, the controller's original programming must be cleared.

1 Remove plastic cover from around redundant mode switches.

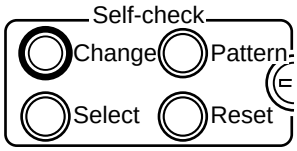
*

Cover installation screws x 2

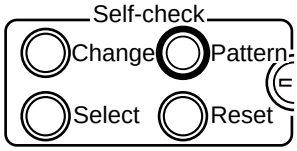


2 Switch ignition on.

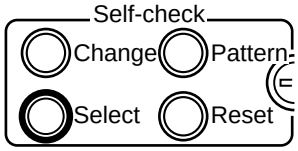
3 Press **CHANGE** button once.



4 Press **PATTERN** button once.



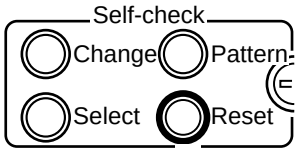
5 Press **SELECT** button until **RESET** is displayed in the message display.



Message

RESET

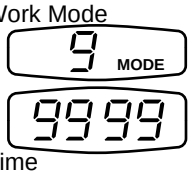
6 Press **RESET** button for 20 sec until buzzer sounds.



7 Switch ignition off.
Controller's original programme is now cleared.

8 Switch ignition on (9999 displayed).

Work Mode

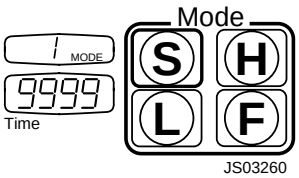


Time

Message

* Initial Set-up of the Controller for Machine Identification (continued)

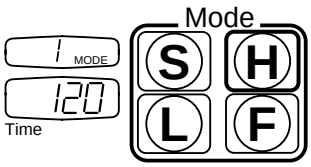
9 Repeatedly press **S** Mode switch until the monitor's desired language is displayed on the mode screen.



JS03260

LANGUAGE	MODE SCREEN
JAPANESE	0
ENGLISH	1
THAI	2
CHINESE	3
GERMAN	4
FRENCH	5
ITALIAN	6
SPANISH	7
PORTUGUESE	8
DUTCH	H
DANISH	L
NORWEGIAN	F
SWEDISH	EC
FINNISH	C

10 Repeatedly press **H** Mode switch until the machine model is displayed on the clock (last 3 digits).



JS03270

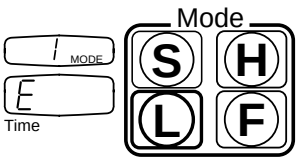
*

MODEL	CLOCK	MODE SCREEN
†JS 200/220	200	1
†JS 240/260	220	1

* † Including all variants.

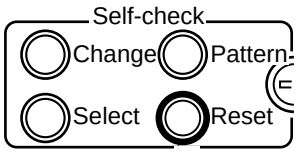
If the 4th digit in the clock window reads '9' (e.g. 129), press the 'F' mode switch until the 4th digit reads '0'.

11 Repeatedly press **L** Mode switch until 'E' is displayed on the clock (1st digit). All other displays are for non-JCB applications and are therefore not applicable.



JS03280

12 Press **RESET** button once.



13 Start engine.

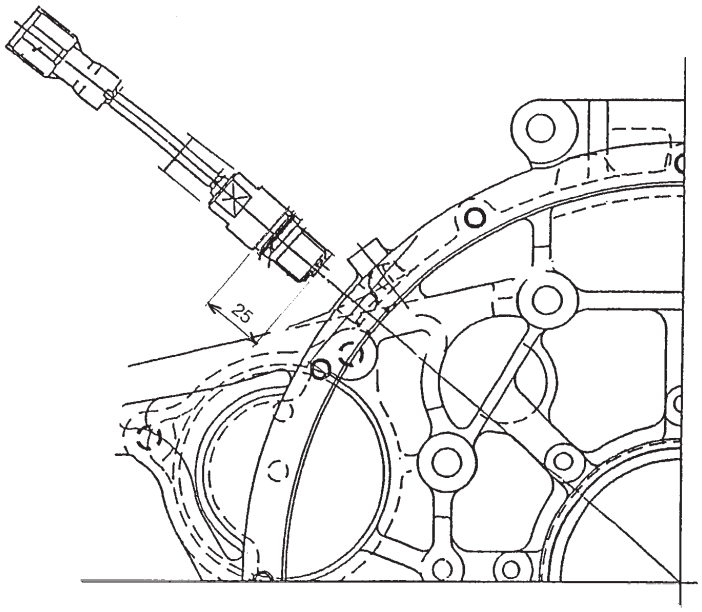
14 Press **CUSHION** switch once. The following sequence will occur:

1. Engine goes to maximum rpm - CAPS fine tunes for **H** mode.
2. Engine speed decreases by 100 rpm - CAPS fine tunes for **S** mode.
3. Engine speed decreases by a further 100 rpm - CAPS fine tunes for **L** mode.
4. Engine speed returns to idle - CAPS fine tunes idling speed.

Programming is complete when a digging mode is displayed in the message screen.

15 Switch the ignition off.

Revolution Sensor Removal and Installation



1. **Prepare the Machine**
   Position the machine on level ground.
   Stop the engine and remove the starter key.
2. **Locate the Flywheel housing**
   a. The flywheel housing is machined to accommodate the sensor.
   b. Remove the sensor by unscrewing it.

Note: *Check the 'O'-ring for damage or wear, replace if necessary.*

3. Installation is by screwing the sensor in the machined section at a torque of 44.13-53.0 Nm(33-40 lb ft).

Note: *The clearance between the sensor and the flywheel is 3.1 +0.4 mm.*

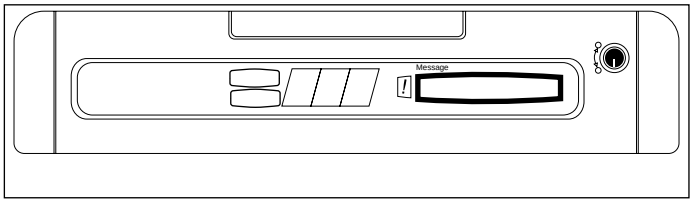
Self Test Function

This series of vehicles contain numerous sensors to enable the machine to perform its own self test diagnosis.

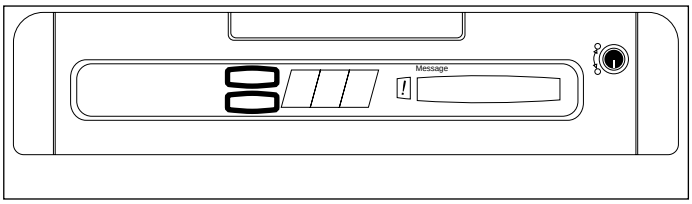
Below is a list of functions which are monitored by the system.

* **1.** Destination, Model Name, Language
2. Engine R.P.M
3. Pump Input Amperage
4. No. of Throttle Pulses
5. Hydraulic Oil Temperature
6. Water Temperature
* **7.** Fuel Sensor Resistance Value
* **8.** Throttle Volume Voltage Input
* **9.** Transistor Output
10. Pressure Switch Input

The items to be checked, appear in the **MESSAGE** display Section



The data is displayed on the **CLOCK** display

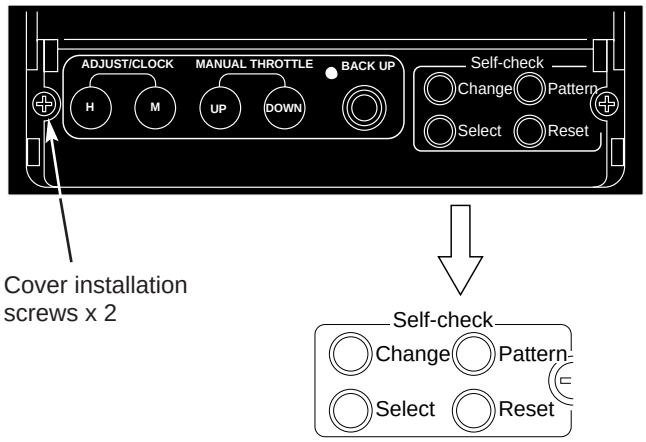


Each item is changed with the Self Check Switches located on the right hand side of the back-up switch. *

There are four Self Check Switches

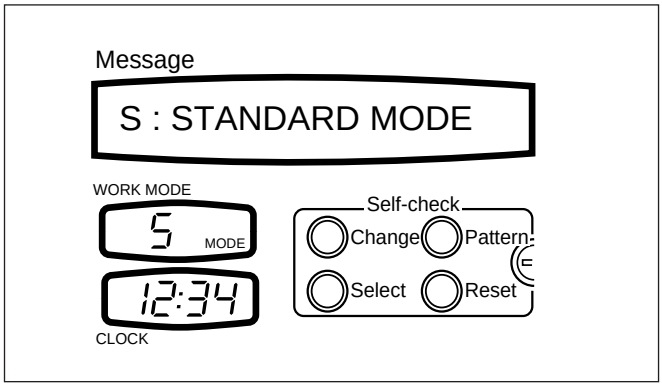
1. The **CHANGE** switch which is used to change to the self-check mode.
2. **PATTERN** switch which changes from the service check function to the setting function.
3. **SELECT** switch which moves from item to item.
4. **RESET** which locks the set values into the controller.

This set of four switches are usually covered so that the operator cannot accidentally operate them.



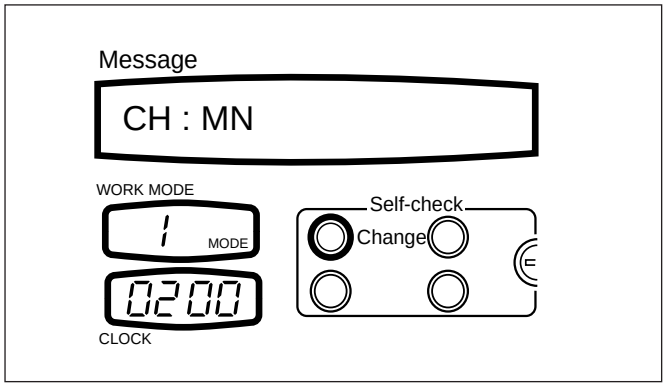
Checking Methods

When the engine key is inserted and turned to the **ON** position, the **"STANDARD MODE"** is displayed in the Message display section, and **S** is displayed in the **WORK** mode section and the**TIME** is displayed in the **CLOCK** display.



When the **CHANGE** switch is pressed the Country and Model designation is displayed:

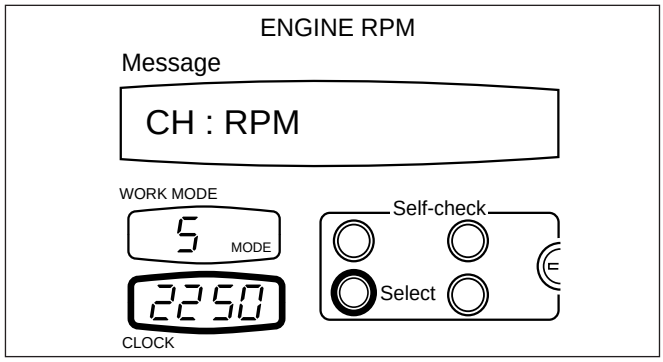
0200 = JS200
0220 = JS240



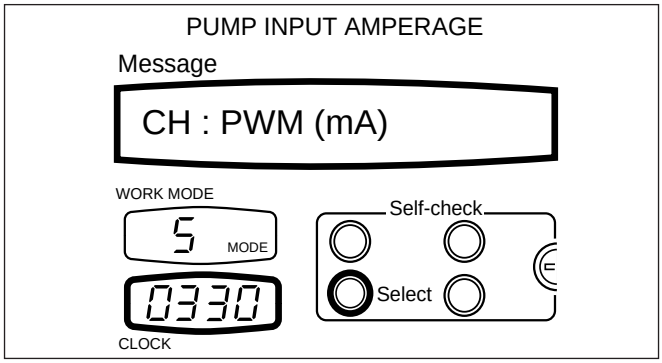
Self Test Function *(continued)*

The Self Check items can be displayed by pressing the **SELECT SWITCH** after every singular display in the following order.

When the **SELECT** switch is pressed the Engine RPM is displayed

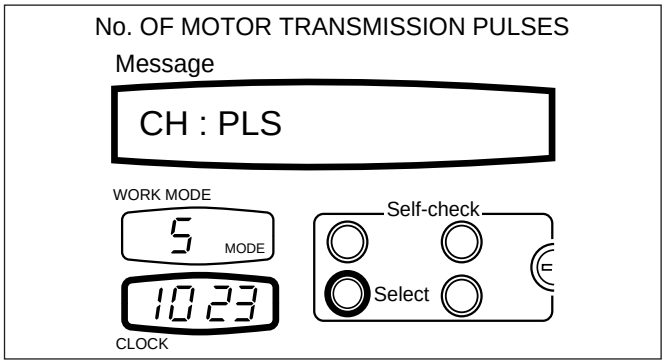


Pressing **SELECT** changes the display as shown.
With the **S** mode displayed it will show 330 mA, the **H** mode will show 520mA, if the engine is at maximum speed

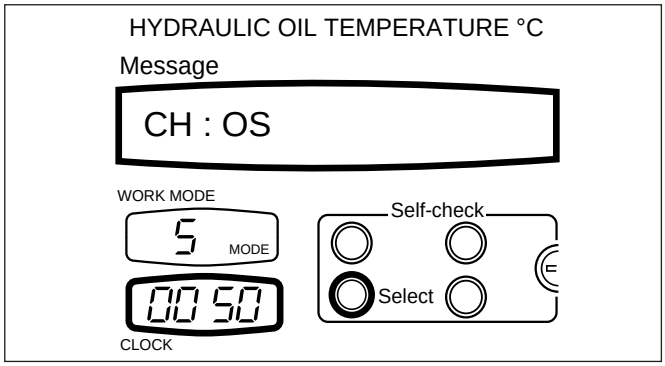


Pressing **SELECT** changes the display as shown.

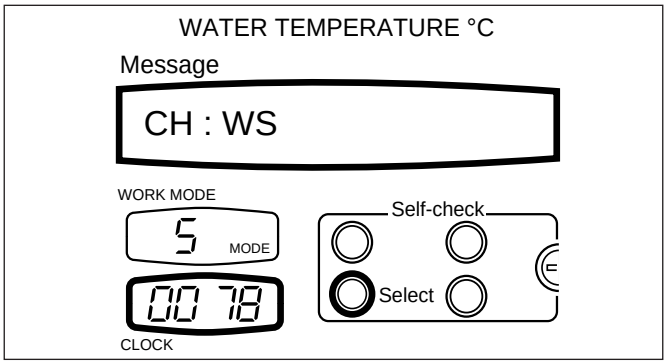
With the throttle motor set at its minimum position it will output approximately 620 pulses to a maximum of 1023 as displayed in the clock display.



Pressing **SELECT** changes the display as shown.



Pressing **SELECT** changes the display as shown.

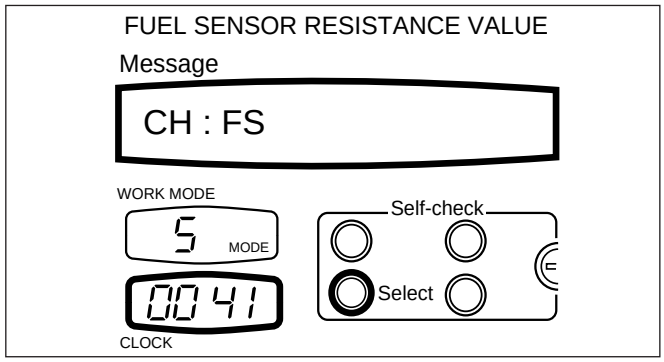


Self Test Function *(continued)*

* FUEL SENSOR RESISTANCE VALUE

Pressing **SELECT** changes the display as shown.

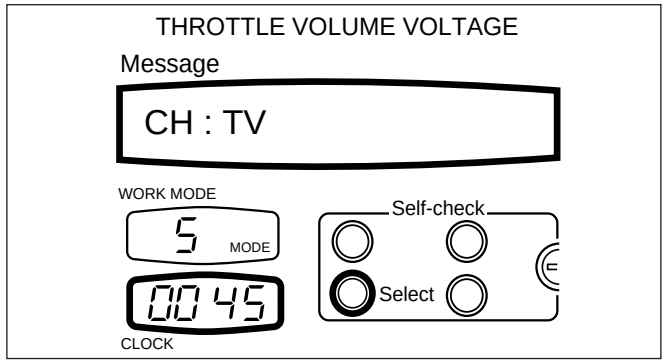
The fuel sensor resistance is shown in Ohms in the clock display.



THROTTLE VOLUME VOLTAGE

Pressing **SELECT** changes the display as shown.

A value of 0 to a maximum of 4.5 Volts will be displayed in the clock display depending on the position of the throttle.



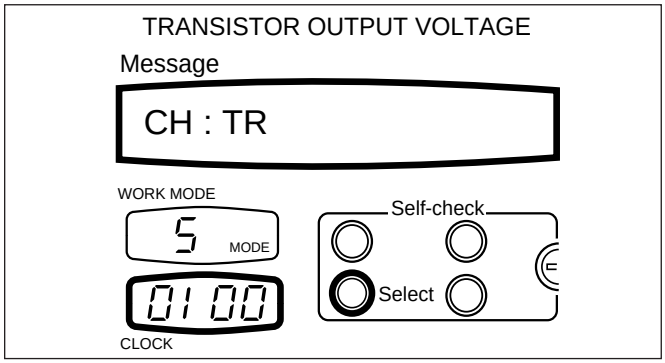
* TRANSISTOR OUTPUT VOLTAGE

Pressing **SELECT** changes the display as shown.This monitors transistor block output.

When TR is displayed, pressing the reset button once will initiate the controller to test all the transistor block outputs 1 through 20. If a faulty output is detected it will stop at that output number. Monitor will display “ELEC. PROBLEM” (short circuits only).

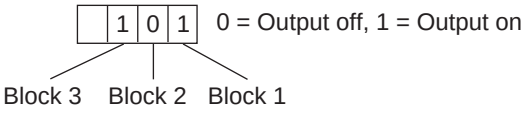
To detect open circuits, select different services in turn and check screen display:

e.g. ‘1’ = closed circuit
‘0’ = open circuit



CONTROLLER TRANSISTOR OUTPUT NUMBERS

1	Free swing solenoid valve	Block 1
2	2 stage MRV control solenoid valve	
3	Low flow hydraulic circuit	
4	Servo isolator solenoid valve	
5	Slew shut off solenoid valve	
6	Not used	
7	Not used	
8	Not used	
9	Boom lower speed restriction solenoid valve	Block 2
10	Not used	
11	Slew lock solenoid valve	
12	Max flow cut solenoid valve	
13	Cushion solenoid valve	
14	Not used	
15	Not used	
16	Negative control solenoid valve	
17	Battery relay	Block 3
18	Glow plug relay	
19	Slew brake solenoid	
20	2 speed travel solenoid valve	

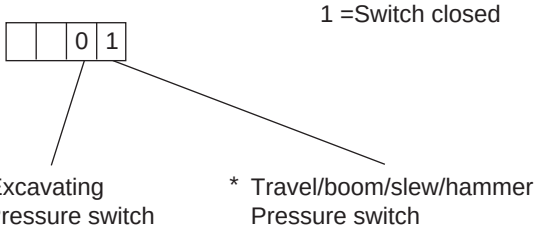


* Self Test Function *(continued)*

Start engine. Pressing **SELECT** changes the display as shown.

* This monitors pressure switch information in the clock display.

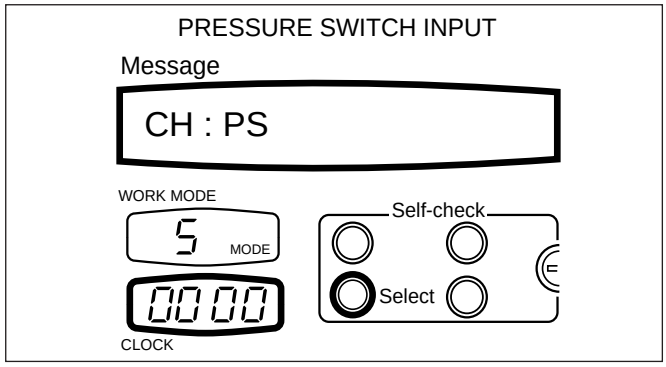
0 =Switch open
1 =Switch closed

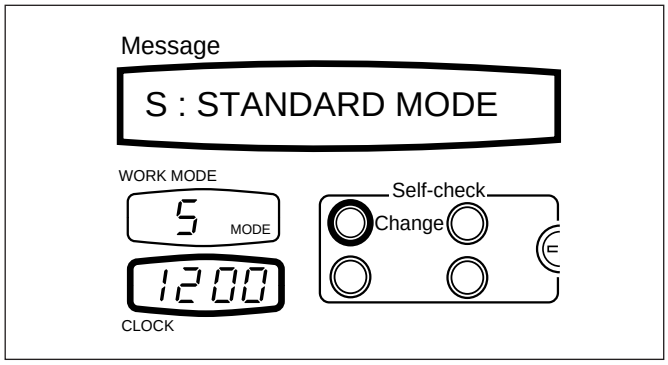


When the **CHANGE** switch is pressed when the checks are completed and the system will return to the **STANDARD MODE** for normal operation.

Note: Engine has to be started to perform the above procedure.

Select boom down, display should be:	1 1
* Select slew left or right, display should be:	1 1
Select any other excavator service, display should be:	1 0
Select travel, display should be:	0 1
* Select hammer, display should be:	0 1





Self Test Function *(continued)*

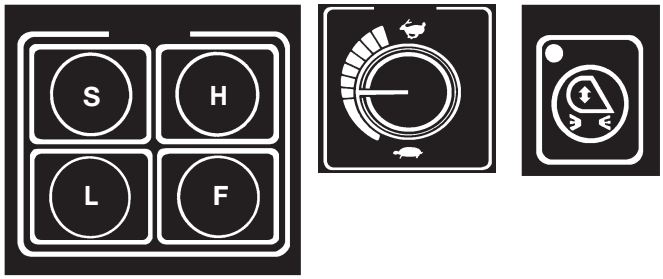
Setting Function

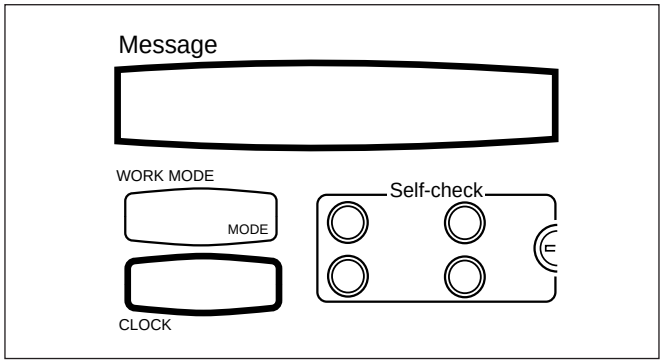
* This section deals with setting separate parameters:

* **1.** Breaker engine speed.

  2. Automatic idle time.

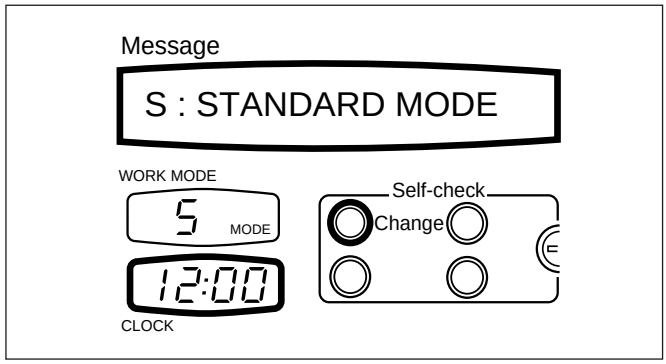
* In addition to the previous sections displays, the following switches are used.

* 

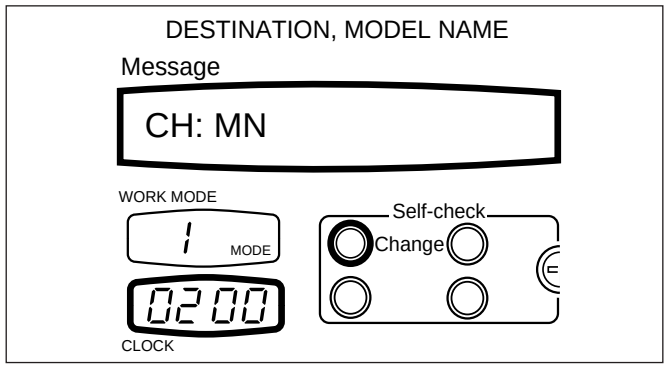


* **Setting Breaker Engine Speed**

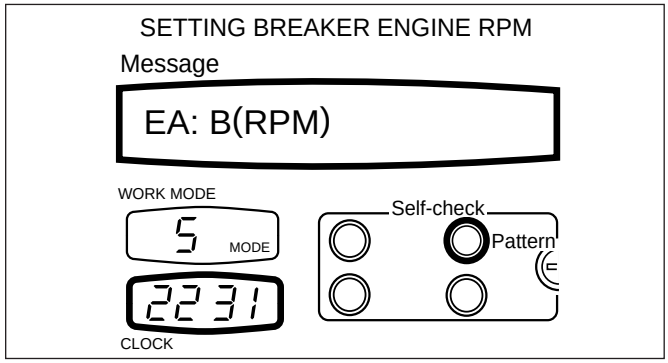
* With the starter key in the **ON** position the display is as shown. Start the engine.



* Press the **CHANGE** switch to produce the display shown right.



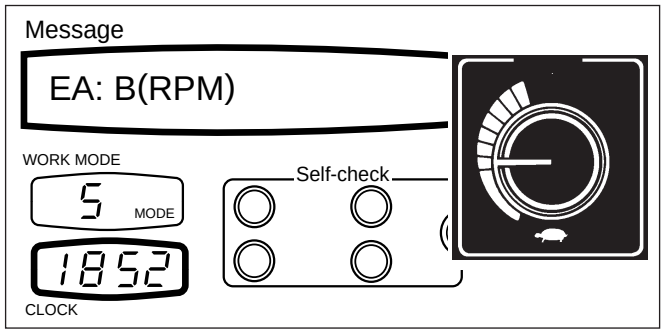
* Press the **PATTERN** switch to produce the display shown right. Engine RPM is displayed in the **CLOCK** window.

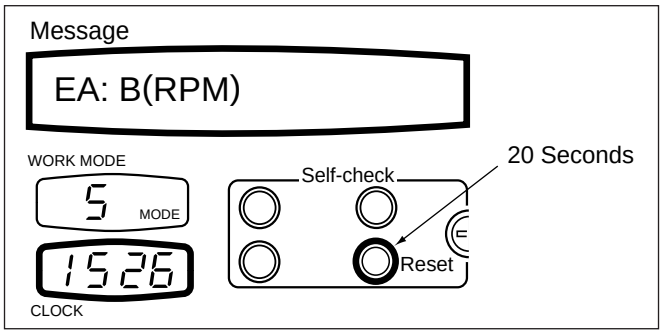


Self Test Function *(continued)*

* Using the **THROTTLE CONTROL** knob, set the engine speed to that required for breaker operation (as displayed in the **CLOCK** window).

* ***Note:*** *Different breakers may require different engine speeds. Check that the breaker engine RPM setting is correct for the breaker being used as given in the following table:*





Machine	Hammermaster	Engine RPM	Normal flow l/min
JS200/200LC/ 220/220LC	660	1765	150
JS240/240LC/ 260/260LC	760	1700	150
JS200/200LC/ 220/220LC	670	1765	150
JS240/240LC 260/260LC	770	1985	180

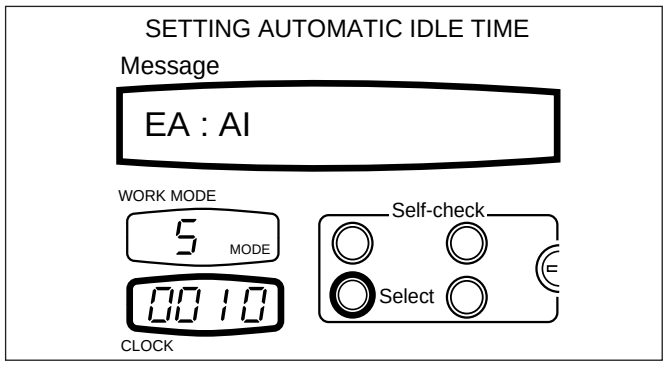
* When the desired RPM is shown, press and hold the **RESET** switch for 20 seconds to enter the setting into the controller. A buzzer will sound when the setting is complete. The controller will now automatically adjust the engine RPM to the selected speed when the breaker is operated.

* Turn the starter key to **OFF** to silence the buzzer.

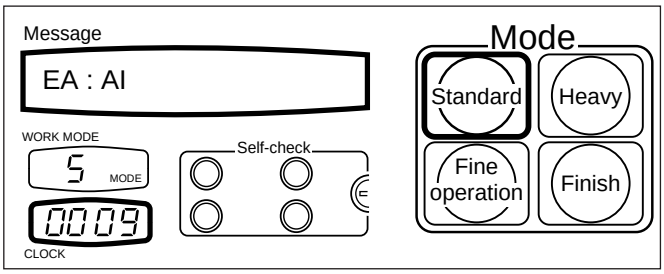
* **Setting Automatic Idle Time**

* Switch the ignition on, and press the **CHANGE** button. Press the **PATTERN** button once, then press the **SELECT** button repeatedly until the monitor displays EA:A1.

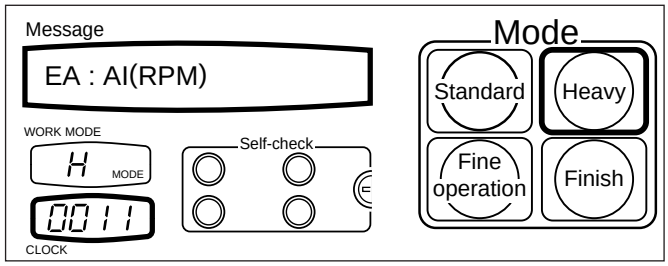
* The 'S' and 'H' **MODE** select switches are used to reset the **AUTOMATIC IDLE TIME**.



* To reduce the **AUTOMATIC IDLE TIME** press the **STANDARD MODE** switch. Each press **reduces** the delay displayed in the **CLOCK** window by 1 second. 'S' is displayed in the **WORK MODE** window during this operation.



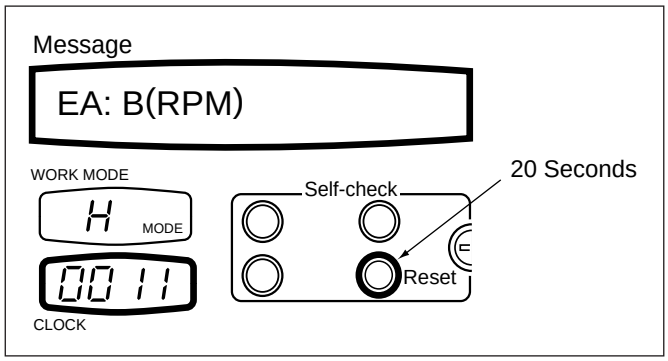
* To increase the **AUTOMATIC IDLE TIME** displayed in the **CLOCK** window, press the **HEAVY MODE** switch. Each press **increases** the delay displayed in the **CLOCK** window by 1 second. 'H' is displayed in the **WORK MODE** window during this operation.



* Self Test Function *(continued)*

* When the desired **AUTOMATIC IDLE TIME** is reached, press and hold the **RESET** switch for 20 seconds to enter the setting into the controller. A buzzer will sound when the setting is complete.

* Turn the starter switch to **OFF** to silence the buzzer.



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* **Other functions**

* Other functions, not applicable in normal use, can be displayed using the **SELECT** button:

CH:1 = Min engine RPM for scrap magnet use.

* **CH:7** = Changing Proportional Solenoid mA Value.

  * If kerosene fuel is to be used it is necessary to reduce the current at the proportional solenoid on the hydraulic pump as follows:

    1. Switch ignition on.
    2. Press **CHANGE** button once.
    3. Press **PATTERN** button once.
    4. Press **SELECT** button repeatedly until monitor reads **CH:7**
    5. Press **H MODE** switch to change mA value. (0=normal,1= reduced current).
    6. Press **RESET** button for 20 sec until buzzer sounds.
    7. Switch ignition off. The proportional solenoid mA value is now reduced.

CH:8 = Battery level sensor.

Fault Diagnosis

This section is designed to simplify the Task of Fault Finding.
When a message is displayed, the description of the fault is shown and the Problem No. is shown; this in turn then relates to the relevant page showing the Problem No.

Procedure
Depending on the result of the inspection or measurement inside the box, continue on to either the **YES** or **NO** branch and onto the next box. Inside each box, the inspection or measurement method or values are written. The necessary preparatory work, operations and values are listed. Make sure the preparatory work is carried out, that is checking the procedures and equipment, as mistakes in judgements and procedures can seriously damage the equipment.

Note: *When removing or checking a piece of electrical equipment turn the key switch* ***OFF****.*

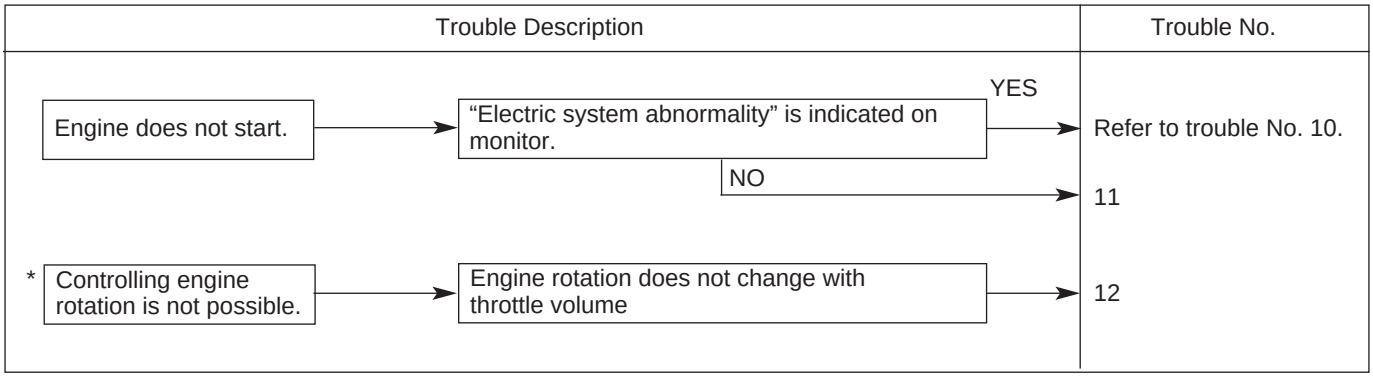
Fault Diagnosis *(continued)*

This explains how to trouble shoot in the event that the message does not go out even though suitable measures are taken to check and clear the problem.

!Mark	Message Display	Trouble Description	Problem No.
!	Engine emergency stop	Even though the emergency stop button is pressed, the message does not go out.	1
!	Refuel	Even though fuel is supplied, the message does not go out.	2
!	Refill coolant	Even though cooling water is supplied, the message does not go out.	3
!	Replenish battery fluid	Battery fluid sensor not fitted, fault should not be displayed.	4
!	Air cleaner clogged	Even though filter is cleaned, the message does not go out.	5
!	Engine oil pressure Drop	Even though engine oil is correct, the message does not go out.	6
!	Engine filter clogged	Even though the engine oil filter is replaced and the engine oil is correct, the message does not go out.,	7
!	Over heat	Even though hydraulic oil temperature is less than 84°C and the engine cooling water temperature is less than 92°C, the message does not go out.	8
!	Battery Charging Deficient	The message does not go out.	9
!	Electric system abnormality	The message does not go out.	10

This explains how to trouble shoot when an operation is not indicated on a message, but it does not operate normally.

1. Engine control area



Fault Diagnosis *(continued)*

		Item	Judgement Value	Measure
Start-up Inspection items	Lubricants • Coolants	1. Fuel amount check	-	Refuel
		2. Inspection for fuel contaminant	-	Clean, drain
		3. Hydraulic oil amount check	-	Refill oil
		4. Inspection of hydraulic oil strainer	-	Clean, drain
		5. Inspection of oil amount for each reduction gear	-	Refill oil
		6. Inspection of engine oil amount (amount in oil pan)	-	Refill oil
		7. Coolant amount check	-	Refill water
		8. Dust indicator clogging check	-	Clean or replace
	Electric Equipment	9. Inspection for looseness, corrosion of battery terminal and wiring	-	Tighten or replace
		10. Inspection for looseness, corrosion of alternator terminal and wiring	-	Tighten or replace
		11. Inspection for looseness, corrosion of starter terminal and wiring	-	Tighten or replace
Other Inspection Items	Hydraulic • Mechanical Equipment	12. Abnormal sound, smell check	-	Repair
		13. Oil leakage check	-	Repair
		14. Air-bleeding	-	Air bleeding
	Electricity • Electric Equipment	15. Battery voltage (engine stopped) check	* 25-26V	Replacement
		16. Battery fluid sensor not fitted, fault should not be displayed.	-	Replenish or replace
		17. Inspection for discolouration, burning, peeling of wiring	-	Replacement
		18. Inspection for wiring clamp removal, sagging	-	Repair
		19. Inspection for wet wiring (special attention to wet connector and terminal)	-	Disconnect and dry
		20. Inspection for fuse breakage, corrosion	-	Replacement
		21. Alternator voltage check (engine revolution more than 1/2 throttle) (When battery insufficiently charged, may be about 25V right after starting.)	27.5~29.5V	Replacement
		22. Battery relay making noise (when starter switch is **ON** or **OFF**)	-	Replacement

Fault Diagnosis *(continued)*

Emergency Engine Stop, Problem No.1

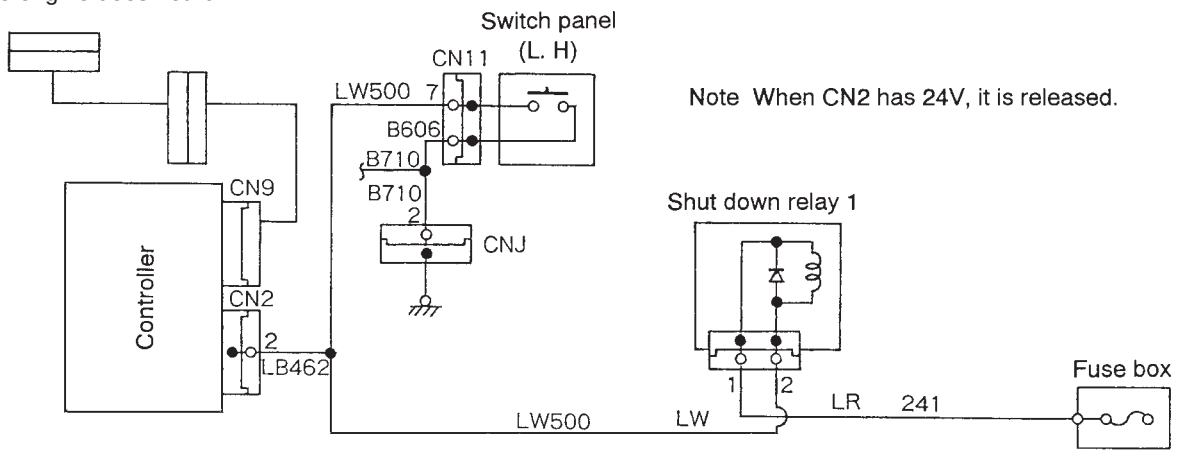
Note: *Even if the emergency stop button is pressed the message does not go out.*

Prior Confirmation
Items

1. The **"MODE"** of the mode display is not flashing.

2. Confirm that the fuses in the fuse box are normal.

3. The engine does not run.



Troubleshoot	Cause	Remedy
Key switch **ON** When CN11 connector is removed, does message go out? YES	* Defective LW wiring from switch panel or switch panel defective.	Repair wiring or replace switch panel.
NO Remove CN2 connector and measure voltage of female side of LB. Is it within the range of 20~30V? YES	Bad connection of CN2 connector or controller defect.	Clean CN2 connector terminal or replace controller.
NO Measure voltage of LW with shut down relay 1 connector connected. Is it within the range of 20~30V. YES	Breakage of LW wiring between shut off relay 1 and controller.	Repair LW wiring.
NO Remove shut off relay 1 connector and measure resistance of 1 and 2 of relay side. Connect 1 to +, 2 to -. Is it 250 . NO (∞)	Defective shut off relay 1.	Replace shut off relay 1.
YES	Breakage of LR wiring between shut off relay 1 and fuse.	Repair LR wiring.

Fault Diagnosis *(continued)*

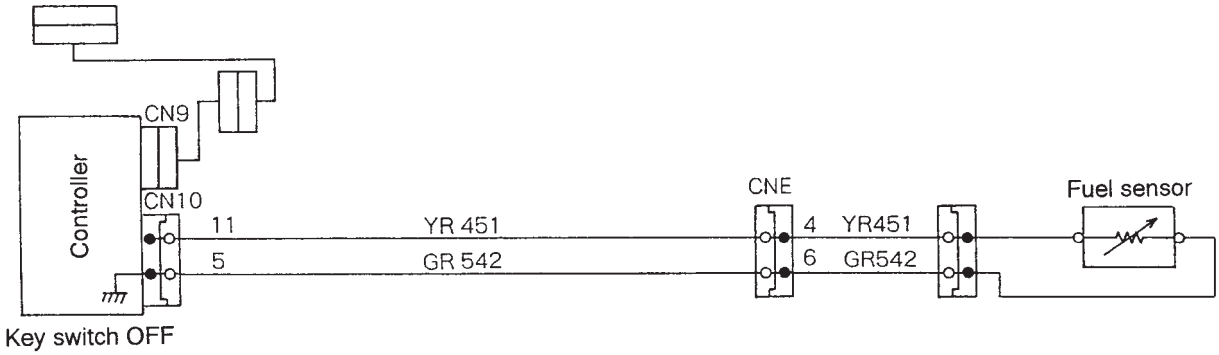
Refuel, Problem No.2

Note: *Message does not go out even if refuelled*

Prior Confirmation Items

1. The **"MODE"** of the mode display is not flashing.

2. Fuel bar graph displays one.



Troubleshoot	Cause	Remedy
Key switch **ON** Measure resistance value of sensor at self-check. Is it within the range of values in chart below? (Refer to resistance values in chart below.) YES	Controller defect	Replace controller.
NO Key switch OFF Remove sensor coupler and measure resistance on sensor side. Is it within the range of values in chart below? (Refer to resistance values in chart below.) NO	Fuel sensor defect	Replace sensor or inspect it.
YES Remove CNE connector and measure resistance between male side terminal YR and GR. Is it within the range of values in chart below? (Refer to resistance values in chart below.) NO	Bad connection of fuel sensor connector	Clean connector terminal.
YES Remove CN10 connector and measure resistance between female side terminal YR and GR. Is it within the range of values in chart below? (Refer to resistance values in chart below.) NO	Bad connection of CNE	Clean CNE connector terminal.
YES	Controller defect or bad connection of CN10	Replace controller or clean CN10 connector terminal.

Note: *When there is breakage in the wiring, the bar graph goes out completely.*

Resistance Value between YR and GR

Monitor	1 Refuel.	2	3	4	5	6	7	8
Resistance Value (OHM)	80~78	78~59	59~44	44~34	34~27	27~21	21~13	13~10

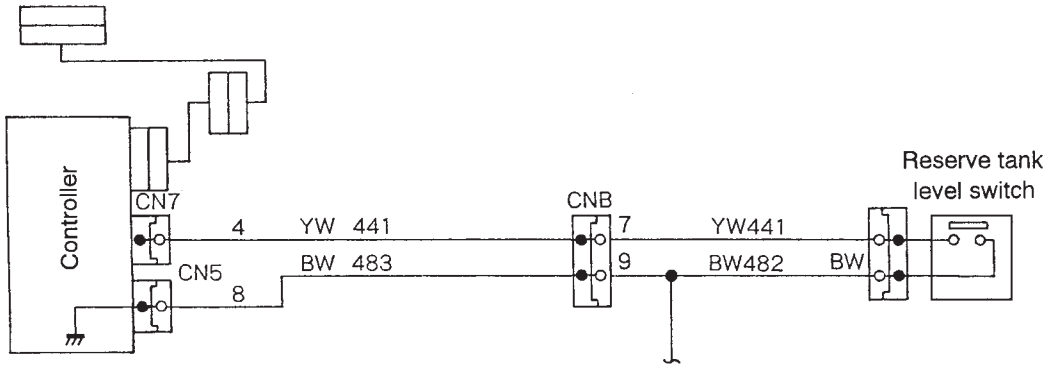
Fault Diagnosis *(continued)*

Coolant Refill, Problem No 3

Note: *Message does not go out even if coolant is refilled*

Prior Confirmation Items

1. The **"MODE"** of the mode display is not flashing.



Troubleshoot	Cause	Remedy
Key switch **ON** When reserve tank level switch connector is removed, does message go out? YES	Reserve tank level switch defect	Replace reserve tank.
NO → When reserve tank level switch connector is removed, does message go out? YES	* Defective YW wiring between reserve tank level switch and CNB	Repair YW wiring.
YES	* Defective YW wiring between CNB and CN7	Repair YW wiring.
NO	Controller	Replace controller.

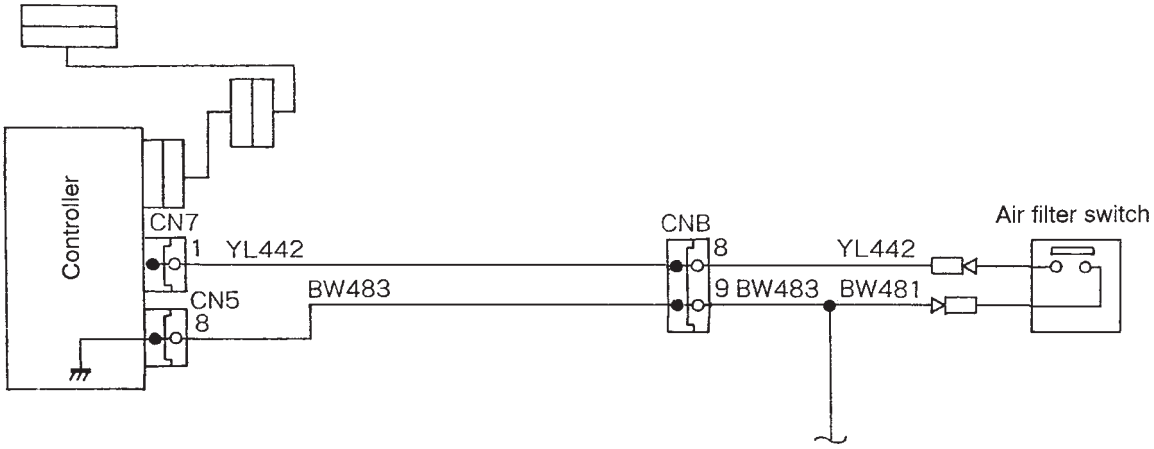
Fault Diagnosis *(continued)*

Air Cleaner clogged, Problem No. 5

Note: *Message does not go out even if the filter is washed.*

Prior Confirmation Items

1. The **"MODE"** of the mode display is not flashing.



Troubleshoot	Cause	Remedy
Key switch **ON**		
When spade terminal of air filter switch on YL side is removed, does message go out? — YES	* Air filter switch defect	* Replace air filter switch.
NO → When CNB connector is removed, does message go out? — YES	* Breakage or bad connection of BW wiring between CNB and air filter switch	* Repair BW wiring.
NO → When CN7 connector is removed, does message go out? — YES	* Breakage or bad connection of BW wiring between CNB and CN5	* Repair BW wiring.
NO	Controller defect	Replace controller

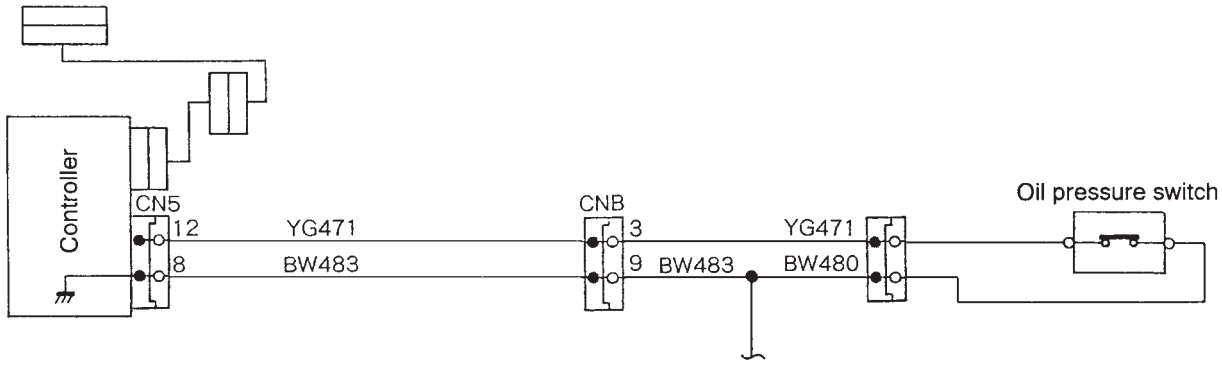
Fault Diagnosis *(continued)*

Low Engine Oil Pressure. Problem No. 6

Note: *Message does not go out even if engine oil is satisfactory.*

Prior Confirmation Items

1. The "MODE" of the mode display is not flashing.



Troubleshoot	Cause	Remedy
Confirm after 12 seconds have passed after starting the engine.		
When oil pressure switch connector is removed, does message go out? — YES	Oil pressure switch defect	Replace-ment
NO → When CNB connector is removed, does message go out? — YES	* Defective YG wiring between CNB and oil pressure switch	Repair YG wiring.
NO → When CN5 connector is removed, does message go out? — YES	* Defective YG wiring between CNB and oil pressure switch	Repair YG
NO	Controller defect	Replace controller

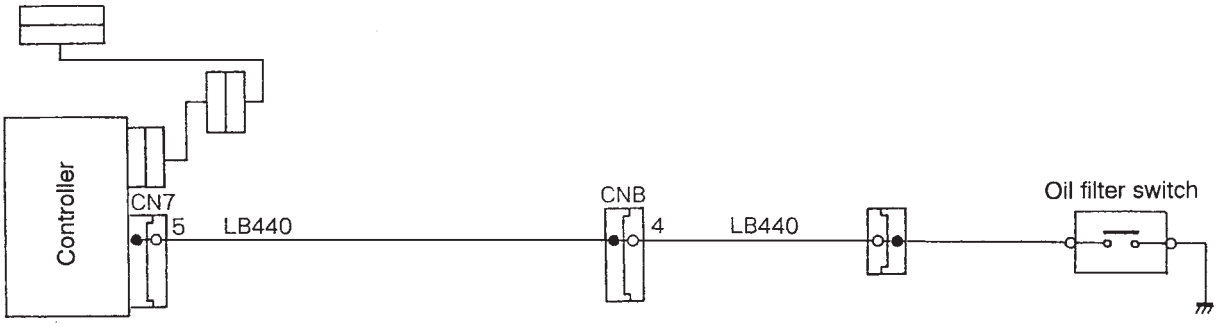
Fault Diagnosis *(continued)*

Engine Oil Filter Blocked, Problem No 7

Note: *Message does not go out even if the engine oil filter is replaced and the oil is satisfactory.*

Prior Confirmation Items

1. The **"MODE"** of the mode display is not flashing.



Troubleshoot	Cause	Remedy
Engine starts When oil filter connector is removed, does message go out? YES	Oil filter switch defect	Replace switch.
NO → When CNB connector is removed, does message go out? YES	* Defective LB wiring between CNB and oil filter switch	Repair LB wiring.
NO → When CN7 connector is removed, does message go out? YES	* Defective LB wiring between CN7 and CNB	Repair wiring.
NO	Controller defect	Replace controller.

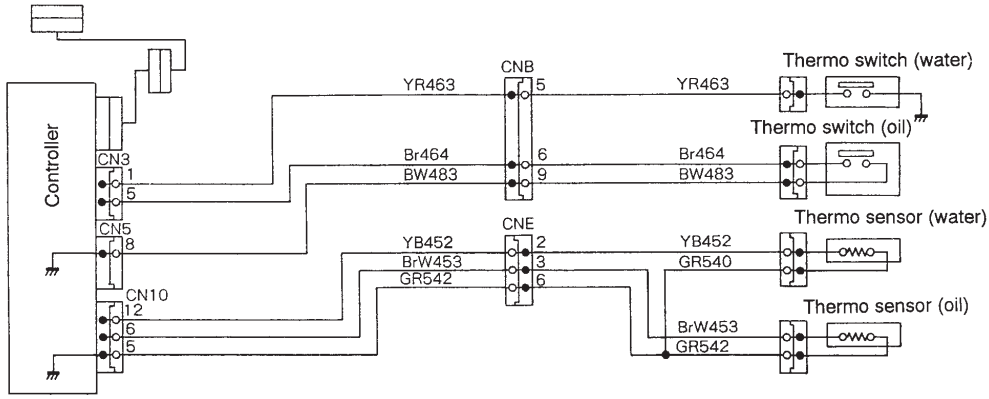
Fault Diagnosis *(continued)*

Fluid Overheating, water, oil, Problem No 8

Note: *Message does not go out even if the actual temperature is below the following; Hydraulic Oil Temperature 84°C. Engine Coolant Temperature 92°C.*

Prior confirmation
Items

1. The **"MODE"** of the mode display is not flashing. **2.** Each bar graph displays more than one graduation.
3. Confirm that the water and oil temperature bar graph is lit at 8 graduations.



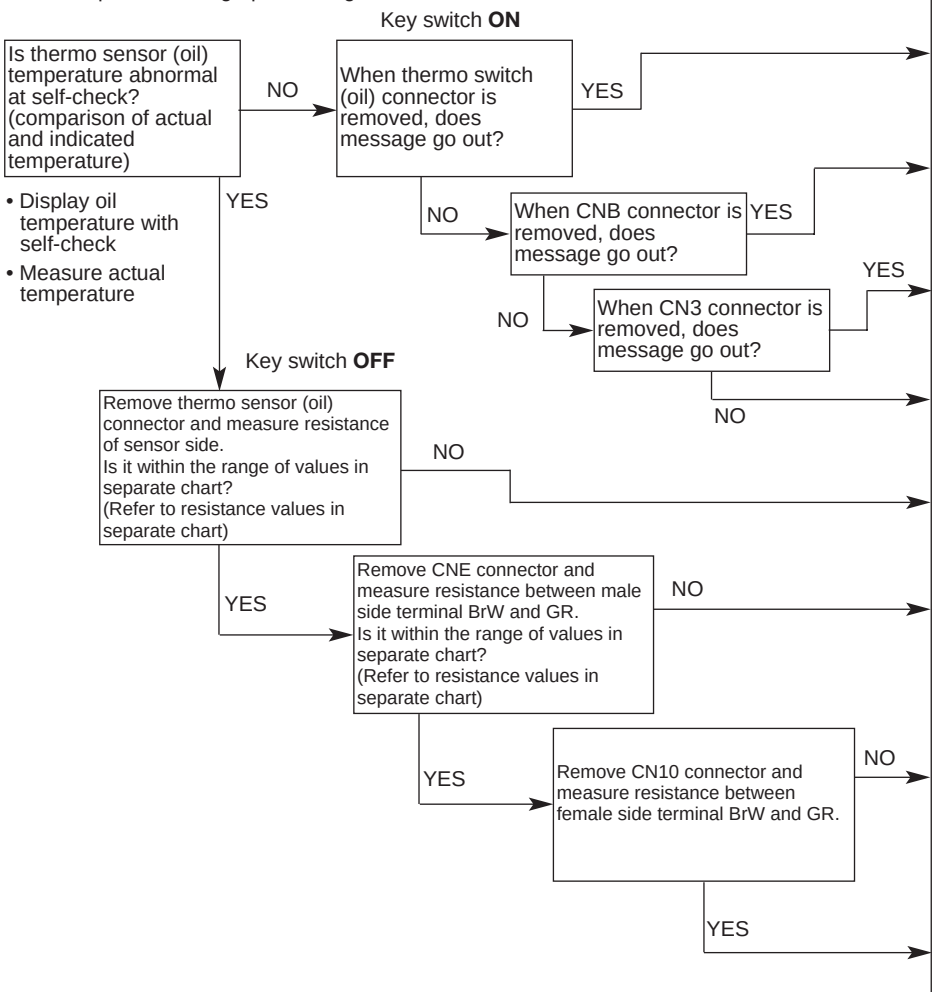
Troubleshoot	Cause	Remedy
1. Water temperature bar graph lit at 8 graduations. Key switch **ON** Is thermo sensor (water) temperature abnormal at self-check? (comparison of actual and indicated temperature) NO → When thermo switch (water) connector is removed, does message go out? YES	Thermo switch (water) defect	Replace switch
• Display water temperature with self-check • Measure actual temperature YES → NO → When CNB connector is removed, does message go out? YES	* Defective YR wiring between CNB and thermo switch	Repair YR wiring
NO → When CN3 connector is removed, does message go out? YES	* Defective YR wiring between CN3 and CNB	Repair YR wiring.
Key switch **OFF** Remove thermo sensor (water) connector and measure resistance of sensor side. Is it within the range of values in separate chart? (Refer to resistance values in separate chart) NO	Controller defect	Replace controller
YES → Remove CNE connector and measure resistance between male side terminal YB and GR. Is it within the range of values in separate chart? (Refer to resistance values in separate chart) NO	Thermo switch (water) defect	Replace sensor.
YES → Remove CN10 connector and measure resistance between female side terminal YB and GR. Is it within the range of values in separate chart? (Refer to resistance values in separate chart) NO	Bad connection of thermo (water) connector	Clean sensor connector terminal
YES	Bad connection of CNE	Clean CNE connector terminal
	Controller defect or bad connection CN10	Replace controller or clean CN10 connector terminal

Note: *When there is breakage in the wiring, the bar graph goes out completely.*

Fault Diagnosis *(continued)*

Fluid Overheating, water, oil, Problem No 8 *(continued)*

Note: *Message does not go out even if the actual Temperature is below the following:-*
Hydraulic Oil Temperature 84°C
Engine Coolant Temperature 92°C



Note: *When there is breakage in the wiring, the bar graph goes out completely.*

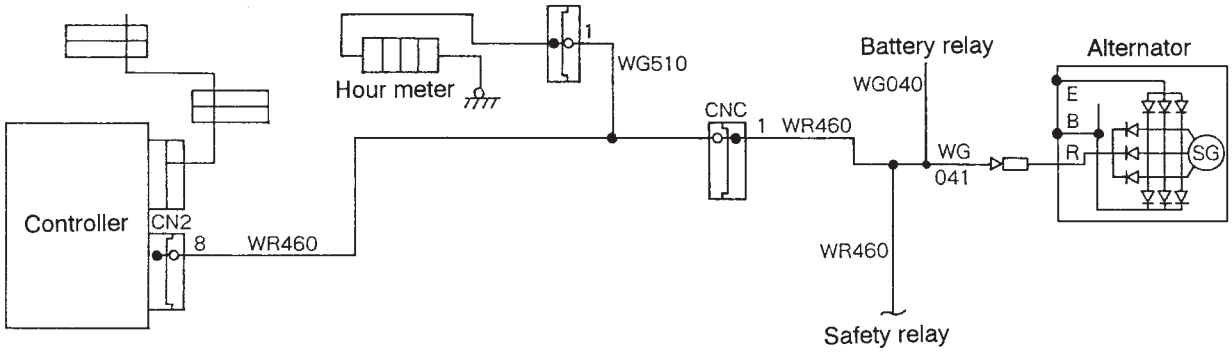
Fault Diagnosis *(continued)*

Battery Charging, Problem No 9

Note: *Message does not go out.*

Prior Confirmation Items

1. The **"MODE"** of the mode display is not flashing.

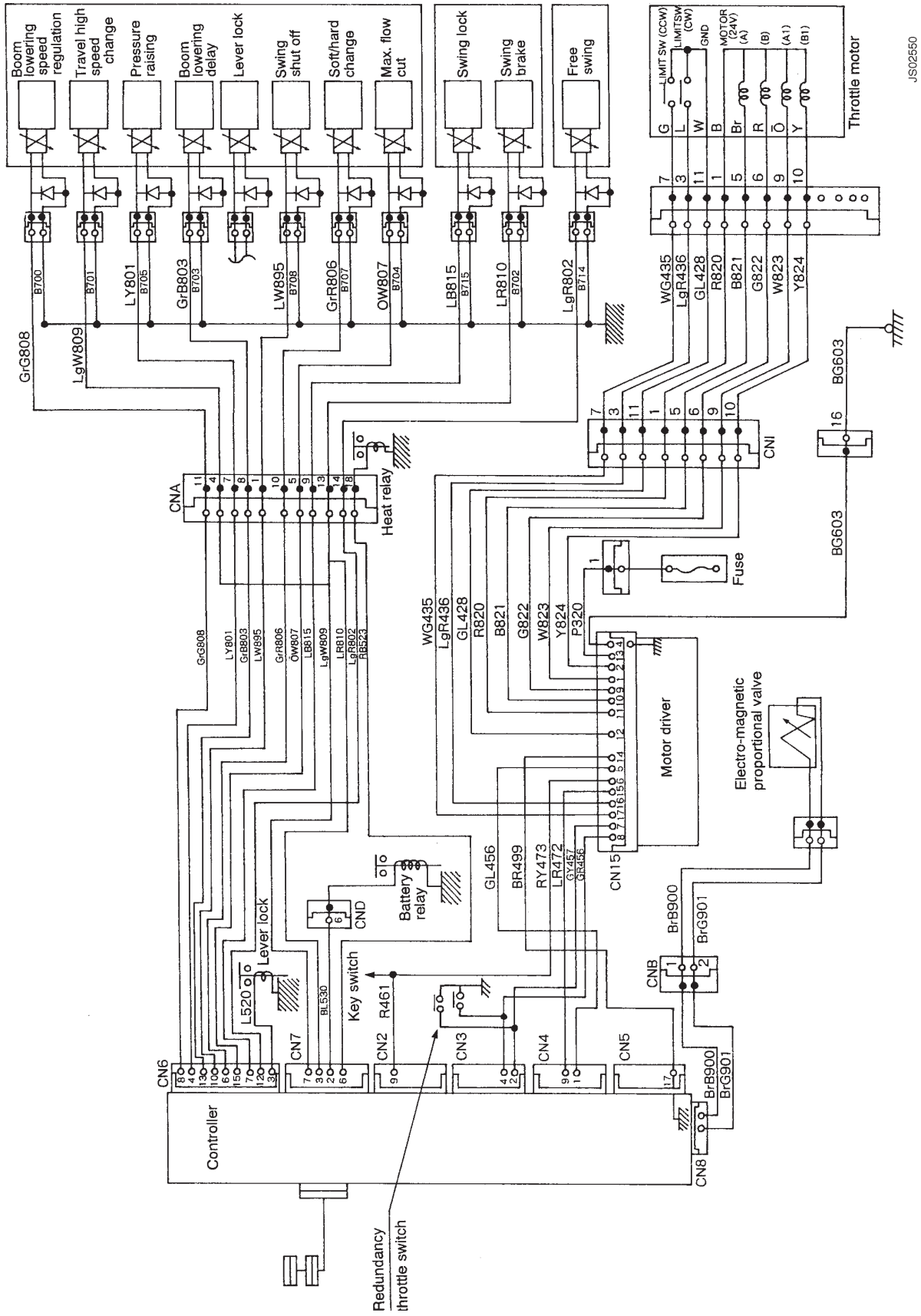


Troubleshoot	Cause	Remedy
Does hour meter operate? YES → Remove CN2 connector and measure voltage between female side terminal WR and ground? Is it more than 10V? NO	* Defective WR wiring between CNC and CN2	Repair WR
Does hour meter operate? YES → Remove CN2 connector and measure voltage between female side terminal WR and ground? Is it more than 10V? YES	Bad connection of CN2 or controller defect	Clean CN2 connector terminal or replace controller.
Does hour meter operate? NO → Remove spade terminal of alternator R and measure voltage between female side and ground. Is it more than 10V? NO	Alternator defect	Replace alternator
Does hour meter operate? NO → Remove spade terminal of alternator R and measure voltage between female side and ground. Is it more than 10V? YES → Remove CNC connector and measure voltage between male side terminal WR and ground? Is it more than 10V? NO	Breakage of WR wiring between CNC and alternator or bad connection of alternator spade terminal	Repair WR wiring between CNC and alternator or clean spade terminal.
Does hour meter operate? NO → Remove spade terminal of alternator R and measure voltage between female side and ground. Is it more than 10V? YES → Remove CNC connector and measure voltage between male side terminal WR and ground? Is it more than 10V? YES		

Fault Diagnosis *(continued)*

* **Electrical Systems, Message Fault, Problem No 10**

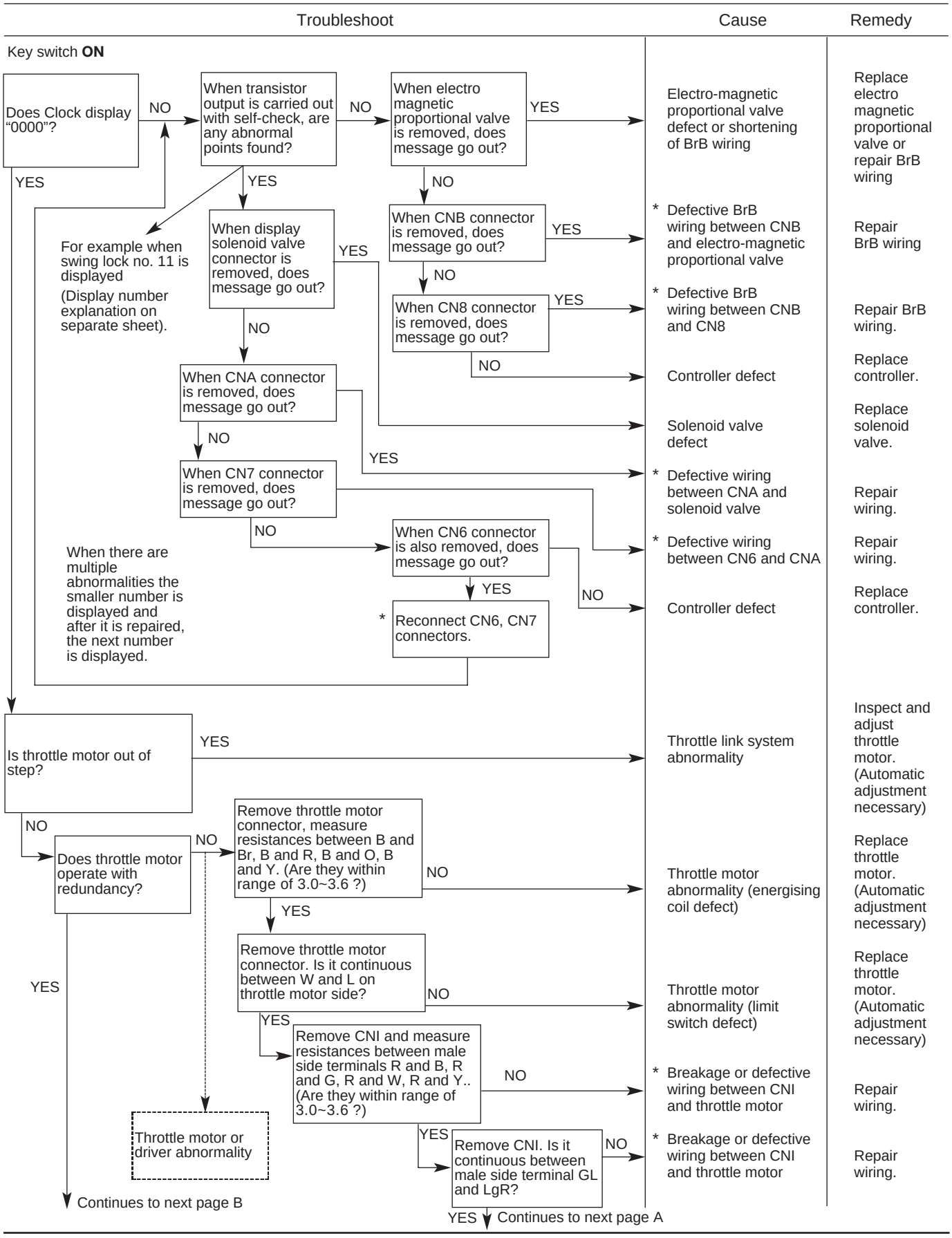
Note: *Message does not go out.*



Fault Diagnosis *(continued)*

Electrical System, Message Fault, Problem No. 10 *(continued)*

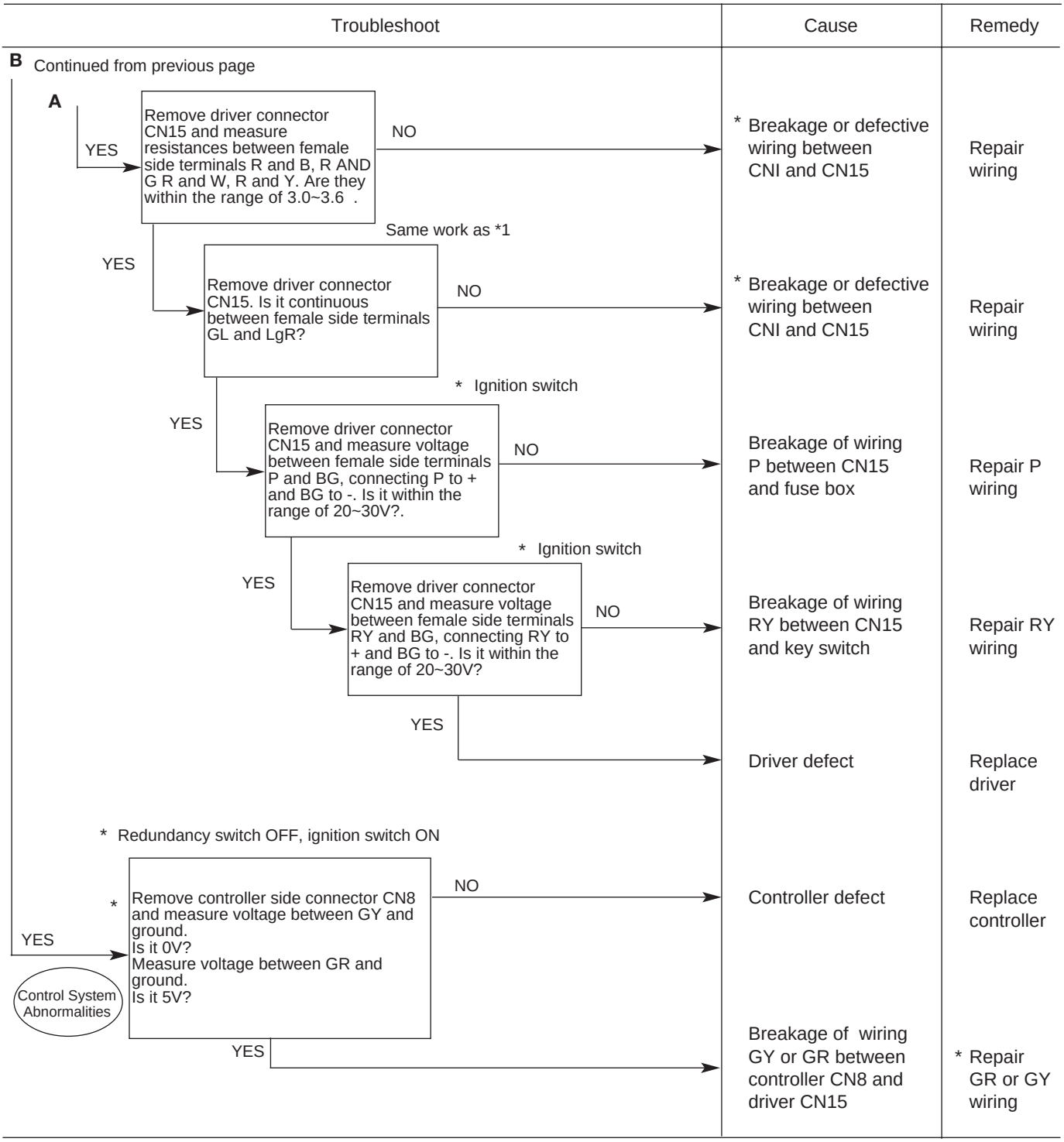
Note: *Message does not go out.*



Fault Diagnosis *(continued)*

Electrical System, Message Fault, Problem No.10 *(continued)*

Note: *Message does not go out.*



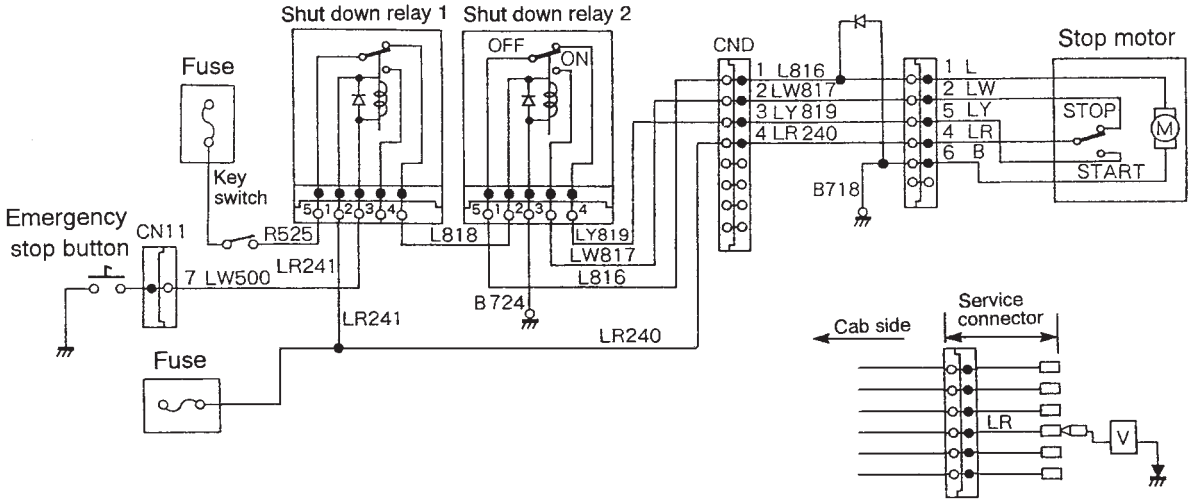
Fault Diagnosis *(continued)*

Engine Trouble, Problem No 11

Note: *Engine does not start even though the message "electrical system abnormal" is not displayed.*

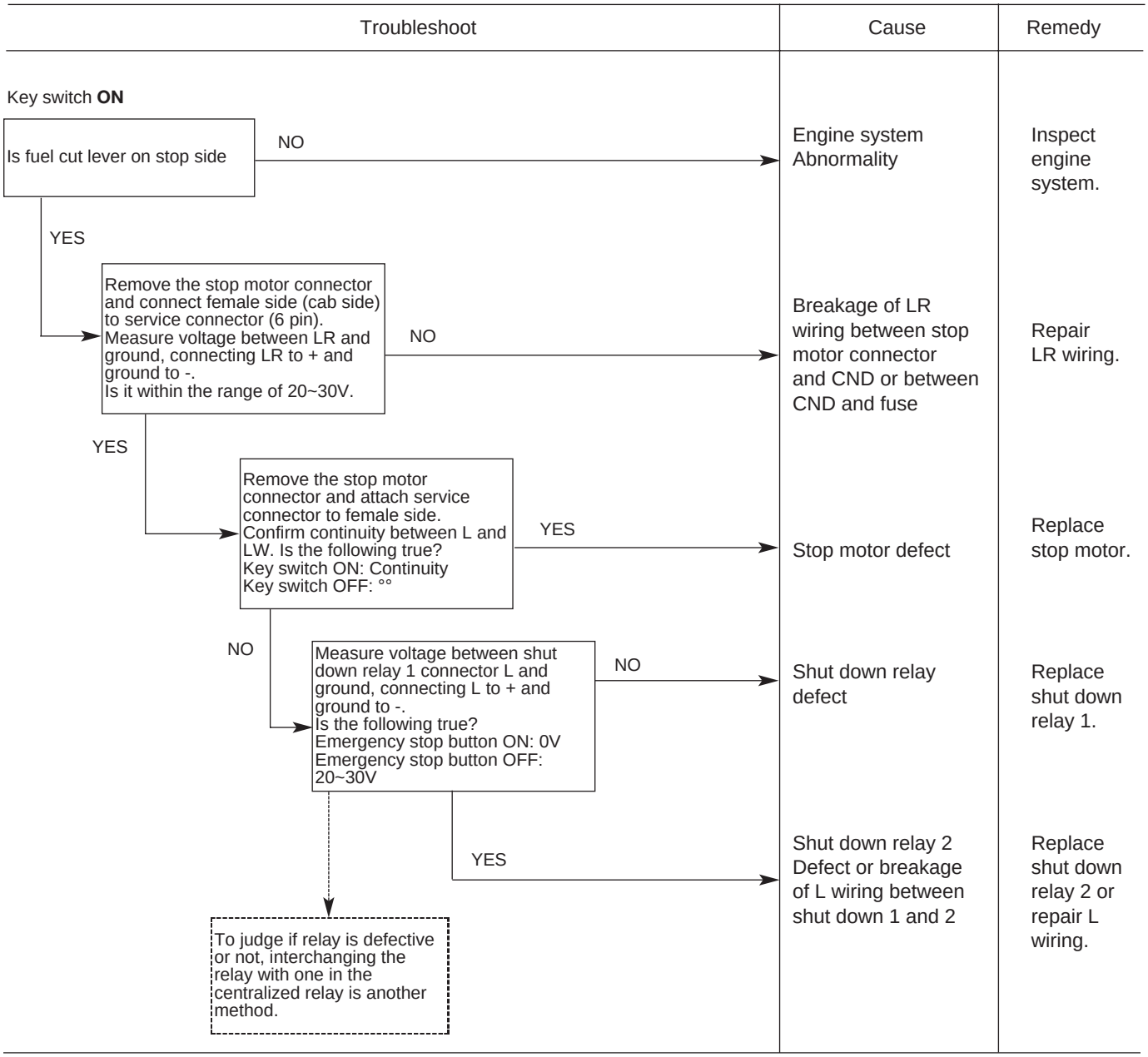
Prior Confirmation
Items

* ● No abnormalities in engine or fuel system.
* ● Fuse is not blown.
* ● The message "Engine emergency stop" is not displayed.
* ● Redundancy switch is **OFF**.
* ● Starter motor rotates and engine is cranking.



Fault Diagnosis *(continued)*

Engine Trouble, Problem No 11 *(continued)*



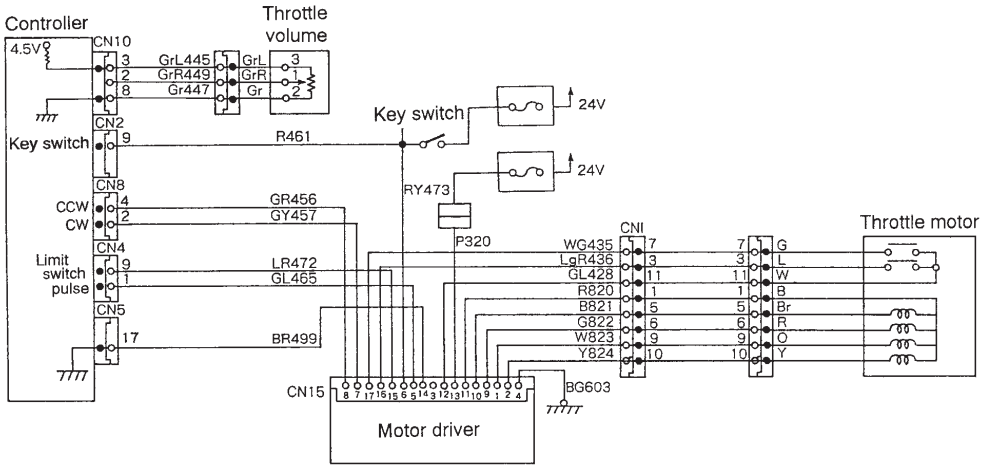
Fault Diagnosis *(continued)*

Engine Problem, Problem No 12

Note: *Engine revolutions do not change with throttle volume control.*

Prior Confirmation Items

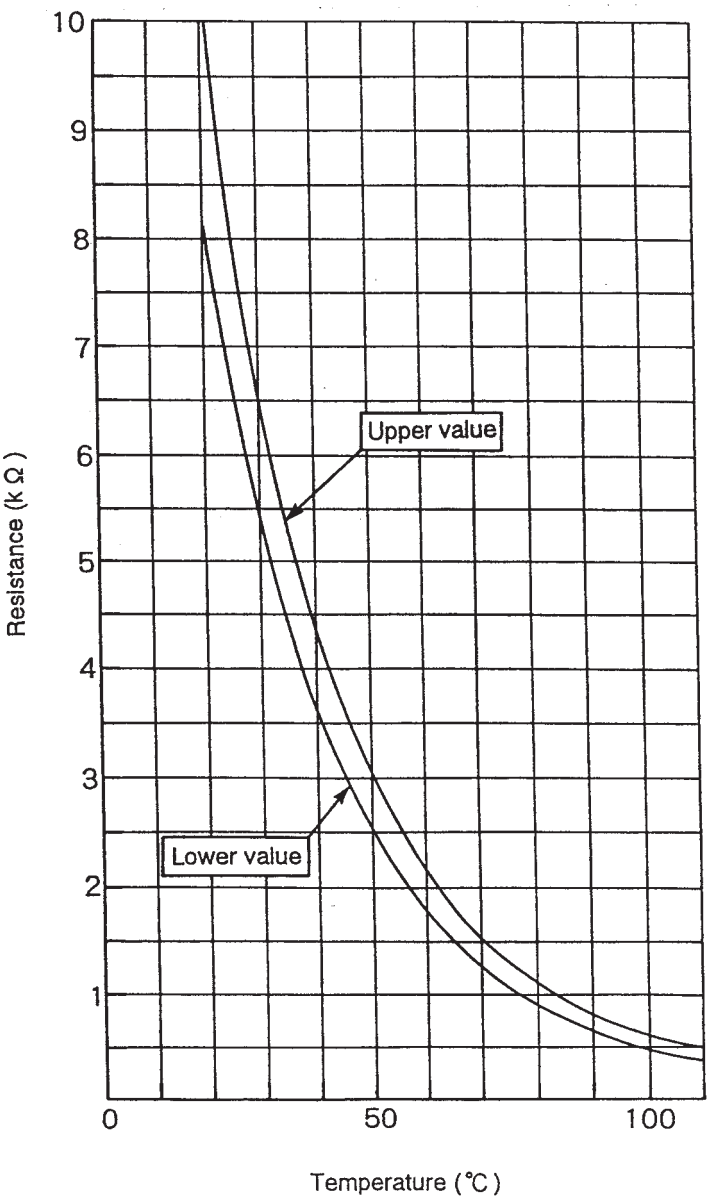
1. The message "Engine emergency stop" is not displayed.



Troubleshoot	Cause	Remedy
Key switch **ON**		
Change voltage moving throttle volume with self-check. Is it within the range of 0~4.5V? — NO → Without removing CN10 connector, change the voltage between GrR + and Gr - moving the throttle volume. Is it within the range of 0~4.5V? — YES →	Controller defect or bad connection of CN10 connector	Replace controller or clean CN10 connector terminal.
YES → Remove throttle volume connector, measure resistance between throttle volume side connector GrR and GrL. Is it within the range of 0~1 ? — NO →	Throttle volume defect.	Replace throttle volume.
YES → Remove throttle volume connector, measure resistance between throttle volume side connector GrR and Gr. Is it within the range of 0~1 ? — NO →	Breakage or shortening of one of the wirings, GrL, GrR, Gr between CN10 and throttle volume	Repair of the GrL, GrR, Gr.
YES → Check motor transmitted pulse by self-check. Is it within the range of 500~1023? — YES →	Controller defect	Replace controller.
NO → Remove controller CN4 and driver CN15. Is GL wiring continuous? — NO →	Breakage of GL wiring	Repair GL wiring
Even though the throttle motor is moving. — YES →	Driver defect	Replace driver.

Sensor Resistance Valve

Water temperature (Oil temperature)	Minimum	Maximum
20°C	8.00k	10.20k
30°C	5.35k	6.50k
40°C	3.60k	4.55k
50°C	2.50k	3.10k
60°C	1.70k	2.20k
70°C	1.20k	1.55k
80°C	0.85k	1.15k



Diagnostics for CAPS II Controllers

The diagnostic capabilities of the present CAPS II system have been improved to include facilities for storing information on intermittent faults occurring in the electrical system and machine performance data .

The original diagnostic capabilities included facilities to check the following:

CH : MN	Machine Model Code
CH : RPM	Engine R.P.M
CH : PWM	Milliamps Supplied To Hydraulic Pump
CH : PLS	Throttle System Pulse Count
CH : OS	Hydraulic Oil Temperature
CH : WS	Water Temperature
CH : FS	Resistance Of Fuel Level Sensor
CH : TV	Throttle System Voltage
CH : TR	Transistor Output Check †
CH : PS	Pressure Switch Output Check

† The controller can check the outputs to the main relays / solenoids and test for short circuit.

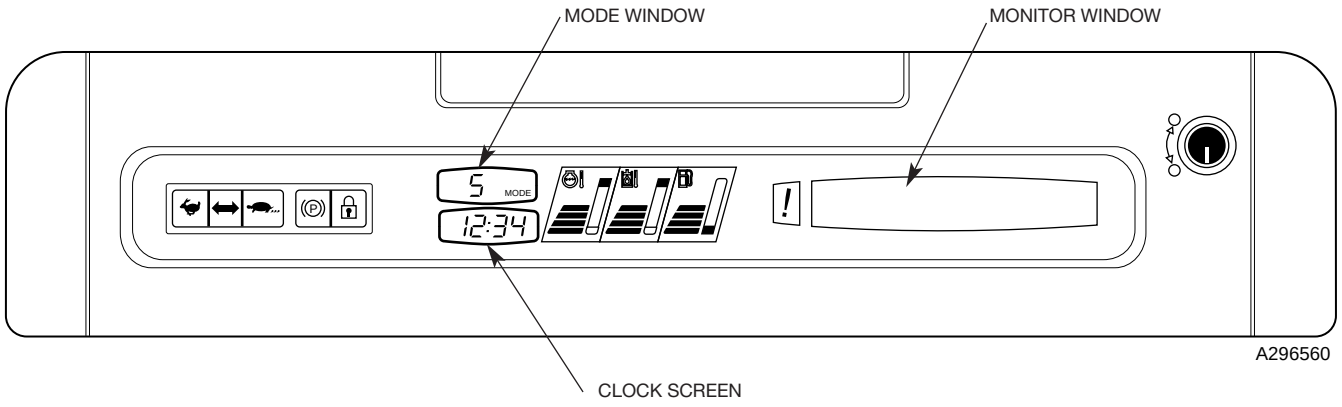
This system was limited by the fact that all checks are instantaneous and no facility existed for storing information on intermittent faults. If the ignition was switched off the controller would reset itself and the fault if intermittent would no longer be present, this can make fault diagnosis very difficult.

Improvements to Diagnostic System

The stage II system retains all of the previous functions of the original system with the addition of two DATA LOGGING channels with the denominations channel 3 and channel 4.

Channel 3: Monitors and stores information on the electrical system.
Channel 4: Monitors and stores information on machine performance.

This system is accessed using the same setup buttons used on the previous system to reprogram the controller and as before, the items to be checked appear in the monitors displays.



Channel 3 electrical system abnormalities

Channel 3 will monitor and store information on the following functions:

Computer reset (engine stop due to electrical interference)
If the computer signal is subject to electrical interference it will shut down the engine as it tries to reset the controller and throttle motor, this function will record any instances of this happening confirming that this was the cause of the problem.

Throttle motor limit switches
The throttle motor relies on information gained from the limit switches. This function will record any instances of the lower limit switch either not operating or operating twice, either of these would cause a throttle system failure. The previous system would only display `ELECTRICAL PROBLEM´. This system will record the number of times that an abnormality occurs with the throttle motor limit switches again confirming that this was the cause of the problem.

Electrical system abnormalities
This function will record any electrical faults occurring on the main solenoids and relays, showing that a fault had occurred with a particular solenoid or relay, even if no fault was evident when fault finding.

Intermittent electrical contact
This function will indicate any electrical services which experience intermittent electrical contact.

Air filter clogged
This will record the engine hours at which any air filter clogged messages were received by the controller.

Channel 4 machine performance data

Channel 4 will monitor and store information on the following machine performance:

Hour meter
The controller will store a back up reading of engine hours in case of failure or unauthorised tampering with the hour meter in the cab.

Machine actual working hours
The controller will store the actual hours a machine has been working as opposed to hours the engine has been running, this can give a clearer indication of actual component life.

Machine working modes
The controller will store the amount of hours the machine has been working in each of the four working modes.

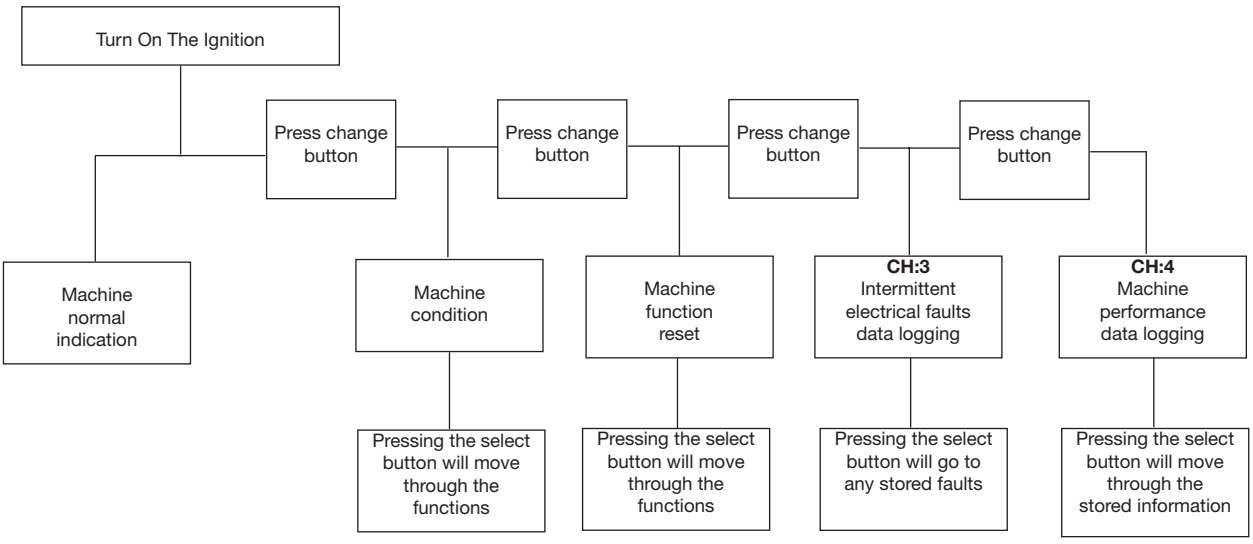
Travel/Swing / excavating / hammering operations
The controller will store the amount of hours that a machine has been performing each of these functions.

Engine coolant / hydraulic oil temperature
The controller will record how many hours a machine has been operating at a specific coolant or hydraulic oil temperature, it will also record the maximum temperature reached by the engine coolant and hydraulic oil.

Engine RPM
The controller will record how many hours the engine has been operating at specific engine rpm's.

Key Switch ON / OFF;
The controller records how many times the key switch has been turned on.

One touch idle/ auto idle
The controller records the frequency of use of these functions.

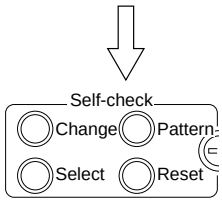


To read stored information on channel 3

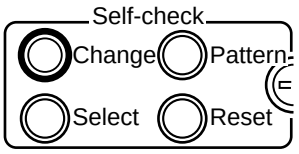
1 Remove redundancy buttons cover.

2 Switch on the ignition.

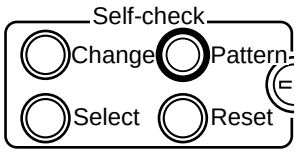
Cover installation screws x 2



3 Press the change button once.

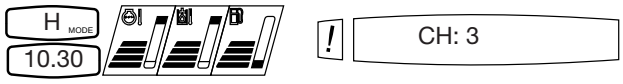


4 Press the pattern button twice.



5 Set the working mode to H mode.
If the monitor now gives 3 beeps this is to indicate that no faults have occurred and therefore no information has been stored.

If the monitor does not give 3 beeps then one or more faults have occurred and been stored.



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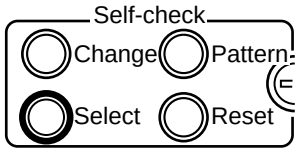
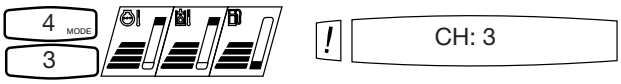
6 Press the select button once.



7 The monitor will now display the first numerical fault code.

Make a note of the numerical codes in the mode screen clock screen and message window (refer this to data sheet for channel 3).
Press the select button again, if a second fault has been stored, the monitor will display the fault codes for this fault.
If no second fault has been stored then the display will return to the clock time and mode indication.



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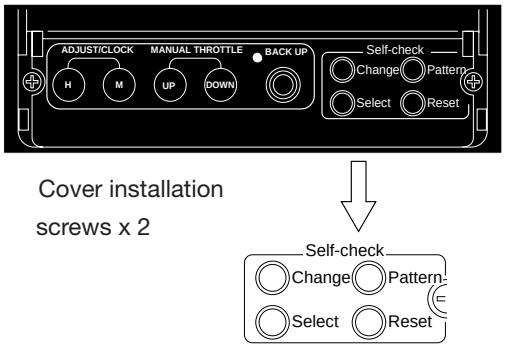
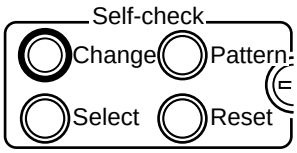
To Read stored information on channel 4

1 Remove redundancy buttons cover.

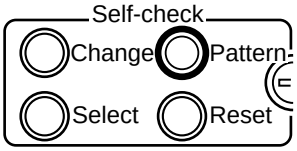


2 Switch on the ignition.

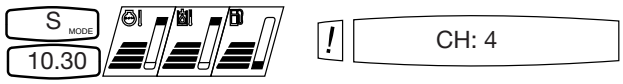
3 Press the change button once.



4 Press the pattern button three times.



5 Set the working mode to S mode.



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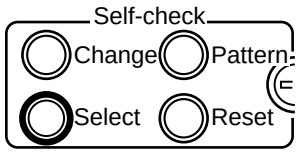
6 Press the select button once.



7 The monitor will now display the first numerical performance measurement.

Make a note of the numerical codes in the mode screen, clock screen and message window refer to the attached performance logging pages (10 - 8 and 10 - 9).

Press the select button again to read the second code and record this, continue until all of the codes have been recorded.

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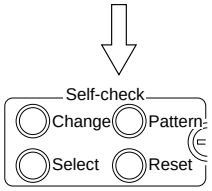
To Reset Stored Information

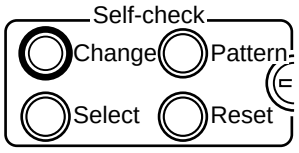
1 Remove redundancy buttons cover.

Cover installation screws x 2

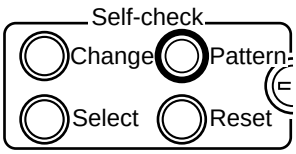


2 Switch on the ignition.

3 Press the change button once.



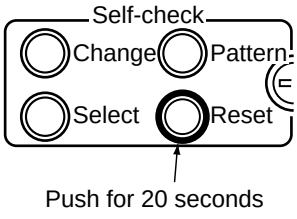
4 To reset channel 3 press the pattern button twice, to reset channel 4 press the pattern button three times.



5 Press and hold the reset button for 20 seconds. The buzzer will sound after 20 seconds to indicate that the channel has been reset.

6 Switch off the ignition.

IMPORTANT: REPROGRAMMING THE CONTROLLER WILL NOT RESET THE INFORMATION STORED ON CHANNEL 3 AND CHANNEL 4.



Calculating max. engine water temperature reached and max. hydraulic oil temperature reached

The values given in channel 4 monitor window 8, mode window 9, clock screen value X are digital values and need to be converted to a temperature value using the formula.

$$\text{Resistance} = \frac{1000 \times \text{value X}}{255 - \text{value X}}$$

This resistance value will then relate to a temperature on the temperature graph on the following page.

FOR EXAMPLE:

The value given for the max engine water temperature reached is 95
Using the formula

$$\text{Resistance} = \frac{1000 \times \text{value X (which is 95)}}{255 - \text{value X (which is 95)}}$$

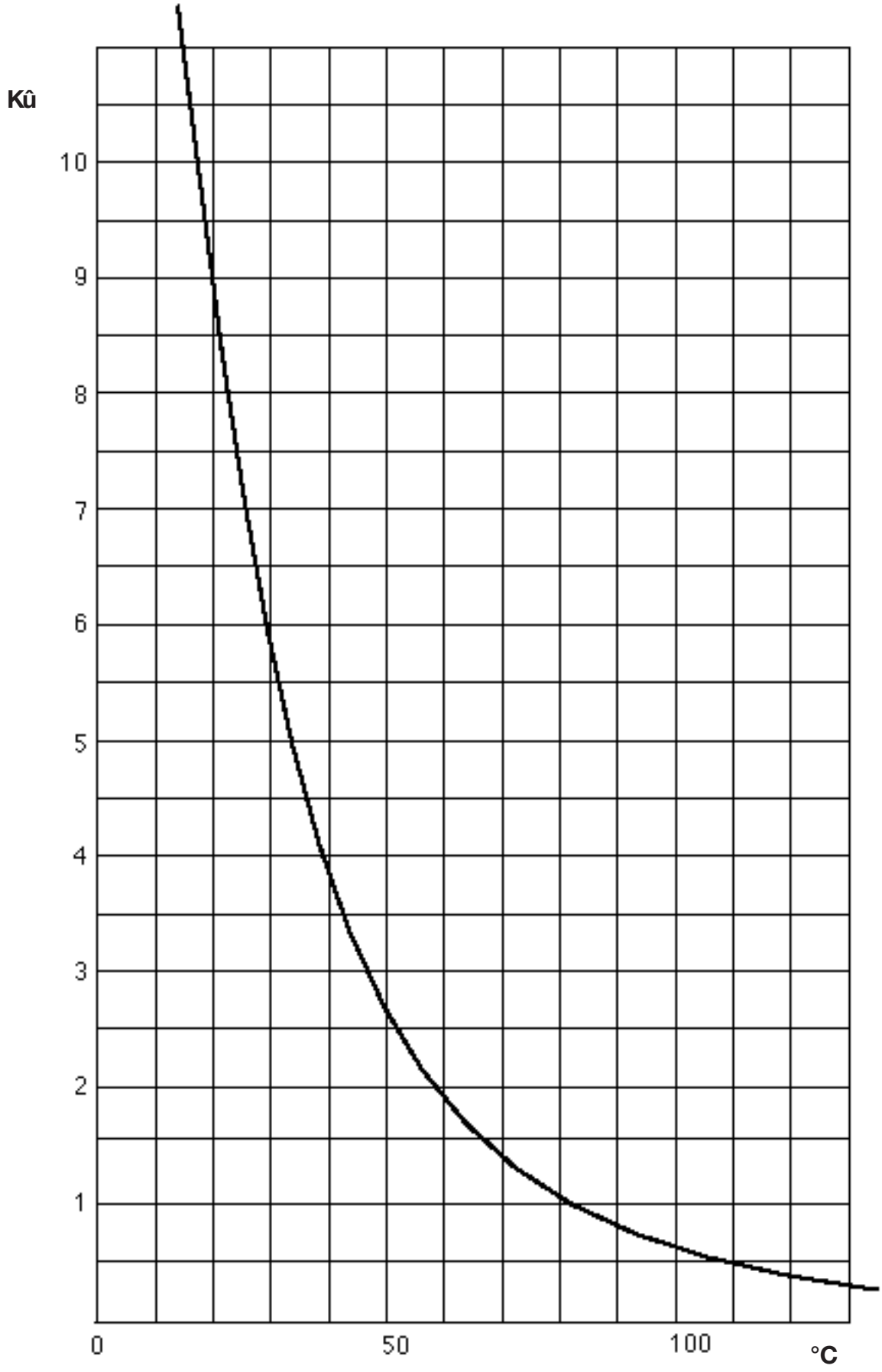
therefore:

$$\text{Resistance} = \frac{1000 \times 95}{255 - 95}$$

$$\text{Resistance} = \frac{95000}{160} = 593.75 \text{ ohms}$$ (Remember 1kû = 1000 û.)

Relating this value to the temperature graph on the following page gives a temperature of 97°c
Therefore max temperature reached by engine water is 97°c

This procedure is the same for calculating max. temperature reached by hydraulic oil.


Kû
10
9
8
7
6
5
4
3
2
1
0
50
100
°C

Channel 3: Service Text

SELECT SWITCH (*1)	MONITOR WINDOW	MODE WINDOW	CLOCK WINDOW INDICATION ITEM		Unit/ Indication
	CH; 3	H, S, L or F	Hour meter	Initial indication	hour
		1	Computer reset (Engine stop)	Wrong earth	Numbers (occurrence)
		2	Electric system abnormality (1)	Limit SW ON = 0 time	Numbers (")
		3	Electric system abnormality (2)	Limit SW ON = 2 time	Numbers (")
		4	Electric system abnormality (3)	CN6-12 Free swing sol. V	1
				CN6-4 2- stage relief sol. V	2
				CN6-11 Travel alarm	3
				CN6-3 Lever lock sol V	4
				CN6-10 Swing shut off sol.V	5
				CN6-2 Spare	6
				CN6-9 Spare	7
				CN6-1 Spare	8
				CN6-8 Boom lowering speed regulation sol. V	9
				CN6-16 Warning lamp	10
				CN6-7 Swing lock sol. V	11
				CN6-15 Max. flow cut sol. V	12
				CN6-6 Soft/hard change sol. V	13
				CN6-14 Spare	14
				CN6-5 Spare	15
				CN6-13 Negative control sol. V	16
				CN7- 2 Battery relay	17
				CN7-6 Heating relay	18
				CN7-3 Swing brake sol. V	19
				CN7-7 Travel 2 speed change sol. V	20
		7	Wrong electrical contact (digital signal) see 10-9		
		6(*)	Short, Break and Wrong electrical contact (analog system) **A B C D** **A:** Sub-No. **B:** Short or Not **C:** Break or not **D:** Wrong electrical contact or not	1 CN10-13 Eng. rotation sensor	1 0 1 1
				2 CN10-8 Throttle volume	2 0 0 1
				3 CN10-11 Fuel sensor	3 1 1 1
				4 CN10-12 Water temp. sensor	4 1 1 1
				5 CN10-6 Oil temp. sensor	5 1 1 1
		8	Air cleaner clogged	The time the fault was logged	

(*1) If there is no trouble, the computer buzzes for 3 seconds and retains the initial indication.
(*2) Computer can not detect the following items:
Short of Engine rotation sensor.
Short or break of throttle volume.

Channel 3: Service Text (continued)

SELECT SWITCH (*1)	MONITOR WINDOW	MODE WINDOW	CLOCK WINDOW INDICATION ITEM		Unit/ Indication
	CH; 3	7	Wrong electrical contact (digital Signal)	CN2-10 Battery Level sensor	1
				CN2-3 Lever lock	2
				CN2-8 Battery charge	3
				CN2-2 Emergency shut down	4
				CN2-7 Spare	5
				CN2-1 Spare	6
				CN2-13 Spare	7
				CN3-9 S-mode switch	8
				CN3-4 H-mode switch	9
				CN3-8 L-mode switch	10
				CN2-6 F-mode switch	11
				CN2-12 Change switch	12
				CN2-5 Pattern switch	13
				CN2-11 Select switch	14
				CN2-4 Reset switch	15
				CN3-3 Hard/soft change switch	16
				CN3-7 Spare	17
				CN3-6 Warning switch	18
				CN3-2 Auto-idle switch	19
				CN3-5 Over heat switch (oil)	20
				CN3-1 Over heat switch (Water)	21
				CN4-9 Limit switch (throttle motor)	22
				CN4-4 Travel 2 speed change switch	23
				CN4-8 Buzzer stop switch	24
				CN4-3 One touch idle switch	25
				CN4-7 Lever lock switch	26
				CN4-6 Swing lock switch	27
				CN4-2 Spare	28
				CN4-5 2 stage relief switch	29
				CN5-13 Spare	30
				CN5-12 Engine oil pressure switch	31
				CN5-4 Horn switch	32
				CN5-11 Spare	33
				CN5-3 Spare	34
				CN5-10 Spare	35
				CN5-9 Spare	36
				CN7-1 Air filter	37
				CN7-4 Reserve tank switch	38
				CN7-5 Engine oil filter	39

Channel 4: Performance logging sheet

SELECT SWITCH	MONITOR WINDOW	MODE WINDOW	CLOCK WINDOW INDICATION ITEM	VALUE
0	CH; 4	H, S, L or F	Time	
1	1	H, S, L or F	Hour Meter	
2	2	H, S, L or F	Machine actual working hours	
3	3	1	Hours spent in S Mode	
4	3	2	Hours spent in H Mode	
5	3	3	Hours spent in L Mode	
6	3	4	Hours spent in F Mode	
7	4	H, S, L or F	Travel hours	
8	5	H, S, L or F	Swing hours	
9	6	H, S, L or F	Excavating hours	
10	7	H, S, L or F	Hammer hours	
11	8	1	Water temperature 1st bar hours	
12	8	2	Water temperature 2nd bar hours	
13	8	3	Water temperature 3rd bar hours	
14	8	4	Water temperature 4th bar hours	
15	8	5	Water temperature 5th bar hours	
16	8	6	Water temperature 6th bar hours	
17	8	7	Water temperature 7th bar hours	
18	8	8	Water temperature 8th bar hours	
19	8	9	Water max. temperature reached †	
20	9	1	Oil temperature 1st bar hours	
21	9	2	Oil temperature 2nd bar hours	
22	9	3	Oil temperature 3rd bar hours	
23	9	4	Oil temperature 4th bar hours	
24	9	5	Oil temperature 5th bar hours	
25	9	6	Oil temperature 6th bar hours	
26	9	7	Oil temperature 7th bar hours	
27	9	8	Oil temperature 8th bar hours	
28	9	9	Oil max. temperature reached †	
29	10	1	Engine rpm below 1000 rpm hours	
30	10	2	Engine rpm 1000 - 1200 rpm hours	
31	10	3	Engine rpm 1200 - 1400 rpm hours	
32	10	4	Engine rpm 1400 - 1600 rpm hours	
33	10	5	Engine rpm 1600 - 1800 rpm hours	
34	10	6	Engine rpm 1800 - 2000 rpm hours	
35	10	7	Engine rpm 2000 - 2200 rpm hours	
36	10	8	Engine rpm above 2200 rpm hours	
37	11	H, S, L or F	Ignition switch ON/OFF No. of times operated	
38	12	H, S, L or F	One touch idle No. of times operated	
39	13	H, S, L or F	Auto idle No. of times operated	

† Remember this is a digital value and must be converted to a temperature using the equation on page 10-6.