

HYDRAULICS EXCAVATORS

POCLAIN

"988P & C"
powersensor

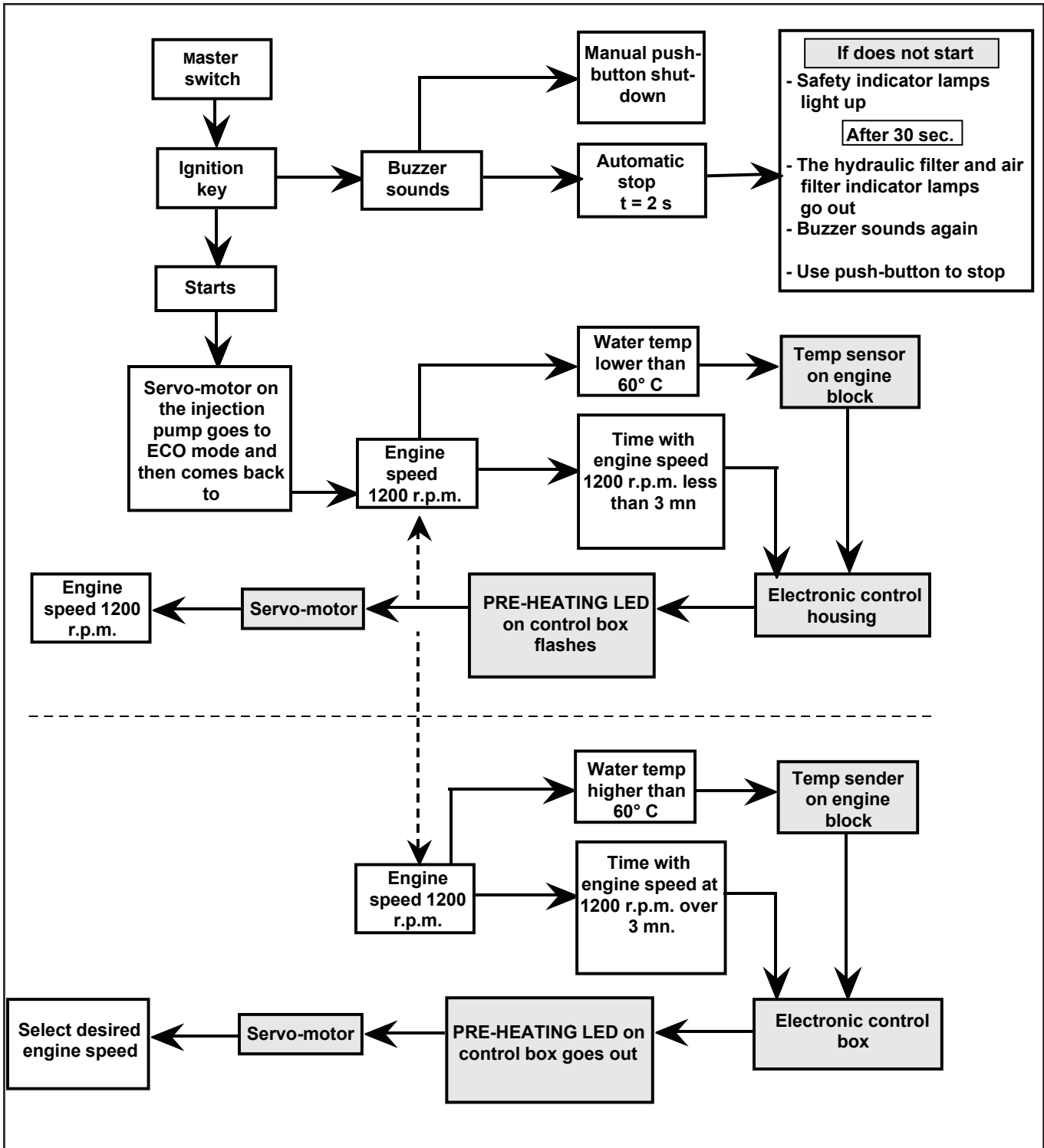


BASIC PRINCIPLES FOR ELECTRONICALLY ASSISTED SYSTEMS

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BASIC PRINCIPLES FOR ELECTRONICALLY ASSISTED SYSTEMS

ASSISTANCE FOR STARTING



BASIC PRINCIPLES FOR ELECTRONICALLY ASSISTED SYSTEMS

ASSISTANCE FOR STARTING

PURPOSE:

When the engine is switched on, the system provides:

- A pre-opening of the injection pump
- Automatic return of injection pump to the high idle position.

WORKING PRINCIPLES

- When the system is switched on using the ignition key, the buzzer sounds. The buzzer stops automatically after two seconds.

- If the engine does not start, the following warning lamps come on:

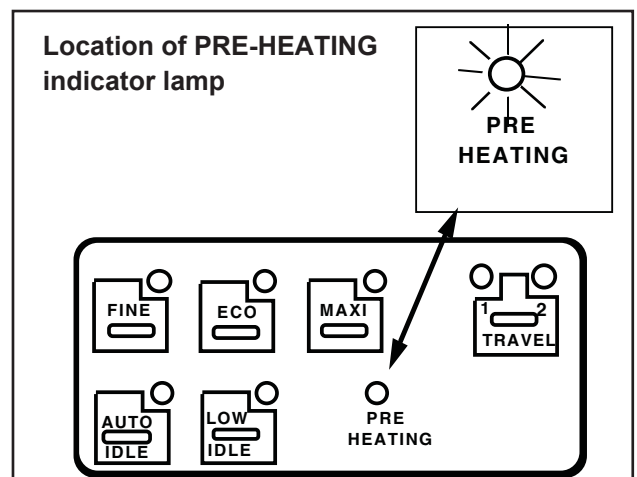
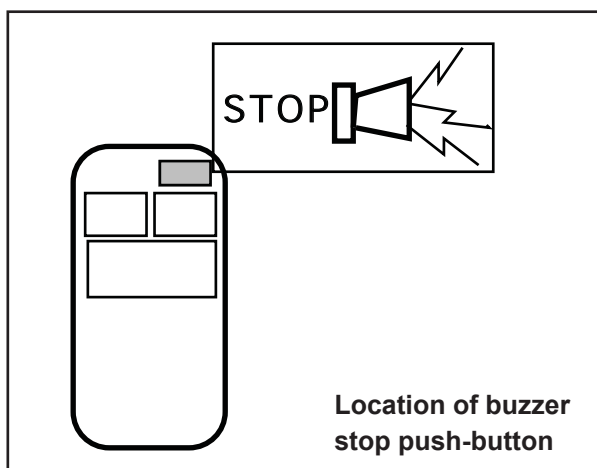
battery charge, engine oil pressure, minimum pilot pressure, air filter and oil filter restriction warning.

After 30 seconds, the last two warning lamps go out and the buzzer sounds (the buzzer can be turned off by the push-button on the instrument panel)

- If the engine starts, the injection pumps servo-motor is in the "ECO" mode, which then changes to an engine speed equal to 1200 rpm (high idle).

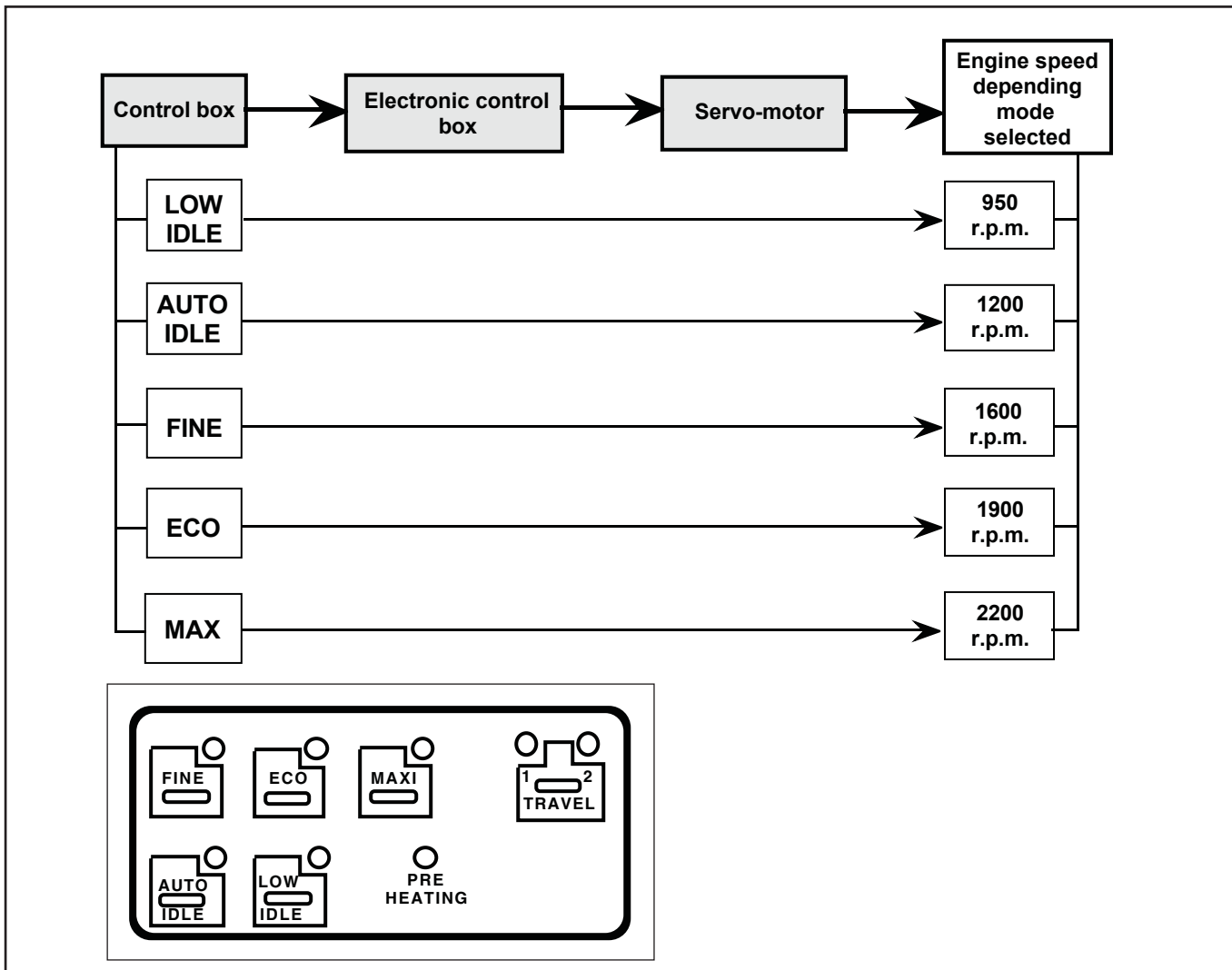
- if the engine coolant water temperature is lower than 60°C or if the time that the motor runs at 1200 rpm is less than 5 minutes, the electronic system will not permit changing to the **FINE**, **ECO** or **MAX** modes.

This is indicated by the **PRE-HEATING** indicator which has a flashing indicator lamp (LED).



BASIC PRINCIPLES FOR ELECTRONICALLY ASSISTED SYSTEMS

ELECTRIC ACCELERATION (AFTER ASSISTANCE WITH STARTING)



PURPOSE

To set the correct engine speed in accordance with the MODE selection made by the operator.

It provides the following :

• 2 idle modes

- **LOW IDLE** is the low idle speed at 950 rpm.
- High idle (**1200 rpm**) cannot be selected and is only obtained automatically during assistance with starting when selecting **AUTO-IDLE** function (see page 1.5.00)

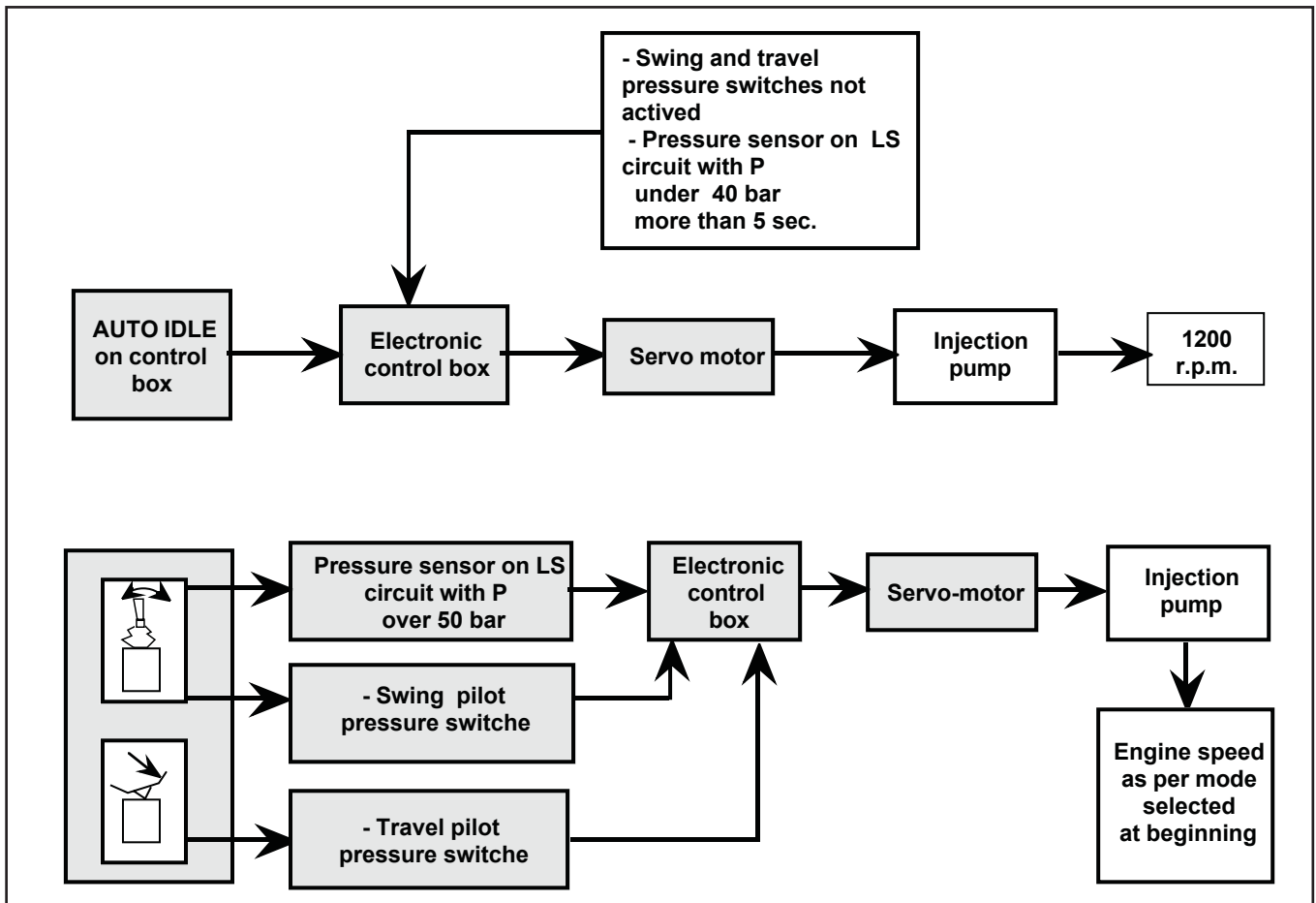
• 3 work modes

- **FINE: 1600 rpm** for low output work, and for handling
- **ECO: 1900 rpm**, economical digging is possible
- **MAX: 2200 rpm**, maximum power, hard work

The mode is selected at the control box which informs the electronic control box. This sends a signal to the servo-motor which is directly connected to the injection pump lever. In this way engine speed is obtained in accordance with the selected mode.

BASIC PRINCIPLES FOR ELECTRONICALLY ASSISTED SYSTEMS

AUTOMATIC RETURN TO IDLE (AUTO-IDLE MODE)



PURPOSE

Sets engine speed to idle when none of the various controls for excavator functions are activated. This applies whichever mode has been selected (**FINE**, **ECO** or **MAX**)

WORKING PRINCIPLES

- The LED lights up as soon as the **AUTO-IDLE** mode is selected to obtain automatic return to idle.
- When not operating any of the excavators functions, for a period of five seconds the swing and travel pressure switches must be not activated and the LOAD SENSING information line at a pressure lower than 40 bar.
- In that case, the electronic control box activates the injection pump's servo-motor and the **AUTO-IDLE** mode is obtained (idles at **1200 rpm**)
- When one or more of the controls is operated again, the engine returns to the speed of the mode which was previously selected (**FINE**, **ECO** or **MAX**).

This is because information is given to the control box in the following manner:

For attachment and options functions

- When the L-S information pressure sensor detects a pressure greater than **50 bar**

For the swing function

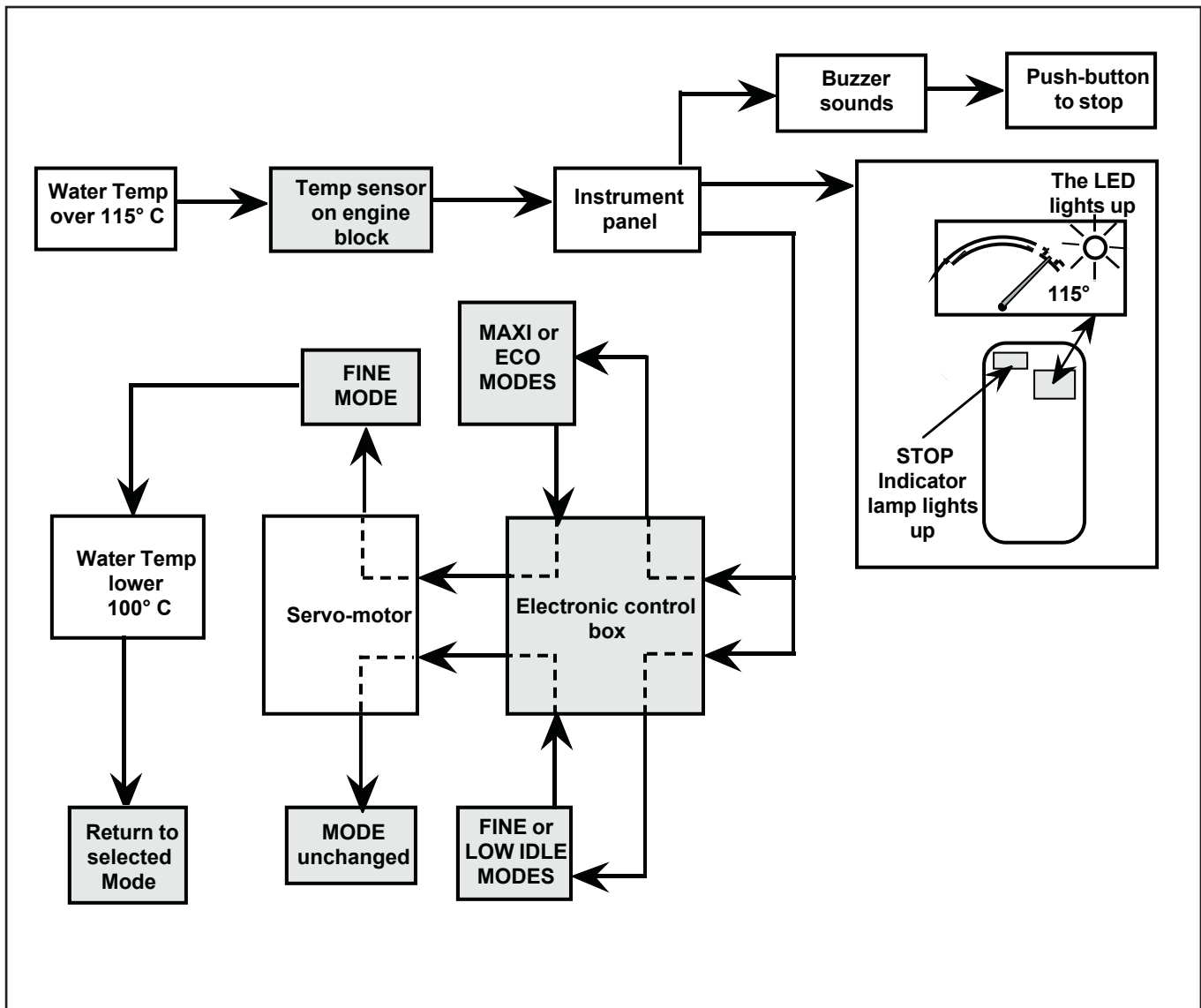
- When the pilot pressure switch receives a pressure information of 6 bar

For the travel function

- When the pilot pressure switch receives a pressure information of 6 bar or
- When the L-S information pressure sensor receives a pressure greater than **50 bar**

BASIC PRINCIPLES FOR ELECTRONICALLY ASSISTED SYSTEMS

ENGINE OVERHEATING SAFETY SYSTEM



PURPOSE

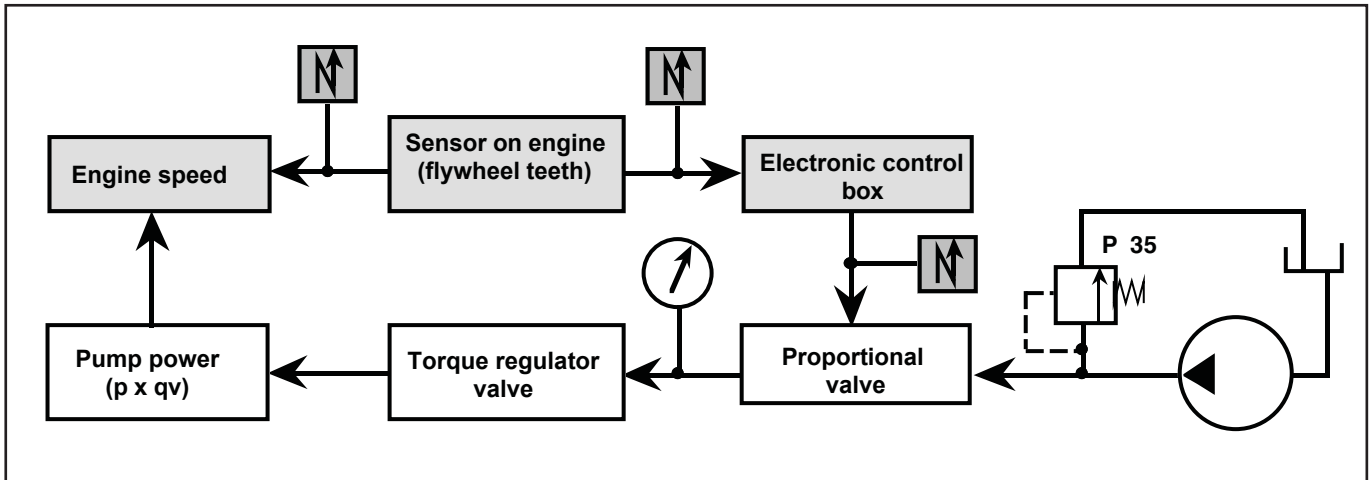
Safeguards the engine as regards temperature

WORKING PRINCIPLES

- If the engine coolant solution reaches a temperature in excess of 115°C, the sensor on the engine block gives information to the instrument panel
- The buzzer sounds (stopped by push-button)
- The stop warning lamp located at top left of instrument panel lights up.
- The engine temperature gauge needle is in the beginning of the second quadrant.
- The engine temperature gauge LED lights up.
- If the engine is in **ECO** or **MAX**, the information is transmitted to the electronic control box which reduces the engine speed to the **FINE mode** and the **"FINE" LED lights up**.
- If the engine is in **FINE** or **LOW IDLE**, there is no change
- As from a temperature threshold of 105°C, all modes can be selected again

BASIC PRINCIPLES FOR ELECTRONICALLY ASSISTED SYSTEMS

"SPEED-SENSING" SYSTEM



PURPOSE

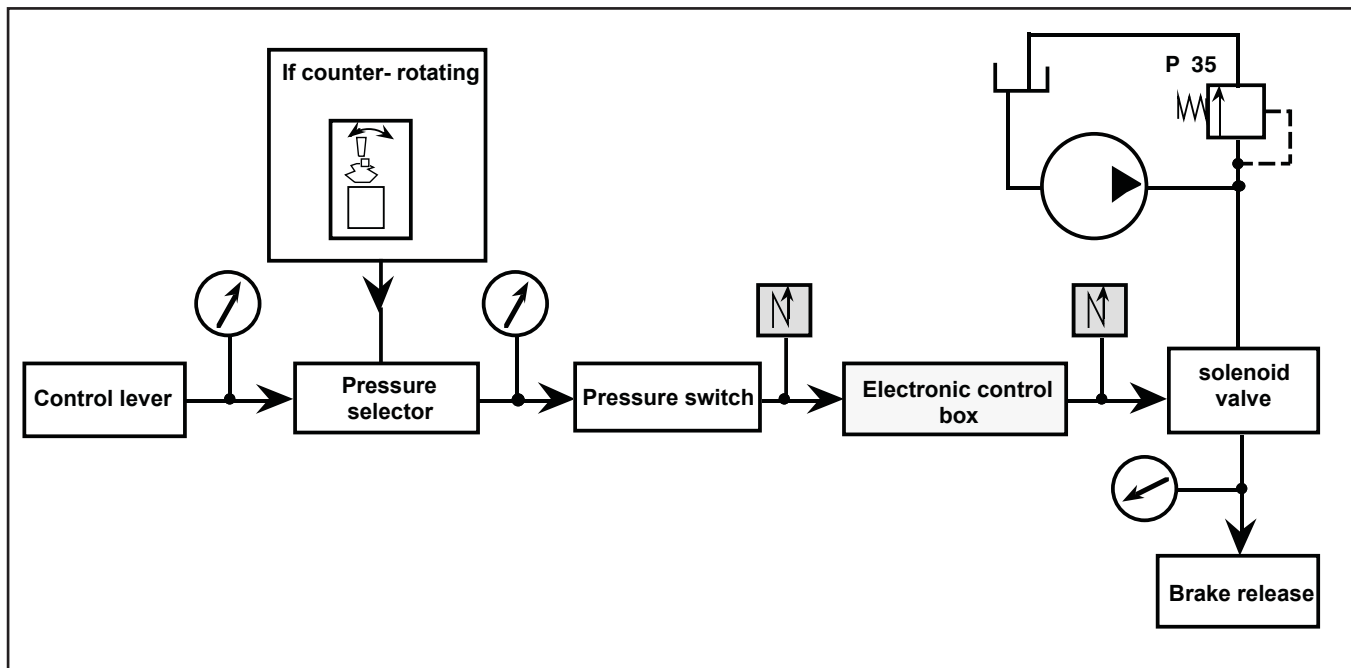
It maintains power balance between the available engine power and the demands of the hydraulic system, regardless of engine speed selected.

WORKING PRINCIPLES

- A sensor located on the teeth of the engine flywheel, detects engine speed and transmits it to the electronic control box.
- If the hydraulic power which has been consumed causes engine speed to fall, electric information coming from the electronic control box acts on a hydraulic proportional valve, fed by pressure from the hydraulic assistance circuit.
- Depending on the intensity of the signal received, which depends itself on the engine speed, this valve delivers a pilot pressure which acts on the torque regulator valve of the hydraulic pump, to reduce the flow supplied by the pump so that the hydraulic power consumed is in line with engine speed (depending on mode selected)

BASIC PRINCIPLES FOR ELECTRONICALLY ASSISTED SYSTEMS

UPPERSTRUCTURE SWING BRAKE RELEASE



PURPOSE

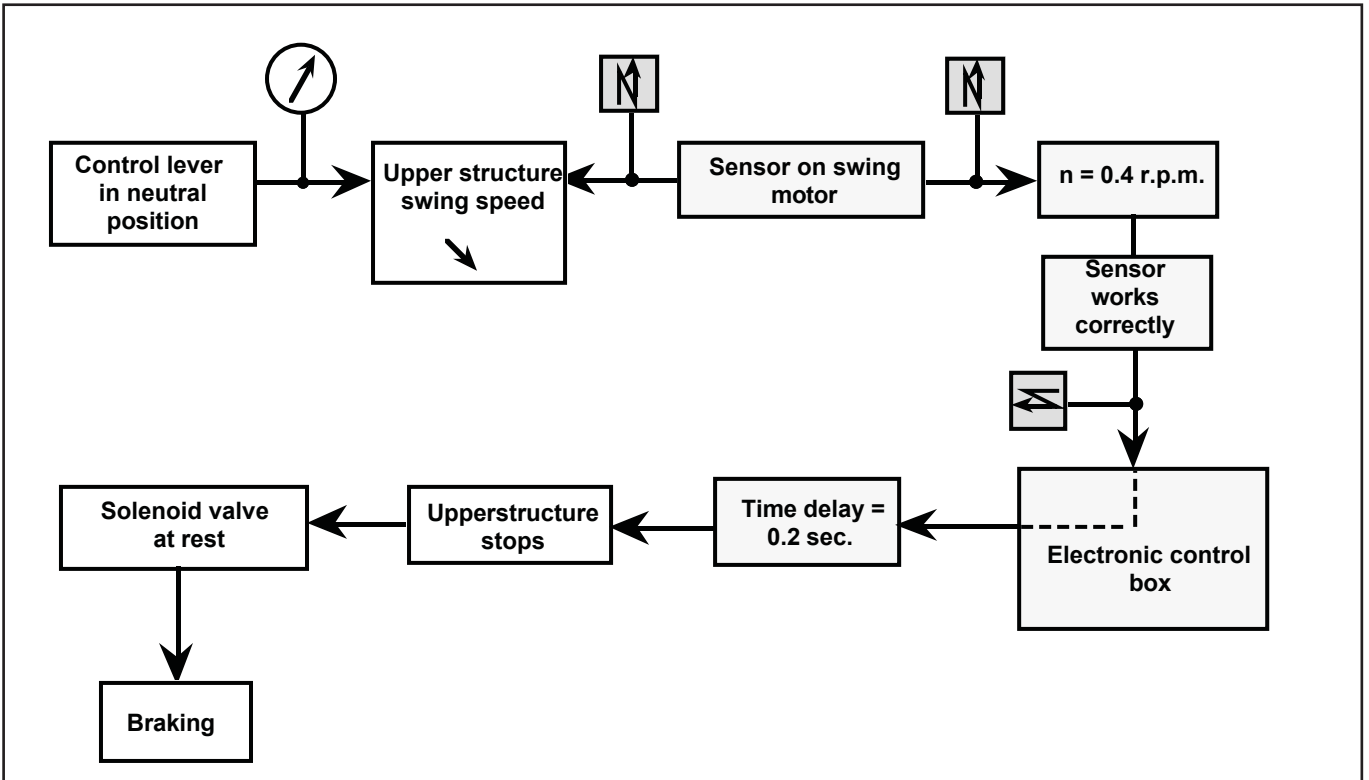
- Enables the upperstructure swing hydraulic motor brake release to take place

WORKING PRINCIPLES

- When the control lever is tilted, the pilot pressure actuates a pressure selector. The pressure selector closes a pressure switch which informs the electronic control box
- This in turn activates a solenoid valve, fed by the hydraulic assistance circuit pressure. This pressure arrives at the hydraulic motor brake and releases the brake.
- Since the hydraulic motor is being fed it drives the upperstructure round by means of a reduction gear
- When counter rotation takes place without stopping at the control lever neutral point, the pressure selector acts on the other side and informs the pressure switch which in turn informs the electronic control box and enables the brake to remain released.

BASIC PRINCIPLES FOR ELECTRONICALLY ASSISTED SYSTEMS

UPPERSTRUCTURE SWING BRAKE(Sensor on hydraulic motor working correctly)



PURPOSE

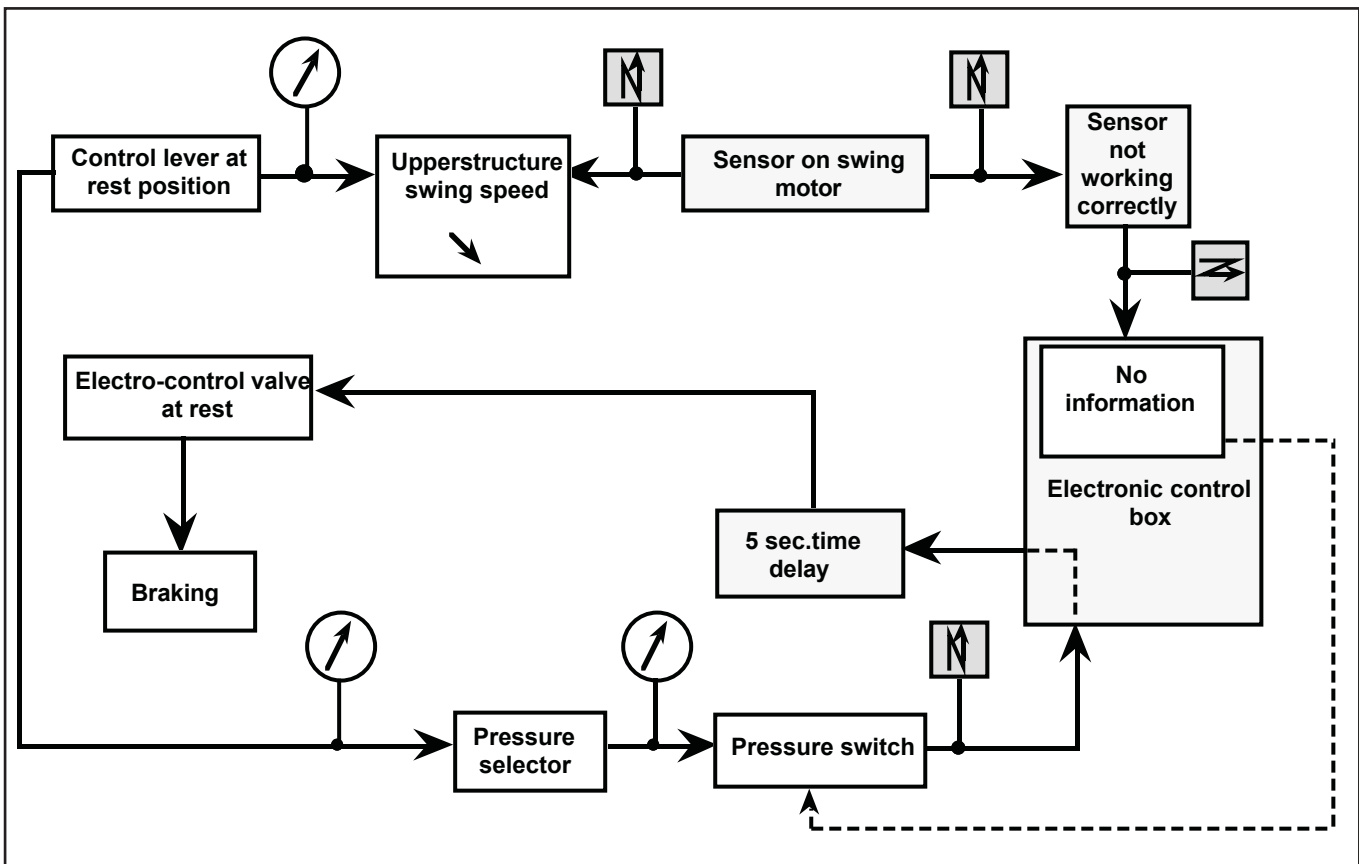
- Provides an optimum braking time for the upperstructure swing depending on its speed

WORKING PRINCIPLES

- When the control lever is at neutral position, the upperstructure decelerates
- At a speed less than **0.4 rpm**, the hydraulic motor sensor informs the electronic control box
- At that moment, a **0.2 seconds** time delay enables the solenoid valve to remain piloted so that the upperstructure can stop completely before applying the hydraulic motor brake.

BASIC PRINCIPLES FOR ELECTRONICALLY ASSISTED SYSTEMS

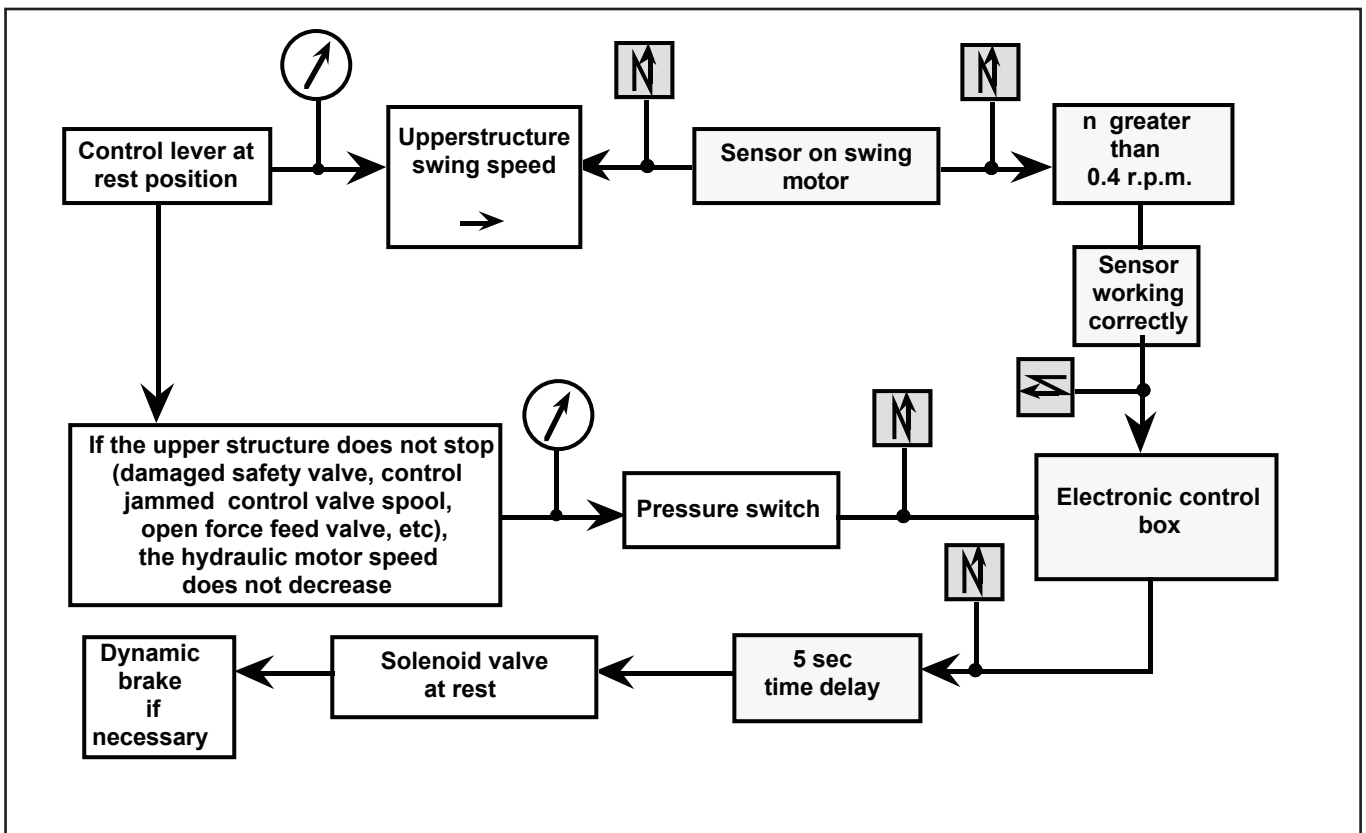
UPPERSTRUCTURE SWING BRAKE (sensor on hydraulic motor not working correctly)



- If the sensor is defective, when the control lever is released the upperstructure swing pilot circuit pressure switch informs the electronic control box which at that time imposes a **5 second time delay before disactivating the solenoid valve to provide braking**

BASIC PRINCIPLES FOR ELECTRONICALLY ASSISTED SYSTEMS

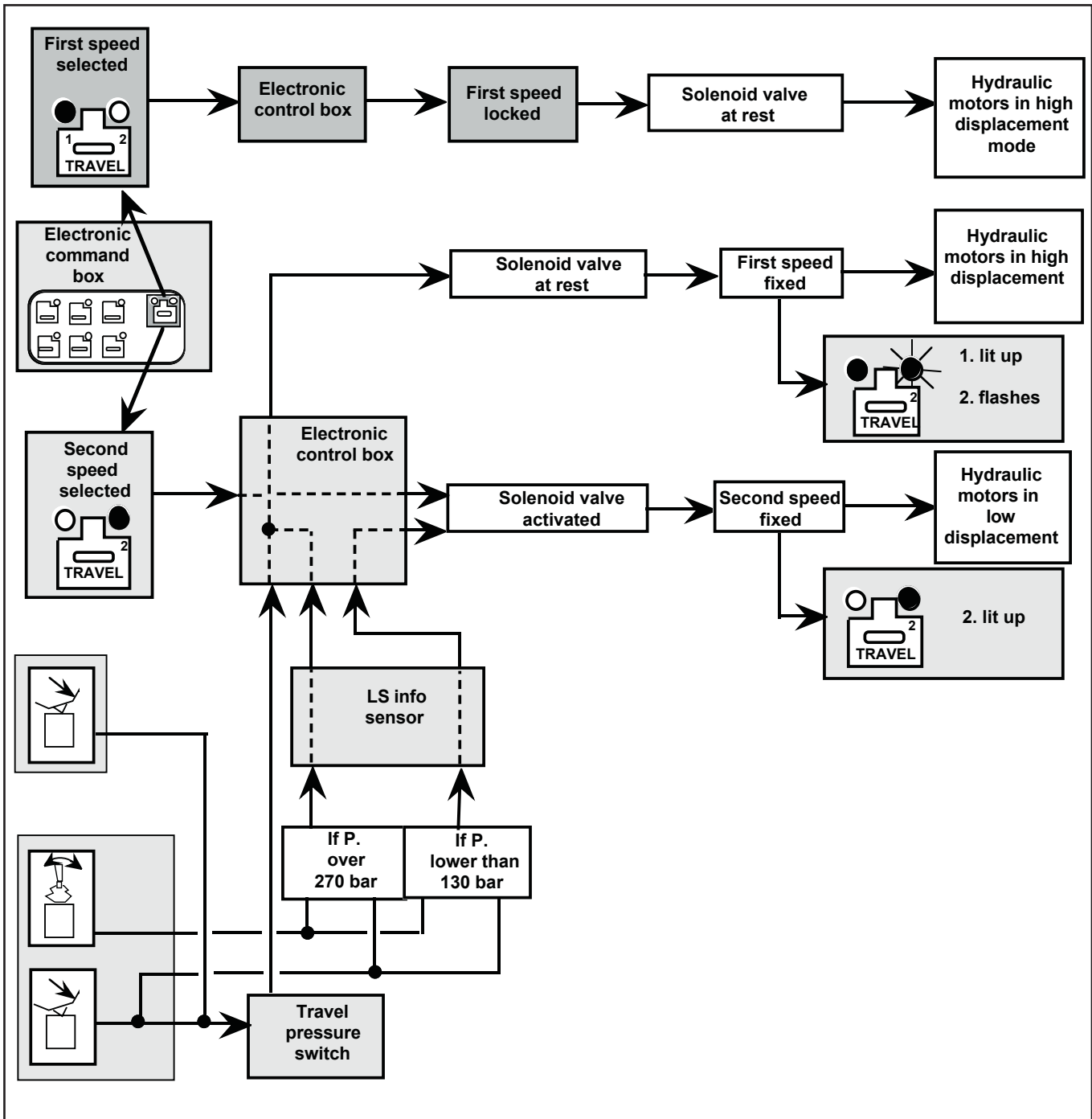
UPPERSTRUCTURE SWING BRAKE (Sensor is good but problems in hydraulic circuit operation)



- When there is a problem in the hydraulics (defective safety valve or force feed valve, or a control valve spool jammed, even though the control valve is at rest position, the upperstructure continues turning. The sensor which is still being informed, instructs the electronic control box to perform brake release. But the pressure switch is not being activated. This means that braking * takes place after a time delay of **5 seconds** (* which can be dynamic braking)

BASIC PRINCIPLES FOR ELECTRONICALLY ASSISTED SYSTEMS

AUTOMATIC TRAVEL SEQUENCES (TWO-SPEED C EXCAVATORS)



BASIC PRINCIPLES FOR ELECTRONICALLY ASSISTED SYSTEMS

AUTOMATIC TRAVEL SEQUENCES (TWO-SPEED C EXCAVATORS)

PURPOSE

- **The TRAVEL 2 mode** enables the high speed position and automatic speed change to be obtained by reading LOAD SENSING information circuit pressures and the travel pilot pressure (activated pressure switch: pressure greater than 6 bar)
- **The TRAVEL 1 mode** enables the machine to be locked in first speed.

WORKING PRINCIPLES

- **To select first speed**, press the **TRAVEL** key so that **LED 1** lights up. The control box locks the machine in this speed. The speed change solenoid valve is at rest position, the motors are in high displacement (low speed).
- **To select second speed**, press the **TRAVEL** key so as to light up **LED 2**. The electronic control box activates the speed change solenoid valve and the hydraulic travel motors are in low displacement (high speed).

WORKING WITH ATTACHMENTS ONLY IN TRAVEL 2 MODE

LED 2 is still lit, **LED 1** has gone out.

The solenoid valve is activated, the motors are in low displacement

WORKING WITH ATTACHMENTS AND TRAVEL OR WITH TRAVEL ALONE.

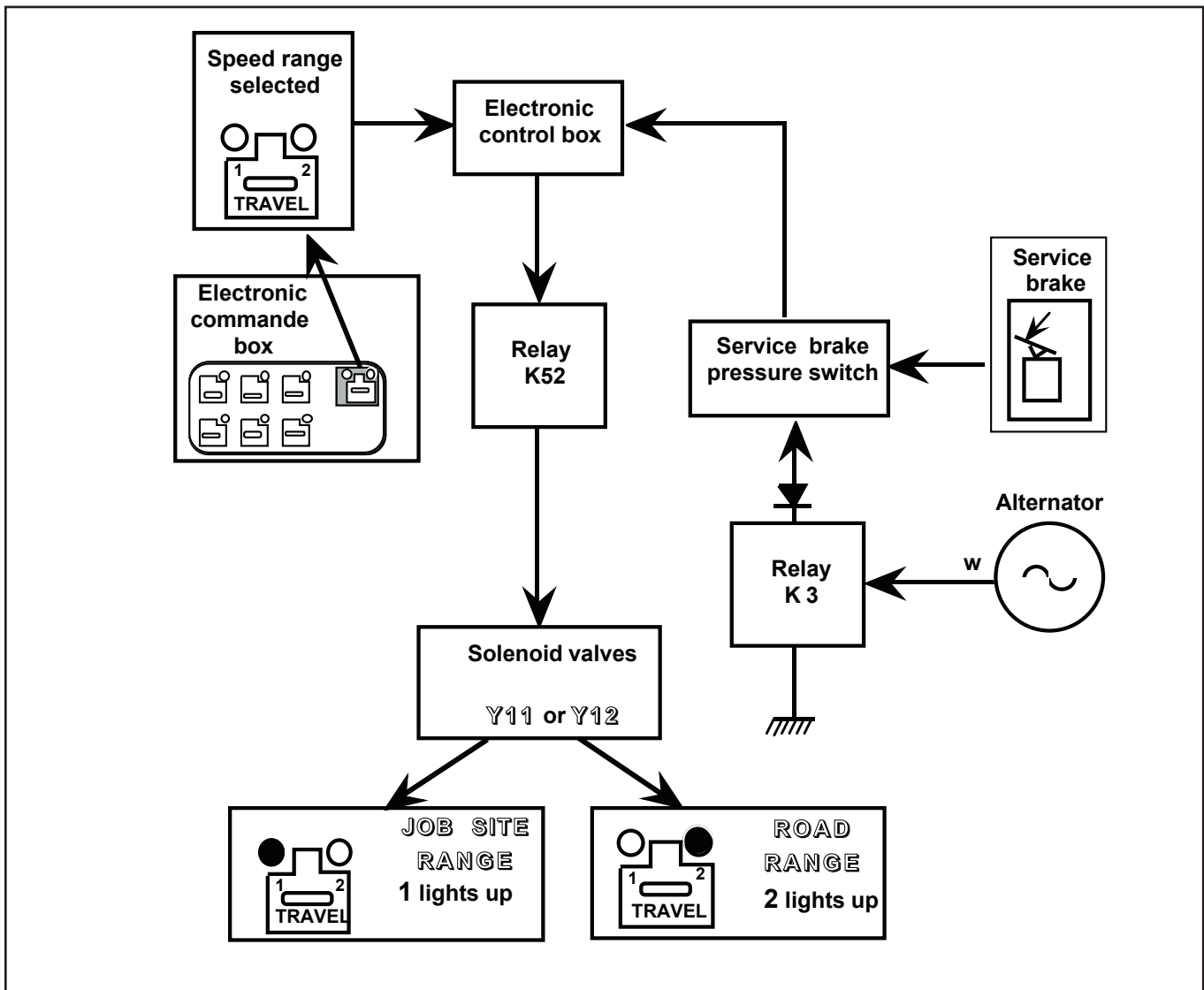
In this case, if the LOAD SENSING information is higher than **270 bar**, whatever may be the functions being operated, a sensor fitted on this line informs the electronic control box. A pressure switch fitted on the hydraulic travel motors pilot circuit also informs the control box.

These two information inputs taken together enable the control box to deactivate the solenoid valve and to obtain the high displacement on the hydraulic travel motor, which gives first speed (**LED 2 flashes and LED 1 lights up**)

If now the LOAD SENSING information circuit pressure falls to a pressure lower than **130 bar**, the control box activates the solenoid valve, the motors return to low displacement, and so change to second speed (**only LED 2 is lit up**)

BASIC PRINCIPLES FOR ELECTRONICALLY ASSISTED SYSTEMS

WHEELED EXCAVATORS SPEED RANGE CHANGE



Relay **K3** is activated as soon as the engine is started, via terminal **W** (12 V) of the alternator.

The service brake pressure switch (40 bars) is in contact with the earth.

If the service brake pedal is depressed and the brake feed circuit pressure reaches 40 bars, the pressure switch located on this circuit closes.

The electronic control box is in contact with earth via the pressure switch, the diode and the **K3** relay.

If the **TRAVEL** (1 or 2) control is depressed to change the speed range, the electronic control box is informed which activates or disactivates relay **K14** which acts either on solenoid valve **Y11** or **Y12**, depending on the **TRAVEL** mode which was selected

NOTA

TRAVEL 1	→	K14 relay activated	→	Job site range
TRAVEL 2	→	K14 relay disactivated	→	Road range

988 HYDRAULICS GENERAL

988 C TECHNICAL SPECIFICATIONS.....8 B 2 00
LOCATION OF HYDRAULIC COMPONENTS ON 988 C8 B 6 00
988 C SINGLE-SPEED GENERAL HYDRAULIC SYSTEM.....8 B 8 00
TWO-SPEED 988 C GENERAL HYDRAULIC SYSTEM.....8 B10 00
TECHNICAL SPECIFICATIONS OF THE 988 P.....8 B12 00
LOCATION OF HYDRAULIC COMPONENTS ON THE 988 P8 B16 00
988 P GENERAL HYDRAULIC SYSTEM.....8 B18 00

988 C HYDRAULICS GENERAL

HYDRAULIC SYSTEM GENERAL INFORMATION

Power unit.

- Engine:

Idle speed

LOW IDLE : 900 to 1000 rpm

MEDIUM IDLE : 1180 to 1220 rpm

No load speed

MAX mode: 2180 to 2220 rpm

ECO mode: 1880 to 1920 rpm

FINE mode: 1580 to 1620 rpm

Speeds under load

MAX mode: 1980 to 2020 rpm

ECO mode: 1680 to 1720 rpm

FINE mode: 1380 to 1420 rpm

- Constant torque variable displacement pump with load sensing, flow cancellation and pressure maintenance systems on the attachment, travel and options functions

- Fixed displacement pump on the upperstructure swing function.

Servo.

- Low pressure pump

Hydraulic tank.

- Self-pressurized to reduce pollution coming from the outside.

Filtration.

- On general return circuit with by-pass and clogging indicators.

- On Load-Sensing information line.(LS1 and LS2)

- On functional leaks return (without clogging indicator)

Control valves: Attachment, travel, options

- "Closed centre and closed outlets" parallel type. Proportional effect and **load sensing**.

- Flow regulator (balance valve) on each receiving component.

Swing control valve.

- "Open centre and closed outlets" parallel type.

Linear receiving components.

- Double action, single rod cylinders with dashpot and flow limiter on certain chambers.

Rotary receiving components.

- Fixed displacement hydraulic motor on the swing function, fitted with automatic static brake

- Fixed displacement on variable displacement hydraulic motors on the travel function fitted with automatic static brakes.

Forced feed.

- All receiving components are force fed.

- Counter pressure valves on the return circuits for the following functions: attachments, travel, swing, options and servo

Oil cooling.

- On swing and servo pump flows.

- Air cooled by the engine fan.

Connective components.

- A very large number of hoses is used.

- Unions are SAE clamps with ISO seals on $\varnothing \geq 20$ mm tubes

- Unions with crimped rings with nuts on $\varnothing < 20$ mm tubes

988 C GENERAL HYDRAULICS

988 C TECHNICAL SPECIFICATIONS

- **Installed hydraulic power**
 - MAX mode:65,5 Kw 89 hp
 - ECO mode:50 Kw 68 hp
 - FINE mode:29,4 Kw 40 hp

- **Hydraulic pumps**
(axial piston and gear type with external teeth)
 - Maximum displacement (variable displacement pump for attachments, travel and options)2 x 80 cc/rev
 - Displacement of the variable displacement swing pump28 cc/rev
 - Servo pump displacement12 cc/rev

 - Maximum flow (variable displacement pump for attachments)320 l/min
 - Maximum flow (variable flow swing pump)56 l/min
 - Maximum flow servo pump24 l/min

 - Pressure for attachment, travel and options355 to 365 bar
 - Servo circuit pressure> 34 bar

- LOAD SENSING valve setting (LS): Δp between M1 and M3
 - Static and dynamic20 to 23 bar
 - **Dynamic**21 to 23 bar

- Torque regulation valve setting
 - Bucket or dipper cylinder large chamber pressure300 bar
 - Engine speed \geq 1980 rpm
 - Variable displacement pump flow124 l/mn

- **Hydraulic filters**
 - Bypass pressure setting3,5 bar
 - Clogging indicator pressure setting3,1 bar
 - Degree of filtration10 μ

- **Attachments control valve** (three spool stackable)
 - Bore20
 - Low pressure piloted8 to 22 bar
 - Pressure setting (*with spacer on control lever pushrods):
 - Relief valve390 to 420 bar
 - boom cylinder small chamber safety valve380 to 410 bar
 - boom cylinder large chamber safety valve380 to 410 bar
 - bucket cylinder small chamber safety valve380 to 410 bar
 - bucket cylinder large chamber safety valve380 to 410 bar
 - dipper cylinder small chamber safety valve380 to 410 bar
 - dipper cylinder large chamber safety valve380 to 410 bar

 - Flow regulator setting (balance valve)
 - Boom cylinder large chambers165 to 185 l/mn
 - Dipper cylinders large chambers140 to 160 l/mn
 - Bucket cylinders large chamber155 to 175 l/mn

- **Swing control valve.**
 - Bore12
 - Low pressure piloted8 to 22 bar
 - Main relief valve pressure setting375 to 405 bar
 - Swing motor secondary relief valve pressure setting345 to 365 bar

988 C HYDRAULICS GENERAL

TECHNICAL SPECIFICATIONS (CONTINUED)

- **Travel control valve** (stackable, two spools).
 - Bore20
 - Low pressure piloted8 to 22 bar.
 - Pressure setting:
 - Right hand or left hand track secondary relief valve (forward or reverse direction)385 to 415 bar.
 - Flow regulator setting (balance valve).
 - Right or left hand motor, forward or reverse drive (single or two speed)130 to 150 l/mn.

- Linear receiving components.

- **Boom cylinder** (quantity 2)100 x 70 C1030
 - fitted with dashpot on large chamber end and a flow limiter in the separator block (large chamber end).
- **Bucket cylinder**100 x70 C130.
 - fitted with dashpot on largel chamber side.
- **Dipper cylinder**110 x 80 C 1320.
 - fitted with dashpot on the large and small chamber ends and a flow limiter on the feed block (small chamber end).
- **Offset backhoe cylinder**110 x 80 C480
 - fitted with dashpot on small chamber end
- **Articulated boom cylinder**110 x 70 C775
 - fitted with dashpot on large chamber end
- **Adjustable boom cylinder**100 x 70 C1625
 - fitted with dashpot on small chamber end

- Rotary receiving components.

- **Swing motor/Reduction gear.**
 - Fixed displacement hydraulic motor with axial pistons
 - Displacement40 cc
 - Theoretical speed1505 rpm.
 - Reduction gear fitted with oil-bath multidisc automatic type brake, mechanically braked, with hydraulic brake release.
 - Reduction ratio1/ 28
 - Theoretical speed at output shaft53,8 rpm.
 - Upperstructure braking torqueXXXXX mdaN.
 - Pressure required for brakes to be completely released8,6 bar.
- Swing pinion.....13 teeth, module 10
- Turntable.....79 teeth, module 10