HYDRAULICS EXCAVATORS

POCLAIN

"1288 & 1488 C"

powersensor

CASE

Centre de formation

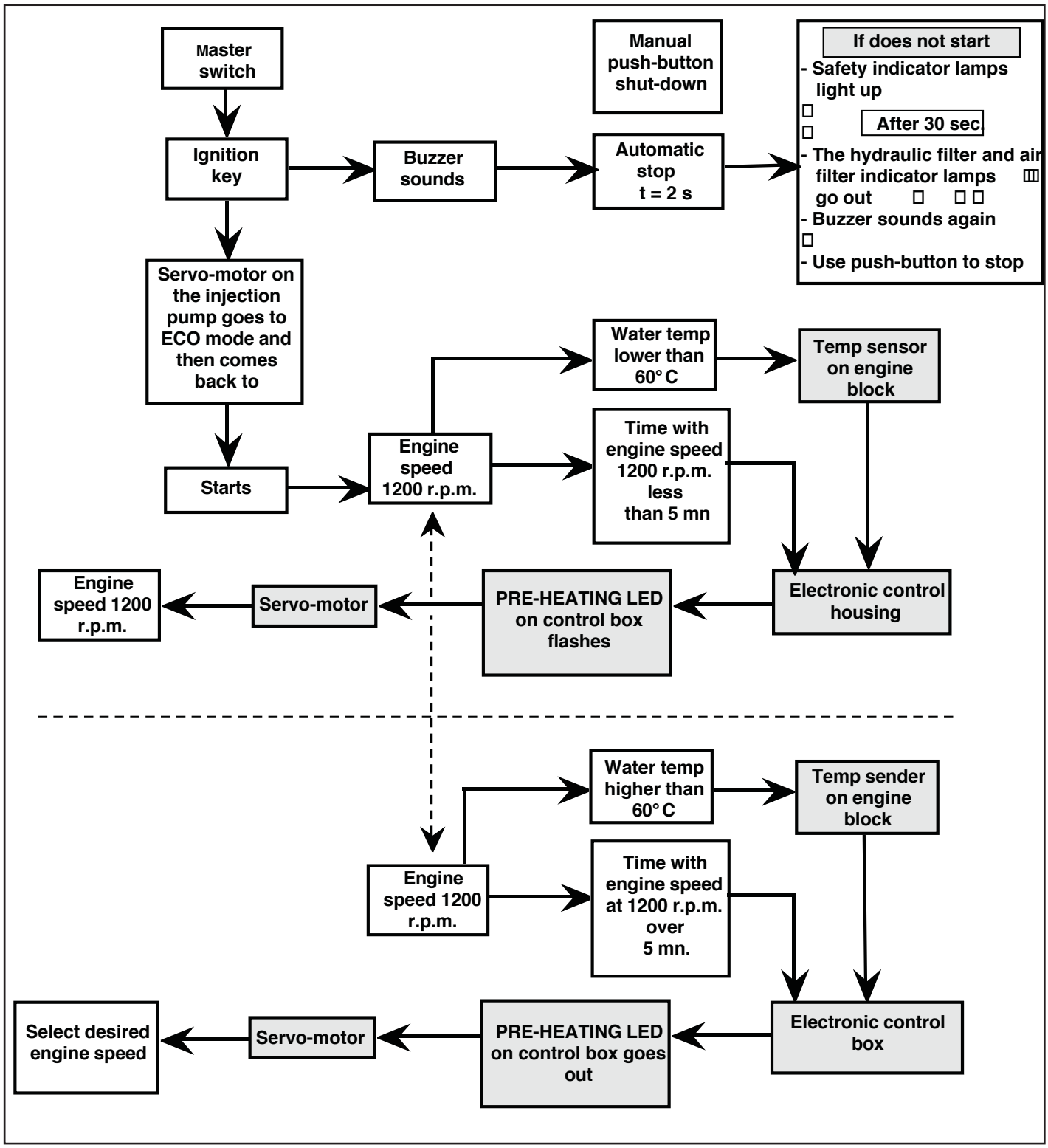
08 - 1998
English version

BASIC PRINCIPLES OF ELECTRONICALLY ASSISTED SYSTEMS

CONTENTS PAGE

BASIC PRINCIPLES OF ELECTRONICALLY ASSISTED SYSTEMS

STARTING ASSISTANCE



BASIC PRINCIPLES OF ELECTRONICALLY ASSISTED SYSTEMS

ASSISTANCE FOR STARTING

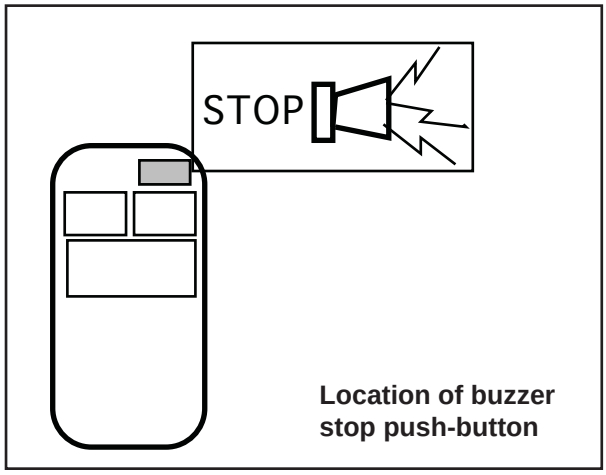
PURPOSE:

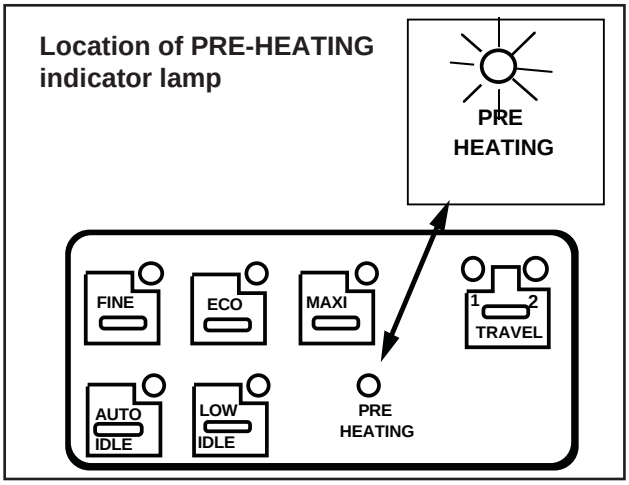
When the engine is switched on, the system provides:
- A pre-opening of the injection pump
- Automatic return of injection pump to the high idle position.

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 pump servo-motor, which is in "**ECO MODE**" speed position, cuts in to provide an engine speed of 1200 rpm (high idle)..

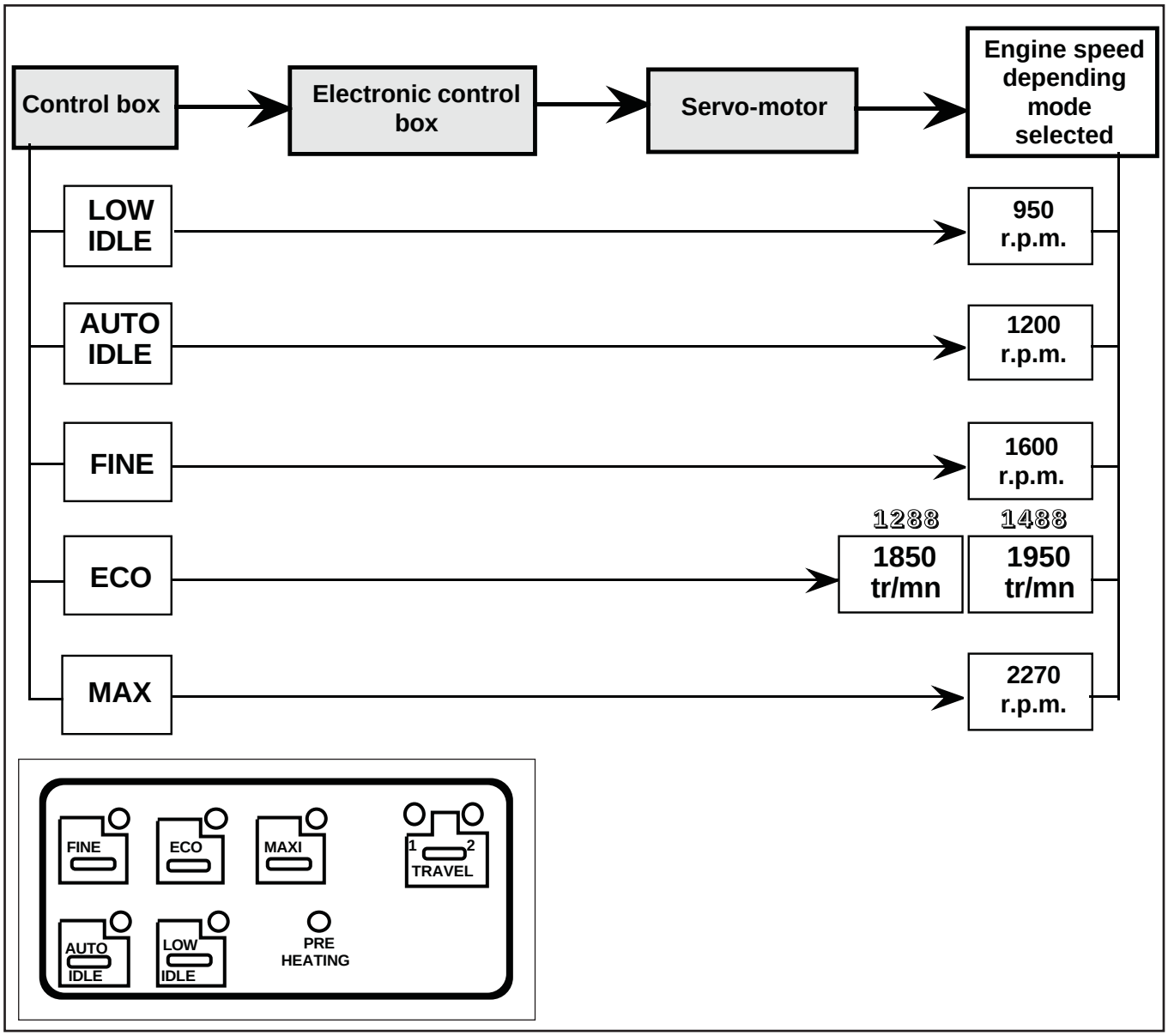
- if the engine coolant water temperature is lower than 60°C or if the time that the motor runs at 1200 rpm is less than 5 minutes, the electronic system will not permit changing to the **LOW, FINE**, **ECO** or **MAX** modes.
This is indicated by the **PRE-HEATING** indicator which has a flashing indicator lamp (LED).





BASIC PRINCIPLES OF 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 :

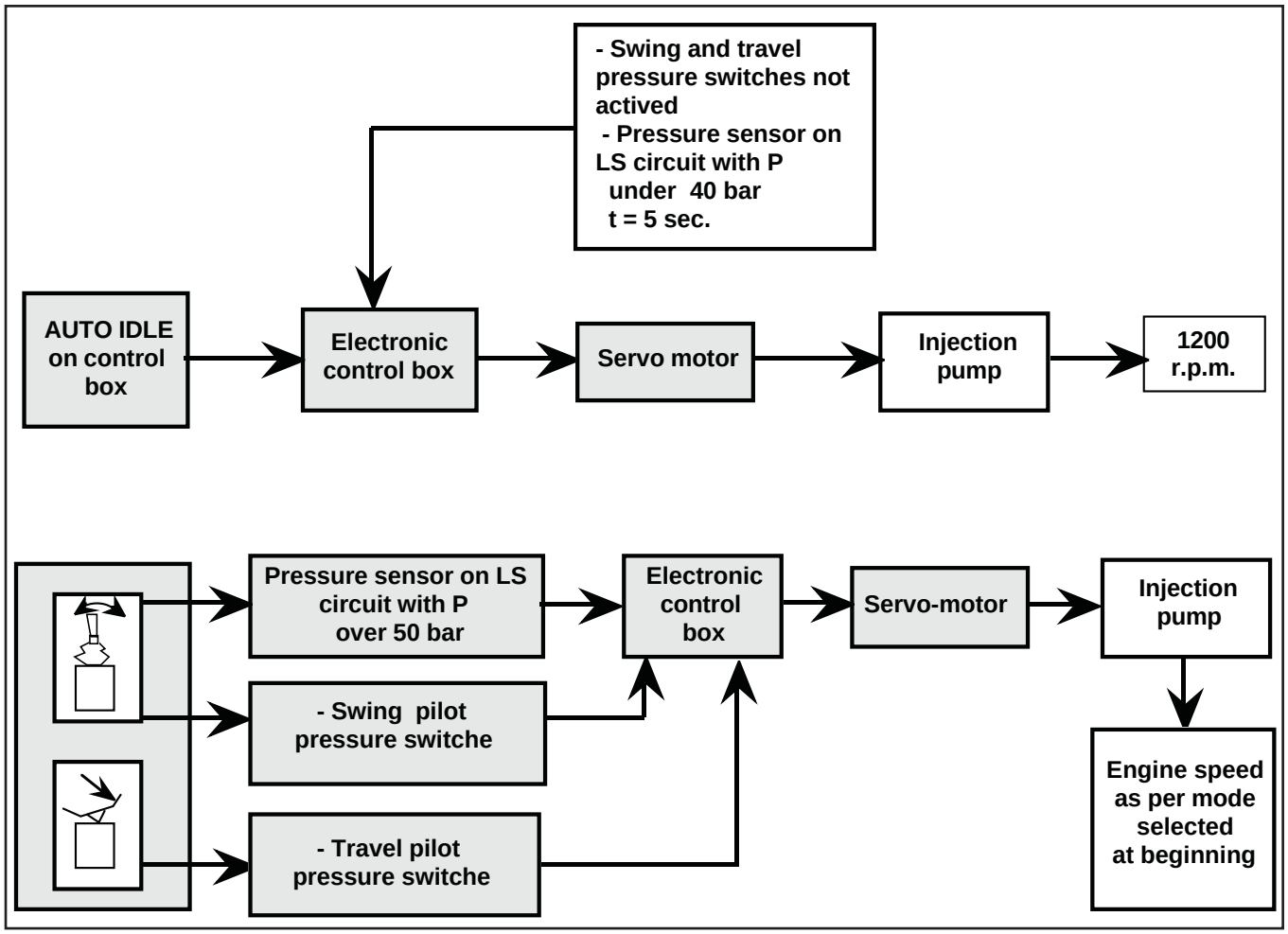
- **2 idle modes**
- **LOW IDLE** is the low idle speed at **950** rpm.
- High idle (**1200 rpm**) cannot be selected and is only obtained automatically during assistance with starting when selecting **AUTO-IDLE** function (see page 1.5.00)

- **3 work modes**
- **FINE: 1600 rpm** for low output work, and for handling
- **ECO: 1850 (1288) or 1950 (1488) rpm**, economical digging is possible
- **MAX: 2240 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 OF 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 indicator lamp on the push-button lights up when the AUTO-IDLE mode is pressed to obtain automatic return to idle.
- On condition that no movement occurs at the control levers or pedals, also that the swing and travel pressure switches show no action and that the LOAD SENSING information line is at a pressure lower than 40 bar, all this for a period of 5 seconds.
- When these conditions are met, the electronic control box informs the injection pump servo-motor and the **AUTO-IDLE** mode (idling at **1200** rpm) is obtained. The indicator lamp lights up on the push-button for the mode selected.- 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

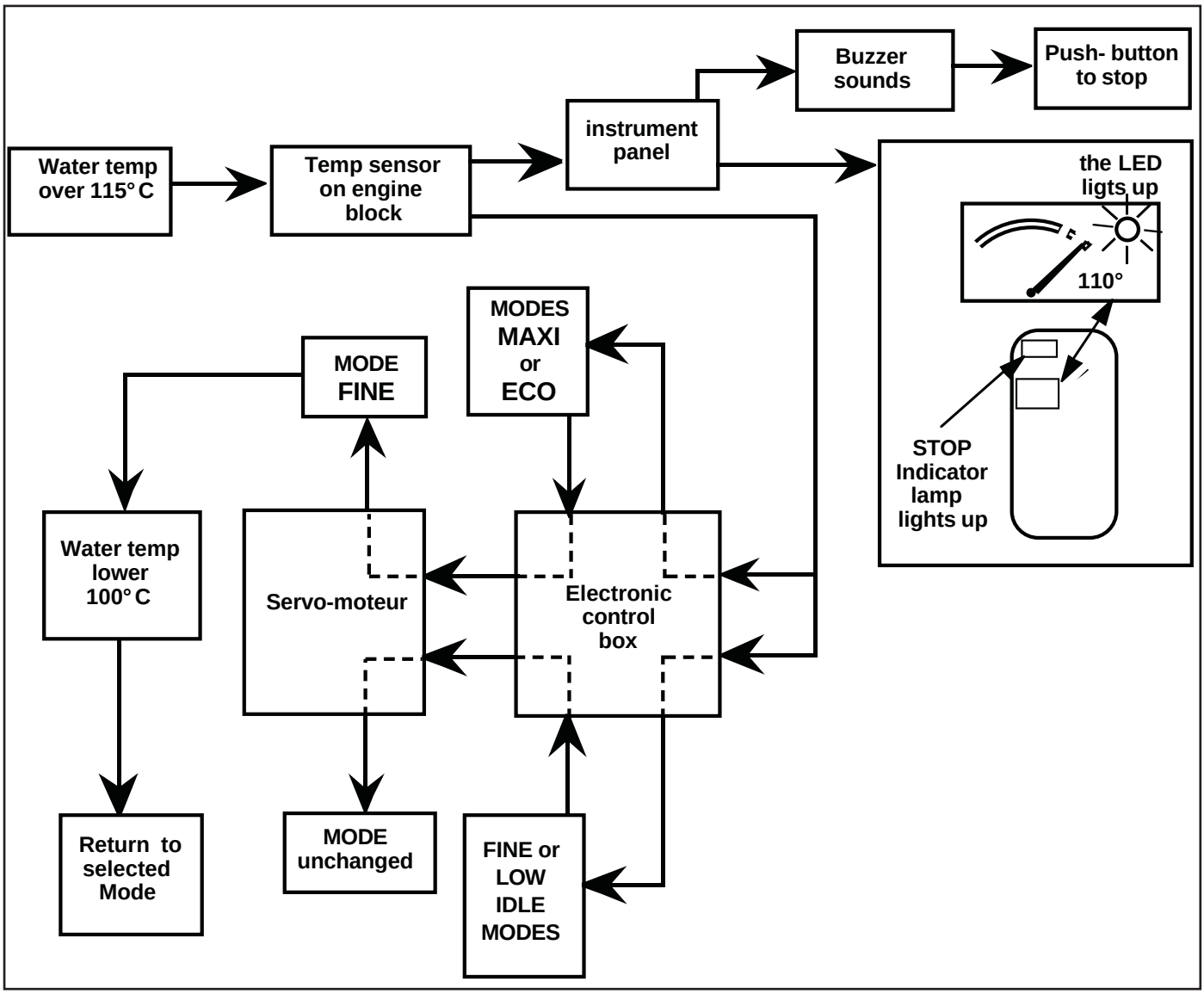
- When the pilot pressure switch receives a pressure information

For the travel function

- When the release pressure switch receives a pressure information
- In this case, the indicator lamp on the push-button stays on continuously.

BASIC PRINCIPLES OF ELECTRONICALLY ASSISTED SYSTEMS

ENGINE OVERHEATING SAFETY SYSTEM



PURPOSE

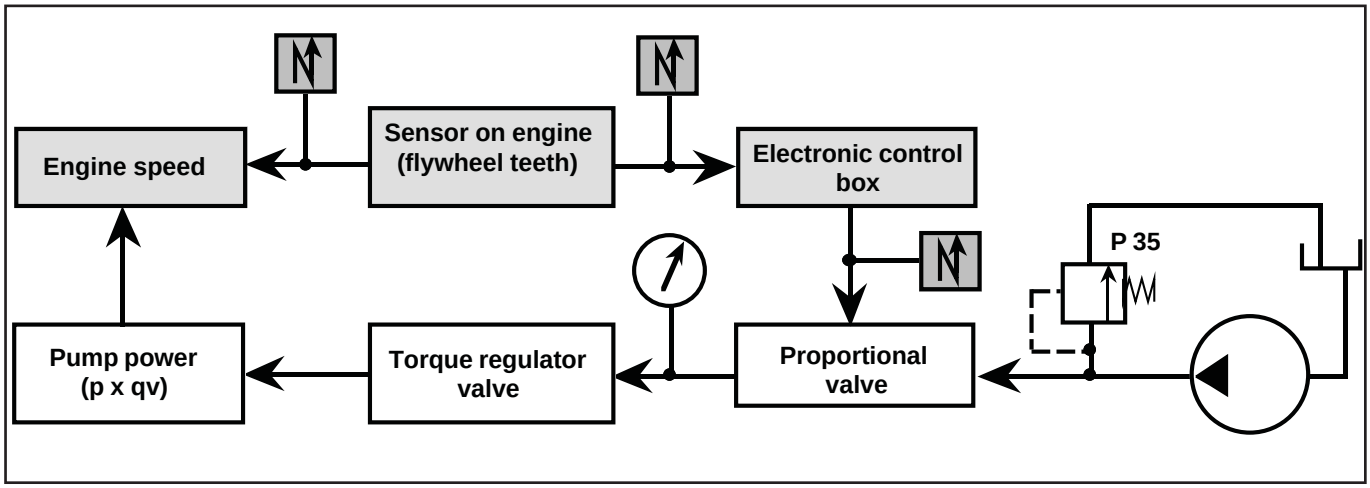
Safeguards the engine as regards temperature

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 at the beginning of the 2nd red mark.
- 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
- At 100°C, the various modes: FINE, ECO or MAX can again be selected.

BASIC PRINCIPLES OF ELECTRONICALLY ASSISTED SYSTEMS

"SPEED-SENSING" SYSTEM



PURPOSE

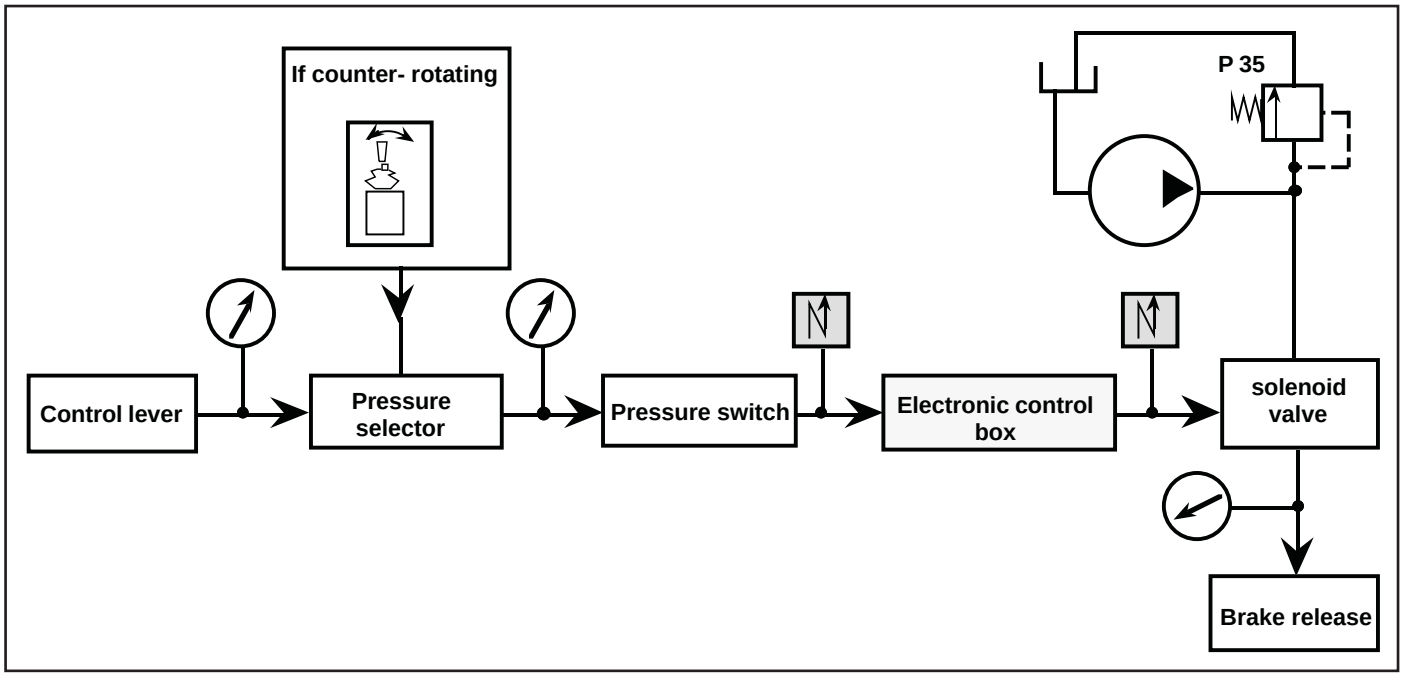
It maintains power balance between the available engine power and the demands of the hydraulic system, regardless of engine speed selected.

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 OF ELECTRONICALLY ASSISTED SYSTEMS

UPPERSTRUCTURE SWING BRAKE RELEASE



PURPOSE

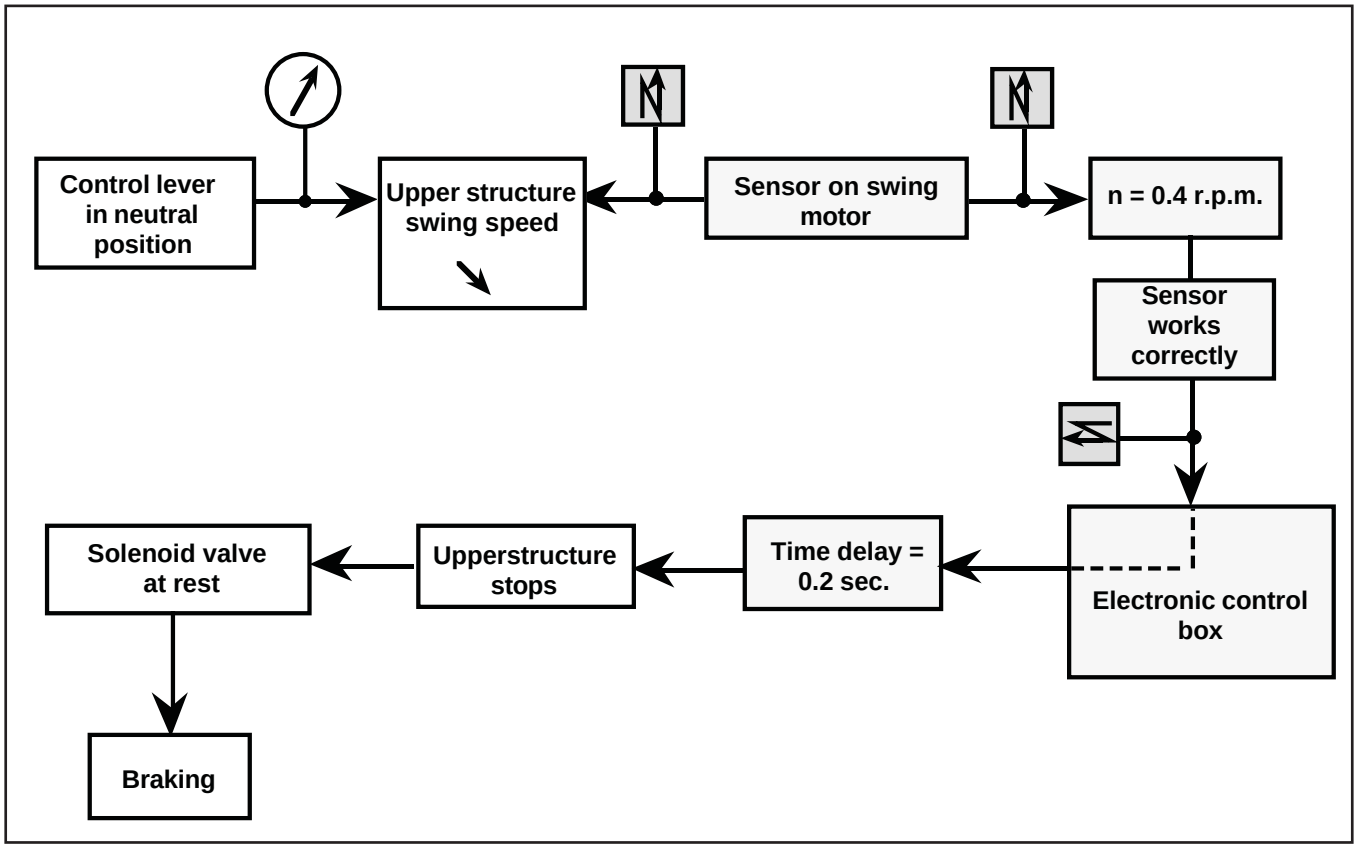
- Enables the upperstructure swing hydraulic motor brake release to take place

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 the operator swings in the opposite direction, without stopping at the control lever neutral position, the pressure selector is pressed onto the other side and the pressure switch informs the electronic control box, which maintains the swing brake in the released position.

BASIC PRINCIPLES OF ELECTRONICALLY ASSISTED SYSTEMS

UPPER STRUCTURE SWING BRAKING (good sensor on hydraulic motor)



OBJECTIVE

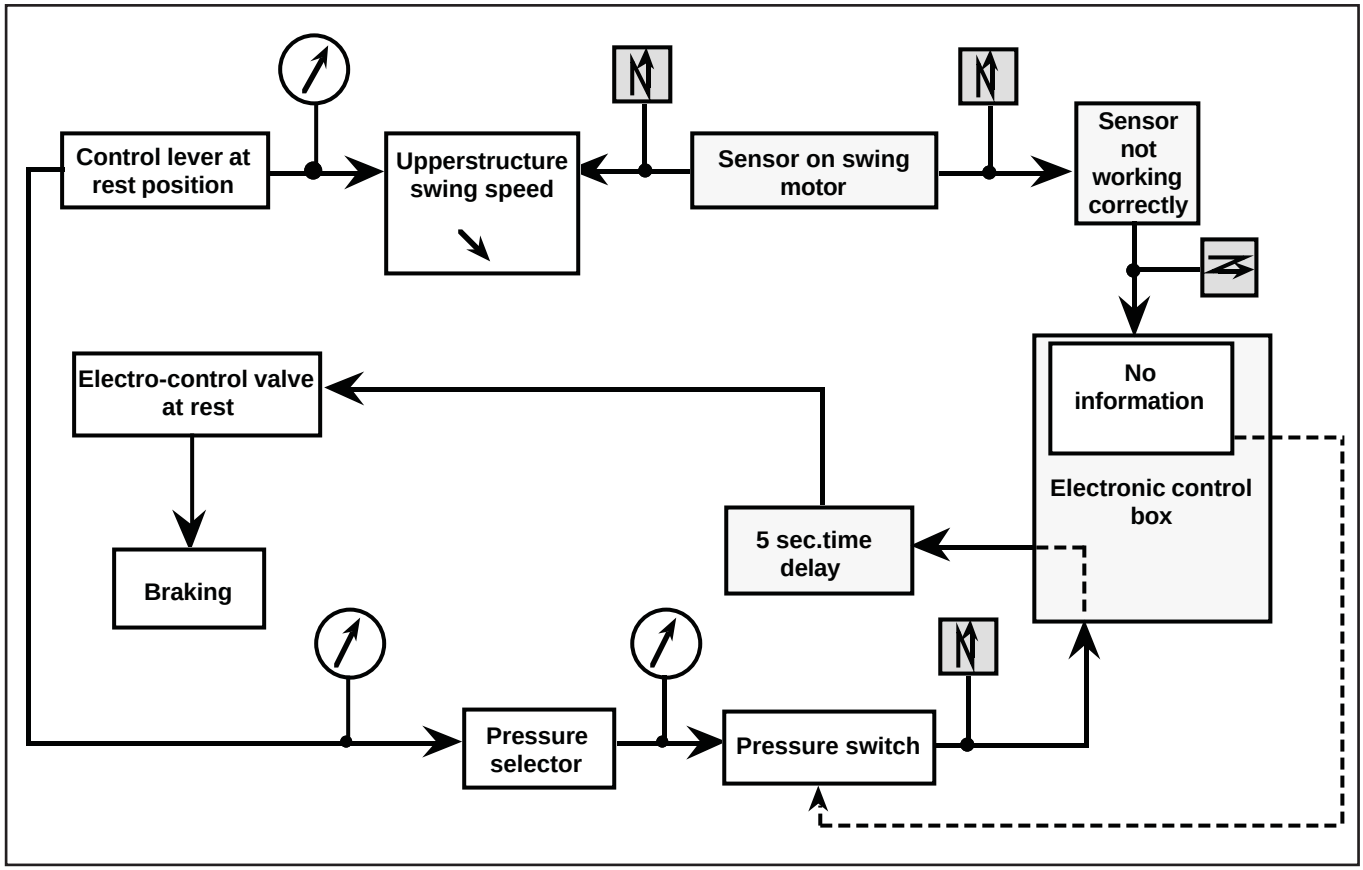
- Optimise the upper structure swing braking time in relation to its swing speed

WORKING PRINCIPLE

- When the control lever is at rest, the upper structure decelerates
- At a speed of **0.4** rpm the hydraulic motor sender no longer informs the electronic control box.
- At that moment, a time delay of **0.2** seconds allows the electro-control valve to remain piloted so that the upper structure can stop completely before the hydraulic motor brake is applied.

BASIC PRINCIPLES OF ELECTRONICALLY ASSISTED SYSTEMS

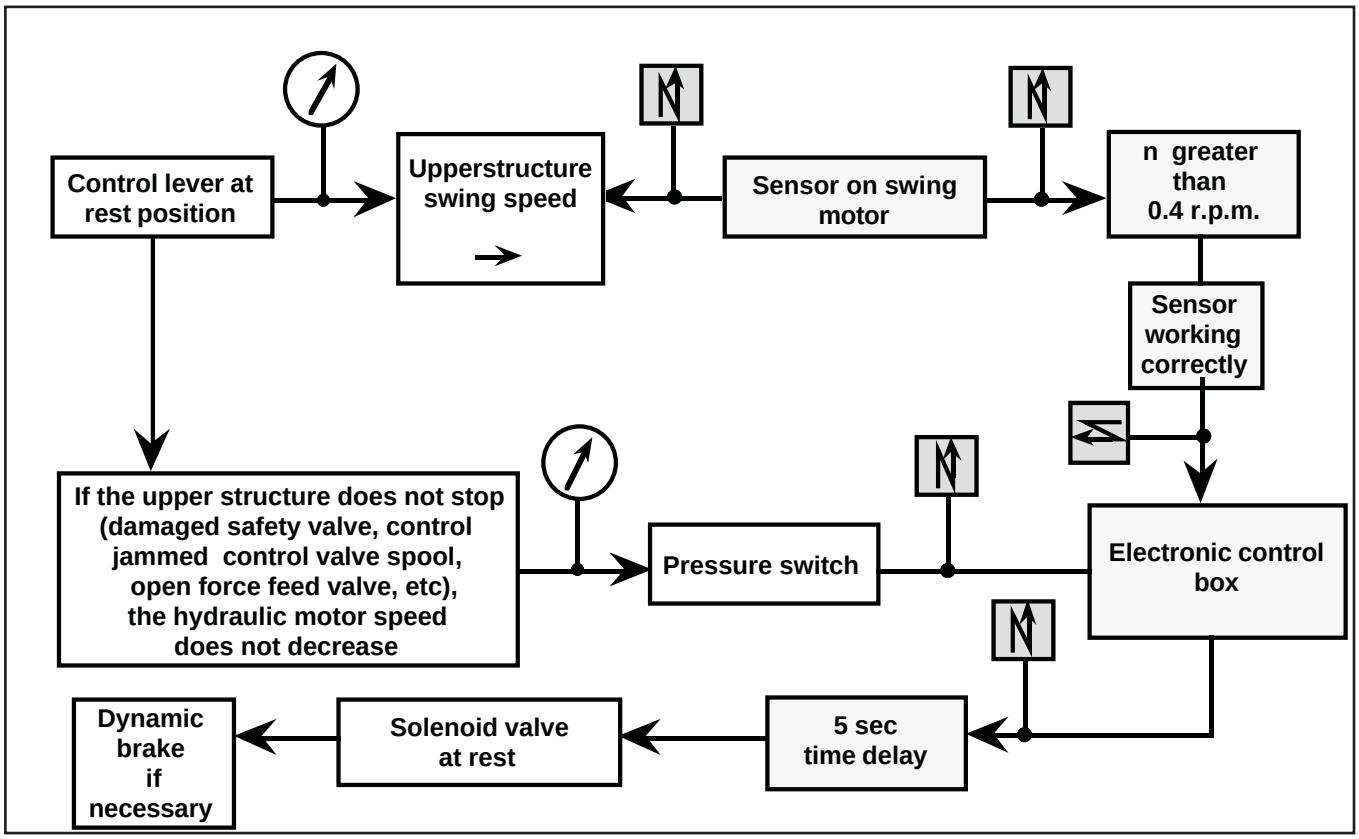
FRENATURA DELLA ROTAZIONE DELLA TORRETTA (captatore sul motore idraulico: guas



- Nel caso in cui il captatore sia difettoso, il contatto manometro del circuito di pilotaggio della rotazione della torretta informa la scatola di controllo elettronico e questa autorizza in questo momento una temporizzazione di 5 secondi.

BASIC PRINCIPLES OF ELECTRONICALLY ASSISTED SYSTEMS

UPPERSTRUCTURE BRAKING (good sensor, but defects in operation of hydraulic circuit

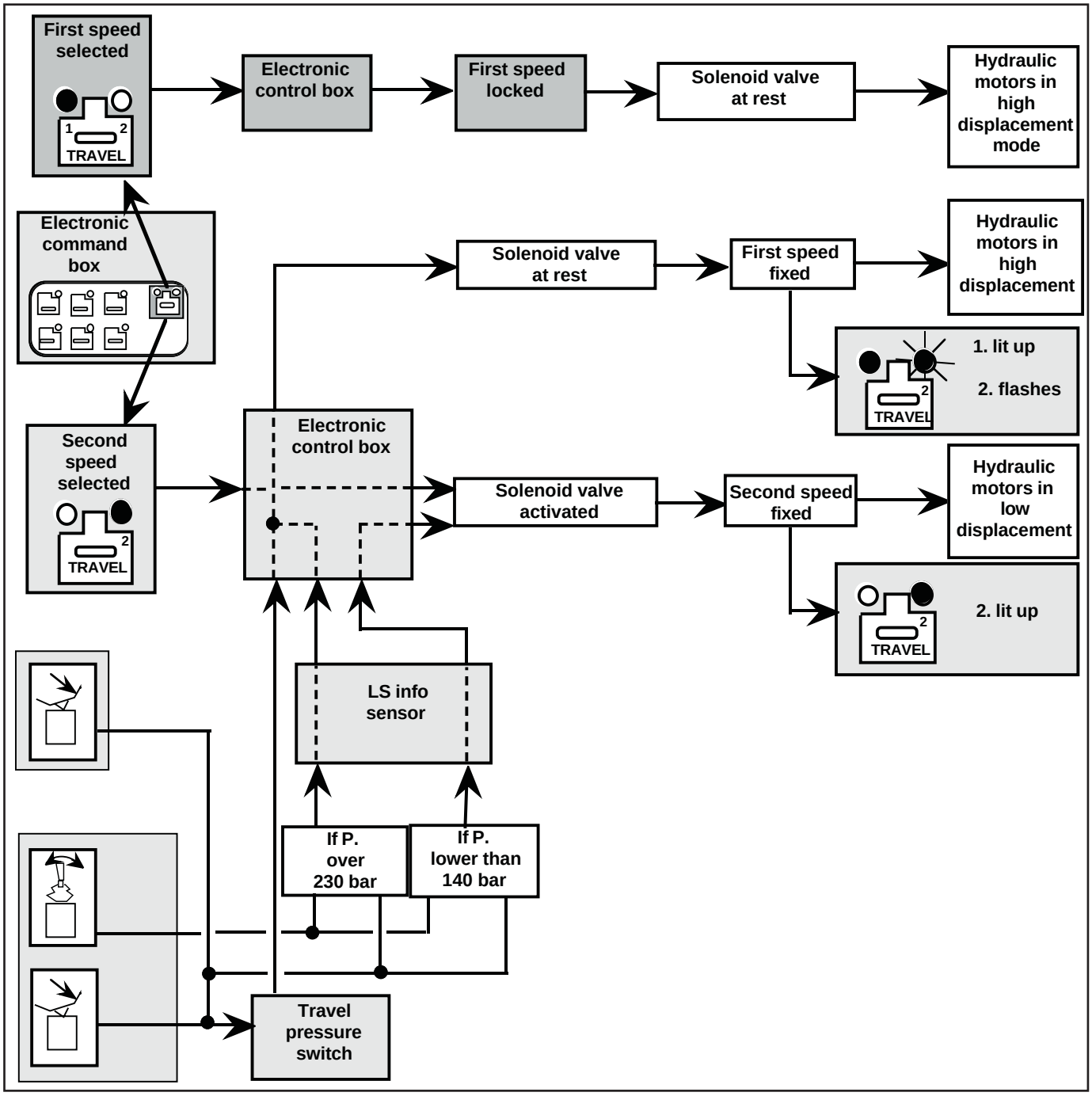


- When there is a hydraulic problem (defective safety valve or anti-cavitation valve, control valve spool jammed) regardless of the control lever being at rest, the upper structure keeps on turning. The sensor is still informed and requests the electronic control housing to release the brake.

But the pressure switch is not activated. In this situation, braking* takes place after 5 seconds (* this can be dynamic braking).

BASIC PRINCIPLES OF ELECTRONICALLY ASSISTED SYSTEMS

AUTOMATIC TRAVEL SEQUENCES (TWO-SPEED EXCAVATOR)



BASIC PRINCIPLES OF 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 **1st speed**, press the **TRAVEL** key to turn on **indicator lamp 1** (This happens automatically when starting 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

- The **indicator lamp 2** stays on, **indicator lamp 1** stays off. The electro-control valve is activated, the hydraulic motors are in high displacement mode (See hydraulic travel motor operation).

WORKING WITH ATTACHMENTS AND TRAVEL OR WITH TRAVEL ALONE.

In this case, if the LOAD SENSING information is higher than **300 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 disactivate 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 **140 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 OF ELECTRONICALLY ASSISTED SYSTEMS

Section

4001

ELECTRICAL SCHEMATICS

1288/1488 Crawler excavators

TABLE OF CONTENTS

SPECIFICATIONS

System voltage ..... 24 Volts negative earth and 12 Volts negative earth
Batteries ..... 2 x 12 Volts 120 A/hrs, low maintenance batteries
Alternator ..... BOSCH, 28 Volts, 45 Amps
Motor starter ..... BOSCH, 24 Volts, 4.0 kW

SCHEMATIC SYMBOLS

A (n) Radio/housings
B (n) Indicators/pressure switches/loudspeakers/pressostats/senders/heat sender/gauge
E (n) Lighting components
F (n) Fuses
G (n) Electrical supply generators
H (n) Warning devices (visible and audible)
K (n) Relays
M (n) Motors
P (n) Instruments
R (n) Resistors/heater plugs
S (n) Switches/battery master switch
Sh (n) Shunt resistors
V (n) Diodes
X (n) Supply line connections
Y (n) Solenoid valves, solenoids

NOTE : *The (n) shows the component number.*
Example : K2 is relay N°2.

(n) Supply on printed circuit

(n) Battery terminal

(n) Printed circuit connection terminal

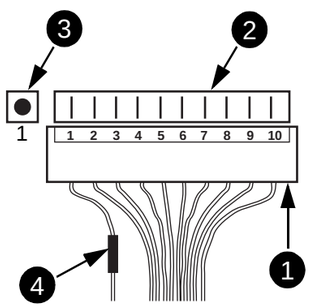
Printed circuit earth connector

A1 Instrument panel connector

1 or 1 or 1 Harness identification

1(1) or (1) or (1) Harness identification followed by path identification number

(1) or (1) Printed circuit earth connectors



The installation position for the harness connector (1) on connector (2) of the printed circuit is identified by a red mark (3) followed by the figure 1 on the printed circuit. This identification corresponds to the position of path 1 of the harness connector (1). This position is completed when the path 1 line is shown by a red ring (4) located on line 1 wire, or by red paint marking.

Local earth

Wire number

NC Closed circuit

NO Open circuit

Intersection of two wires with connection point

Intersection of two wires without connection point

Link with following plate

Link with preceding plate

Return to another plate with the same letter

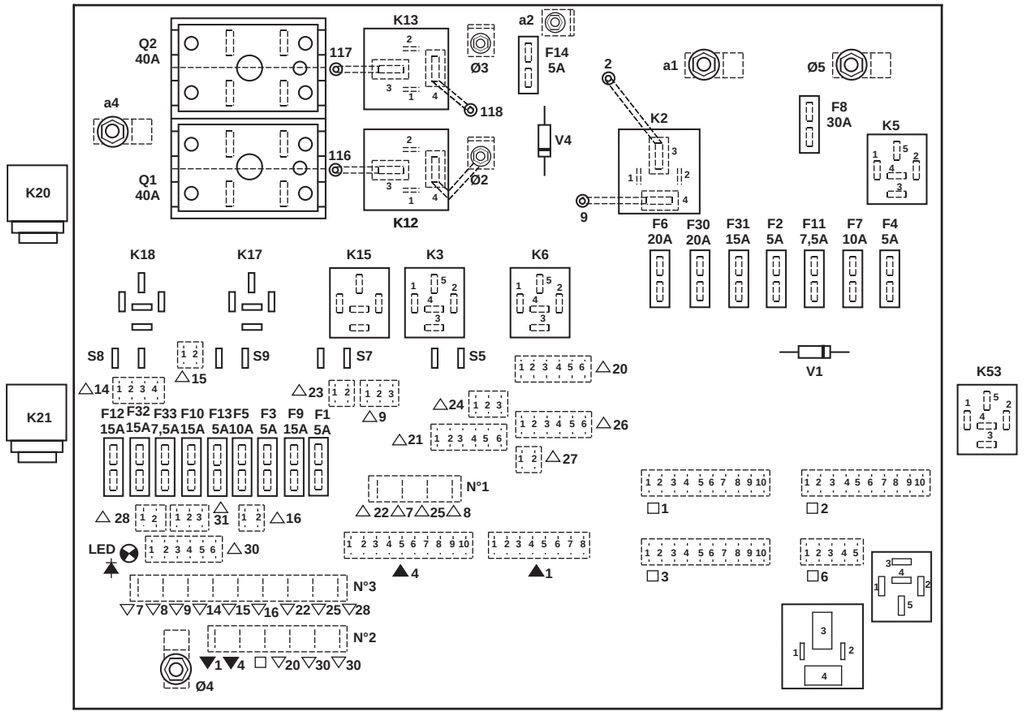
Bulbs

Test bulb

Light emitting diode (LED)

Regulator

DESCRIPTION OF ELECTRICAL CABINET PRINTED CIRCUIT (STANDARD EQUIPMENT)



CM97C001

- ◁ **1** 24 Volts supply before contact
- ◁ **2** 12 Volts supply before contact (radio)
- ◁ **4** 24 volt supply before Q1 and Q2 circuit breaker contact
- **F2** Fuse, starter switch (5A)
- **F3** Fuse, 5A, instrument panel, injection pump sender, alternator
- **F4** Fuse, 5A, cab lighting, horn relay
- **F5** Fuse, 10A, working lights, rotary light (optional)
- **F6** Fuse, 20A, upperstructure working lights
- **F7** Fuse, 10A, horn
- **F8** Fuse, 30A, upperstructure power point
- **F9** Fuse, 15A, windshield washer, windshield wiper
- **F10** Fuse, 15A, ventilation, heater
- **F11** Fuse, 7.5A, cigarette lighter
- **F12** Fuse, 15A, pilot safety
- **F30** Fuse, 20A, cab working lights
- **F31** Fuse, 15A, windshield wiper intermittent action
- **F33** Fuse, 7.5A, electronic control box, diagnostic socket
- **H14** Diagnostic (LED) lamp
- **K2** General contact relay
- **K3** Hourmeter relay, ignition warning lamp
- **K5** Horn relay
- **K6** Attachment and upperstructure working light relay
- **K12** Starter motor solenoid relay
- **K13** Injection pump solenoid relay
- **K15** Cold start assistance relay
- **K20** Windshield wiper intermittent action
- **K21** Pilot safety relay
- **K53** Fuel heater relay base
- **Q1** Circuit breaker, 40A, starter motor
- **Q2** Circuit breaker 40A, injection pump solenoid
- **Sh5, Sh7, Sh8, Sh9** Not used
- **V1** General contact diode
- **V4** Radio diode
- **Ø 2** Starter connection
- **Ø 3** Solenoid/injection pump conenction
- **Ø 4** Printed circuit earth
- **Ø 5** Upperstructure power line connection

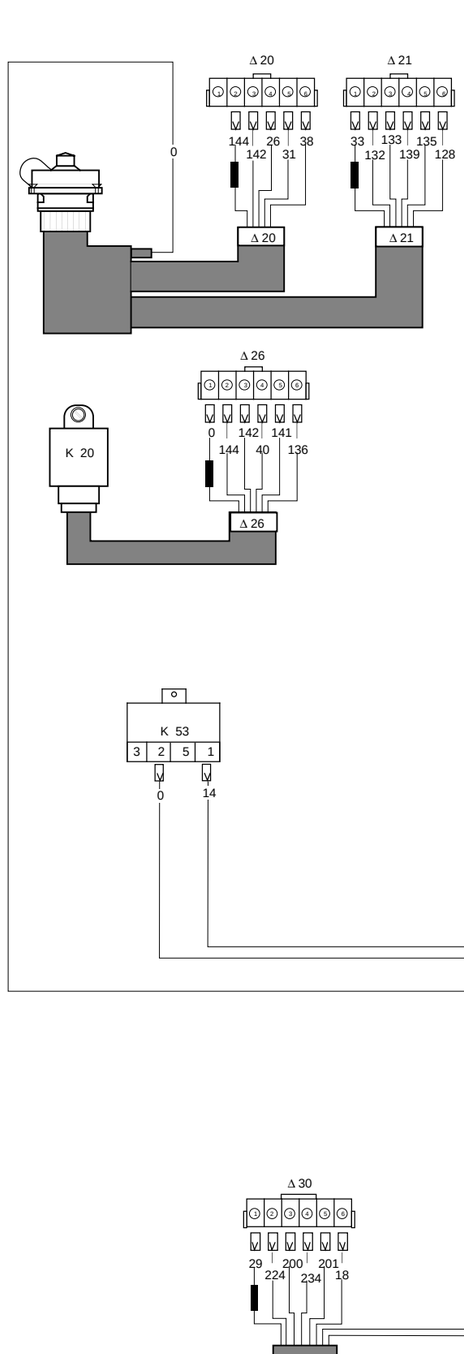
ELECTRICAL CABINET PRINTED CIRCUIT WIRING (STANDARD)

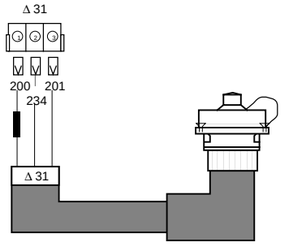
1 4 terminal block

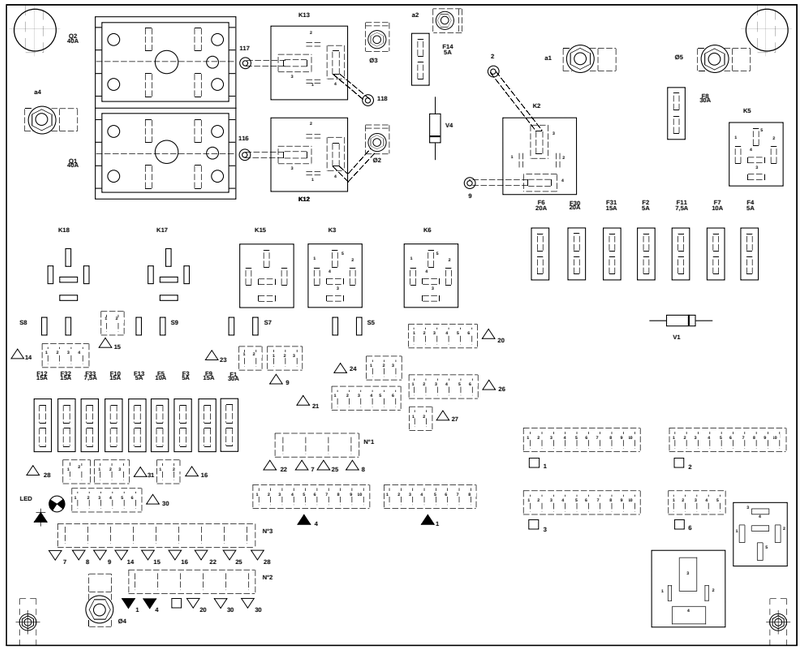
- □ **1** Harness, 10-way connector, floor harness
- □ **2** Harness, 10-way connector, floor harness
- □ **3** Harness, 10-way connector, floor harness
- □ **6** Harness, 5-way connector, floor harness

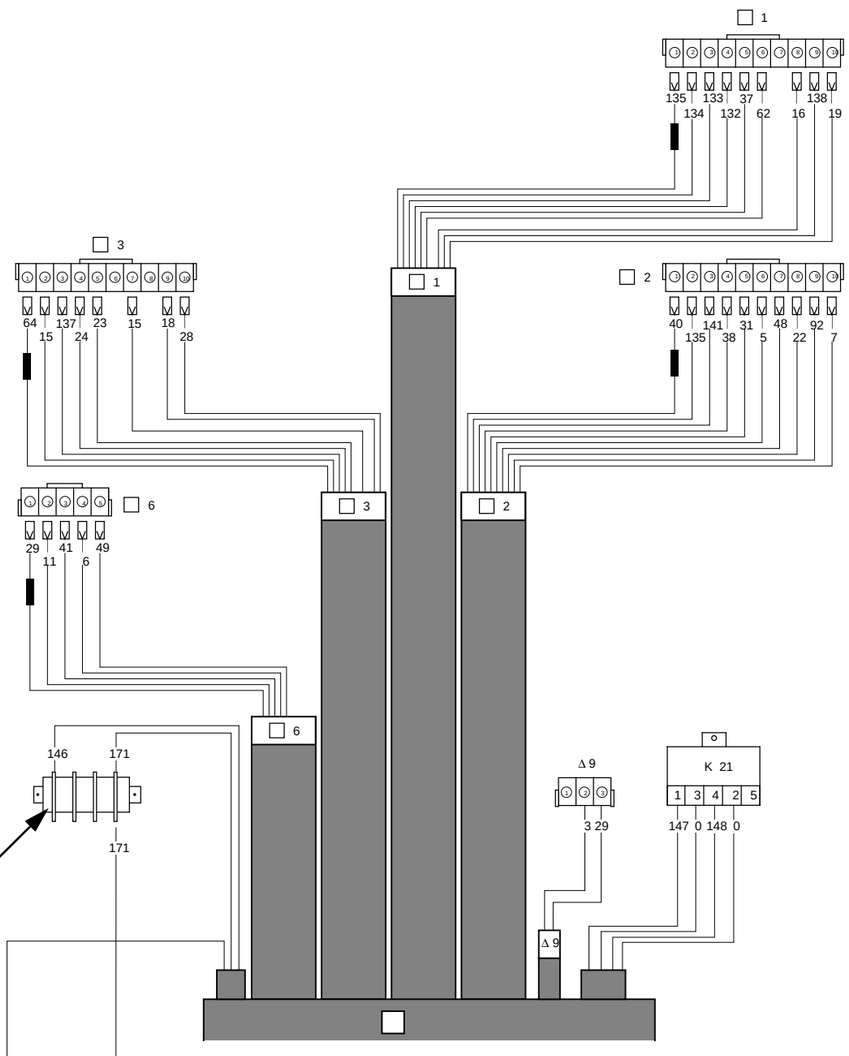
- △ **9** Harness 3-way connector, floor harness
- △ **20** Harness, 6-way connector, cab power connection
- △ **21** Harness, 6-way connector, cab power connection
- △ **26** Harness, 6-way connector, windshield wiper (K20 intermittent action)
- △ **27** Harness, 2-way connector, windshield washer
- △ **30** Harness, 6-way connector, electronic control box
- △ **31** Harness, 3-way connector, troubleshooting test socket

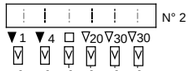
- ▲ **1** Harness, 8-way connector, common harness
- ▲ **4** Harness, 10-way connector, engine

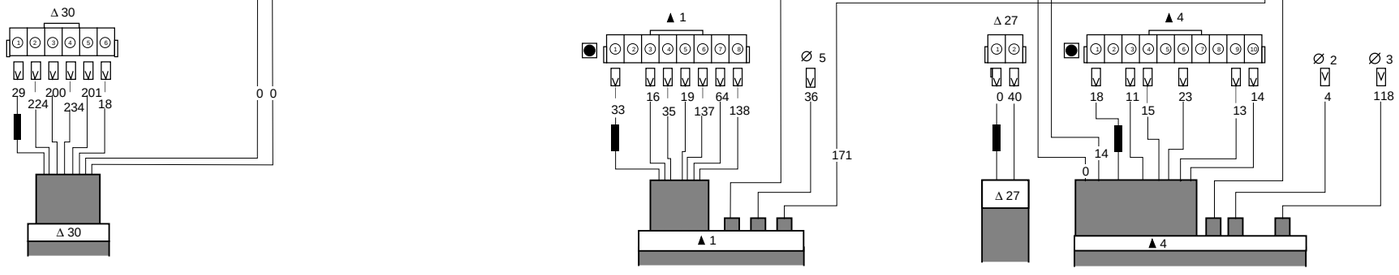












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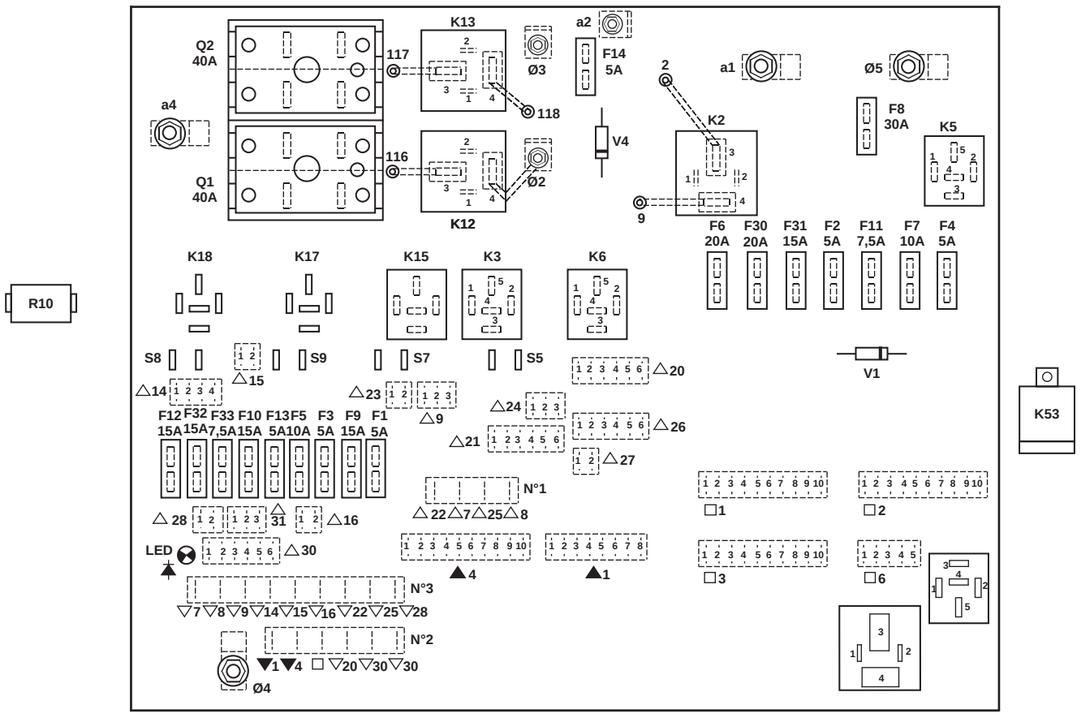
DESCRIPTION OF ELECTRICAL CABINET PRINTED CIRCUIT (OPTIONAL)



CM97C002

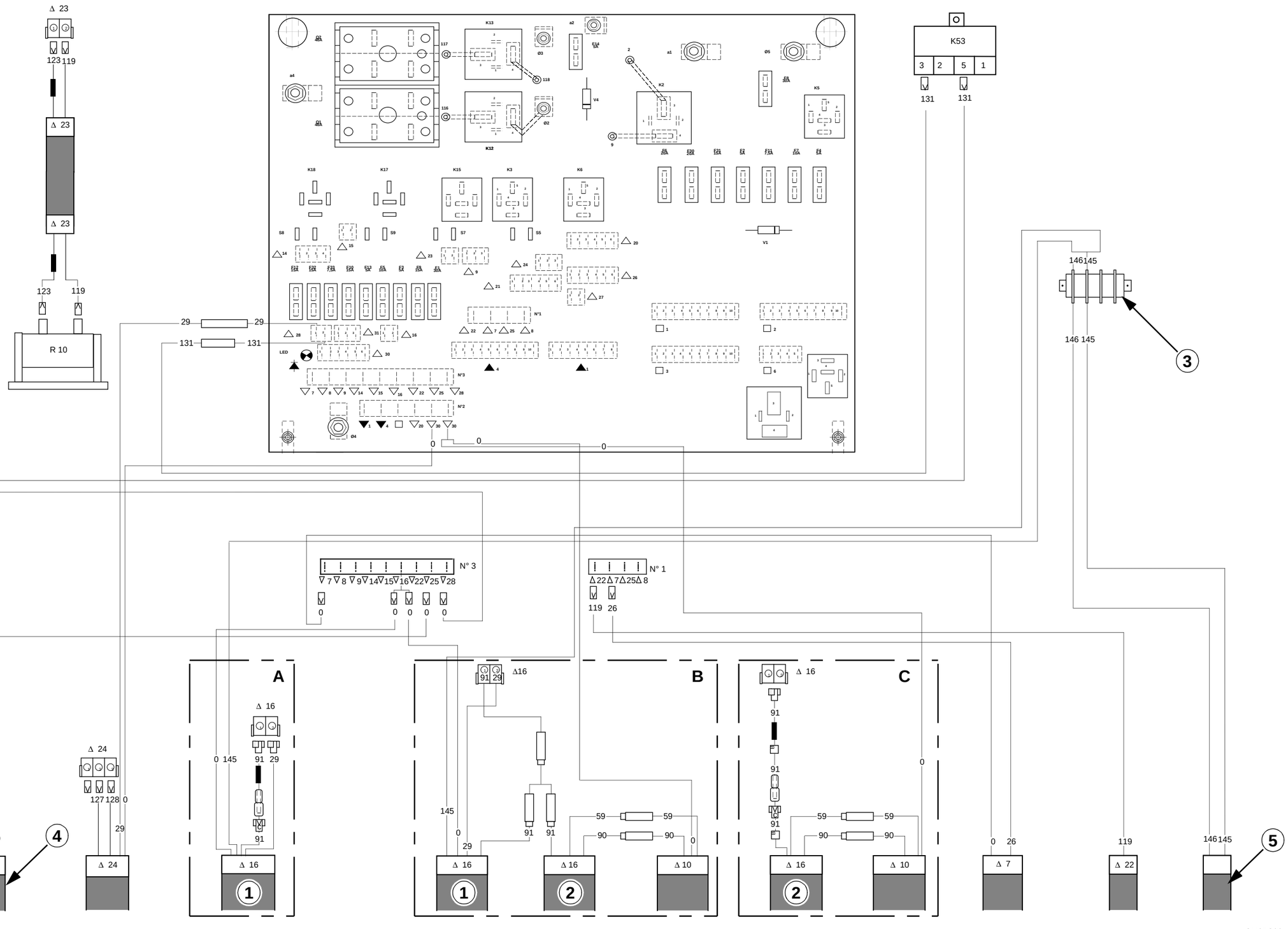
F1 Fuse, 30A, cold starting assistance (optional)
F13 Fuse, 5A, overload indicator, articulated boom (optional)
F14 Fuse, 5A, radio (optional)
F32 Fuse, 15A, fuel heater (optional)
K15 Cold start assistance relay (optional)
K53 Fuel heater relay
R10 Resistor, 0.85 Ohm
V4 Radio diode (optional)

ELECTRICAL CABINET PRINTED CIRCUIT WIRING (OPTIONAL)

3 4 terminal block
4 Fuel pump harness (optional)
5 Overload pressure switch harness (optional)

△ **7** Harness, hood lighting (optional)
△ **10** Harness, articulated boom (optional) **(1488 excavators only)**
△ **16 (1)** Harness, overload indicator (optional)
△ **16 (2)** Harness, articulated boom (optional) **(1488 excavators only)**
△ **28** Harness, fuel heating device (optional)
△ **22** Harness, cold start assistance glow plug (optional)
△ **23** Harness, cold start assistance heating element (optional)
△ **24** Harness, cab front working lights and rear working light (optional)

A Overload indicator option
B Articulated boom and overload indicator option **(1488 excavators only)**
C Articulated boom option **(1488 excavators only)**



CM97C004

PRINTED CIRCUIT SCHEMATIC GUIDE

1 24 Volts supply before contact
2 12 Volts supply before contact (radio)
4 Electronic control box 24 volt supply and diagnostic socket

F1 Fuse, 30A, cold starting assistance (optional)
F2 Fuse, starter switch (5A)
F3 Fuse, 5A, instrument panel, injection pump sender, alternator
F4 Fuse, 5A, cab lighting, horn relay
F5 Fuse, 10A, working light relay, rotary light (specific to certain countries)
F6 Fuse, 20A, upperstructure working lights
F7 Fuse, 10A, horn
F8 Fuse, 30A, upperstructure power point
F9 Fuse, 15A, windshield washer, windshield wiper
F10 Fuse, 15A, ventilation, heater
F11 Fuse, 7.5A, cigarette lighter
F12 Fuse, 15A, pilot safety
F13 Fuse, 5A, overload indicator, articulated boom (optional)
F14 Fuse, 5A, radio (optional)
F30 Fuse, 20A, cab working lights (optional)
F31 Fuse, 15A, windshield wiper intermittent action
F32 Fuse, 15A, fuel heater (optional)
F33 Fuse, 7.5A, electronic control box, diagnostic socket

H14 Diagnostic (LED) lamp

K2 General contact relay 24V, 50A
K3 Hourmeter relay, ignition warning lamp
K5 Horn relay
K6 Attachment and upperstructure working light relay
K12 Starter motor solenoid relay
K13 Injection pump solenoid relay
K15 Cold start assistance relay (optional)
K17 Not used
K18 Not used
K53 Fuel heater relay

Q1 Circuit breaker, 40A, starter motor
Q2 Circuit breaker, 40A, injection pump solenoid

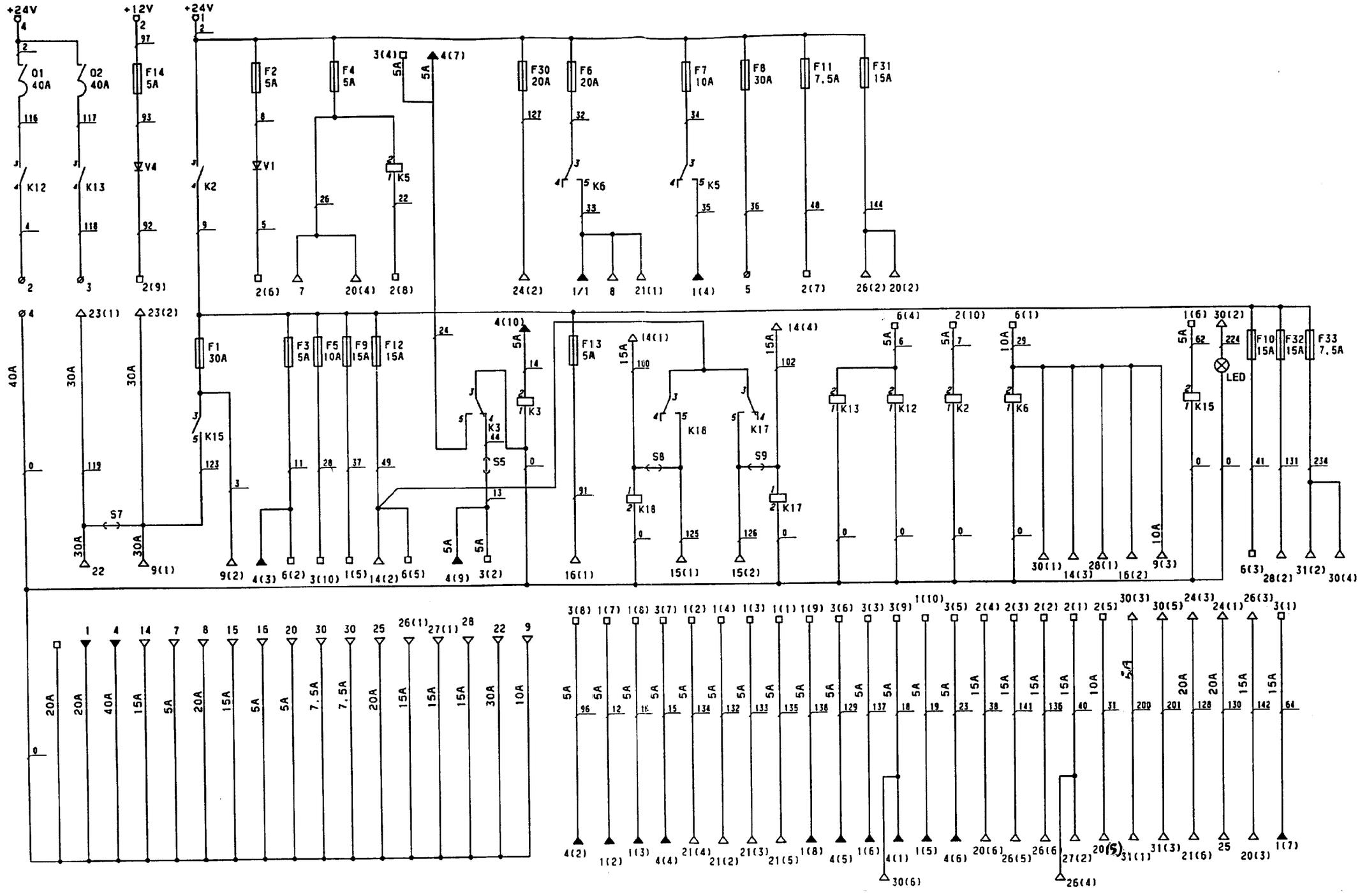
R10 Resistor, 0.85 Ohm

Sh5, Sh7, Sh8, Sh9 Shunt, Aerometer not used

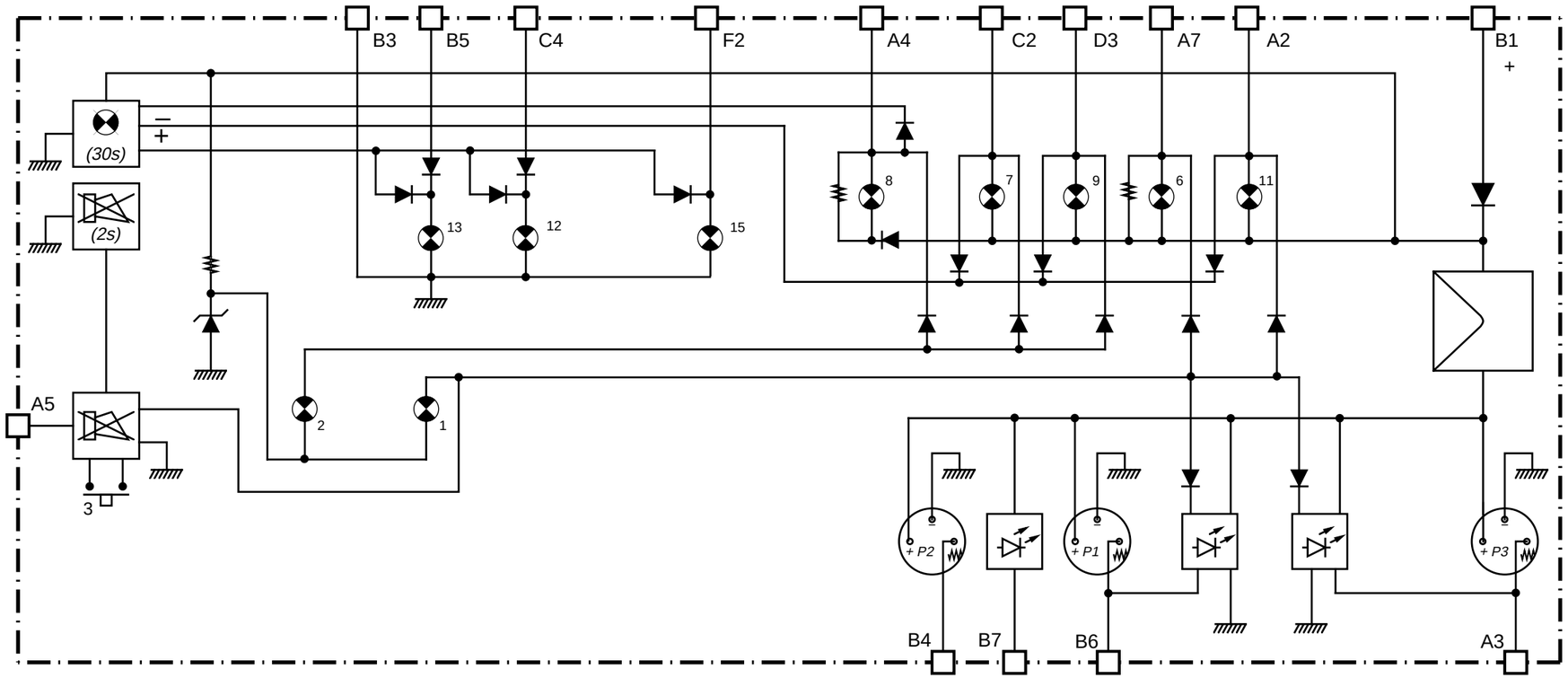
V1 General contact diode
V4 Radio diode (optional)

Ø 2 Starter connection
Ø 3 Solenoid/injection pump connection
Ø 4 Printed circuit earth
Ø 5 Upperstructure power line connection

□ △ ▽ ▲ ▼ : see page 4



P10 INSTRUMENT PANEL ELECTRICAL SCHEMATIC (PLATE 1)



CM97C005

A2 Minimum pilot pressure red warning lamp connector
A3 Hydraulic oil temperature indicator connector
A4 Battery charge red warning lamp connector
A5 Audible warning red, orange indicator lamp connector
A7 Engine oil pressure red warning lamp connector

B1 24 Volts supply
B3 Earth
B4 Fuel level indicator connector
B5 Indicator lighting connector
B6 Engine coolant temperature indicator connector
B7 Fuel minimum level connector

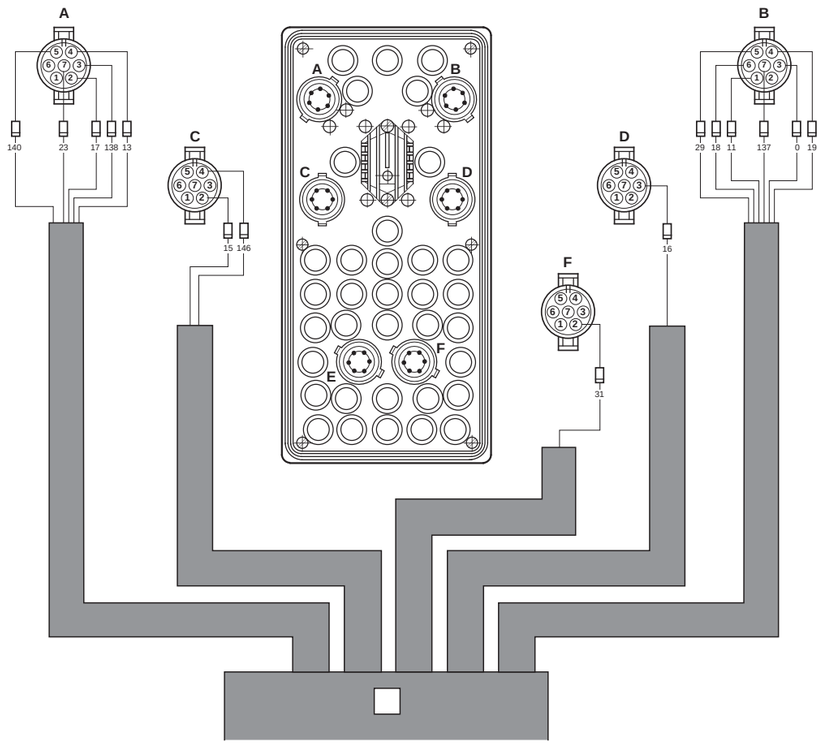
C2 Air filter restriction red warning lamp connector
C4 Overload indicator orange warning lamp connector (optional)

D3 Hydraulic oil filter restriction red warning light connector
F2 Rotary light orange indicator lamp connector (specific to certain countries)

P1 Engine coolant temperature indicator
P2 Fuel level indicator
P3 Hydraulic oil temperature indicator

1 Stop alarm red warning lamp
2 Alarm orange indicator lamp
3 Audible warning stop push button
6 Engine oil pressure red warning lamp
7 Air filter restriction red warning lamp
8 Battery charge red warning lamp
9 Hydraulic oil filter restriction red warning lamp
11 Minimum pilot pressure red warning lamp
12 Overload indicator orange indicator lamp (optional)
13 Instrument panel lamp
15 Rotary light orange indicator lamp (specific to certain countries)

INSTRUMENT PANEL WIRING



PDH0235

A 7 way connector: Pilot system minimum pressure red warning light, hydraulic oil temperature gauge, battery charge red warning light, audible warning device stop push-button, engine oil pressure red warning light, alarm orange warning light, stop alarm red warning light

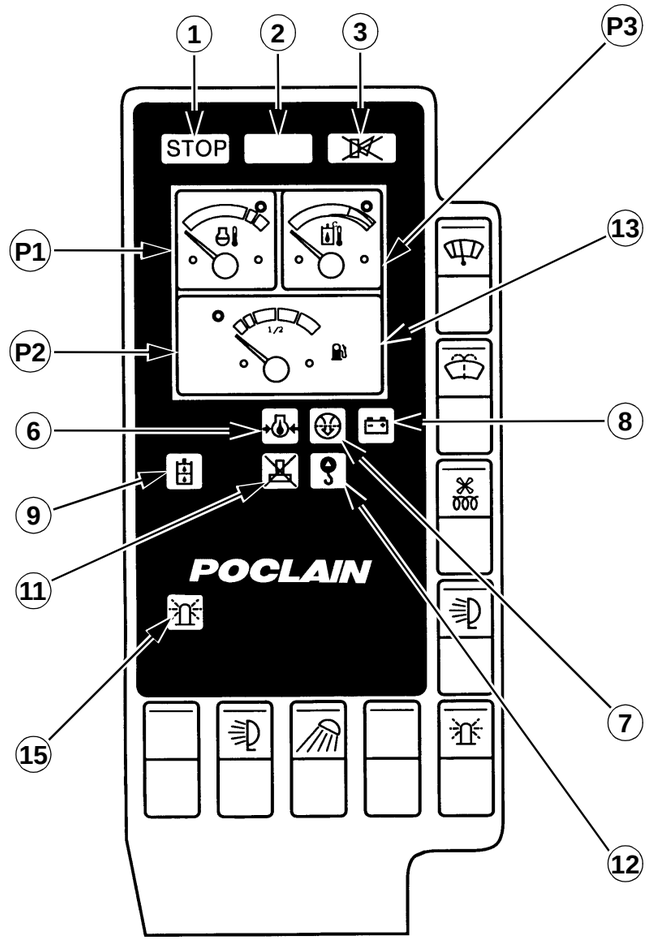
B 7 way connector: 24 Volts supply, earth, fuel level gauge, gauge lighting, engine coolant solution temperature gauge.

C 7 way connector: air filter restriction red warning lamp, overload indicator orange indicator lamp (optional).

D 7 way connector: Hydraulic oil filter restriction red warning light.

F 7 way connector: rotary light orange indicator lamp (optional).

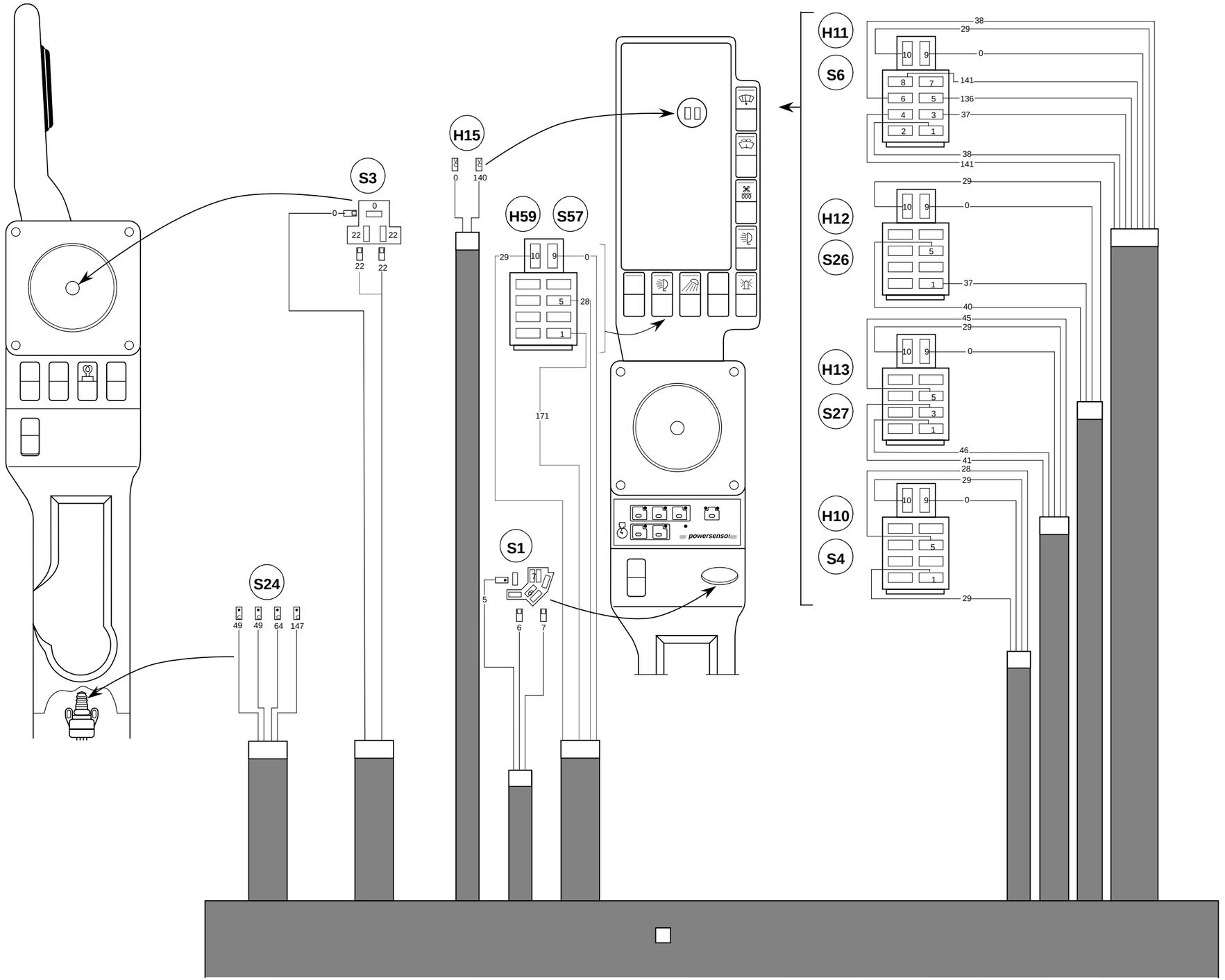
INSTRUMENT PANEL (FRONT FACE)



CS96N047

1 Stop alarm red warning lamp
2 Alarm orange indicator lamp
3 Audible warning stop push button
6 Engine oil pressure red warning lamp
7 Air filter restriction red warning lamp
8 Battery charge red warning lamp
9 Hydraulic oil filters restriction red warning lamp
11 Minimum pilot pressure red warning lamp
12 Overload indicator orange indicator lamp (optional)
13 Instrument panel lamp
15 Rotary light orange indicator lamp (optional)

P1 Engine coolant temperature indicator
P2 Fuel level indicator
P3 Hydraulic oil temperature indicator

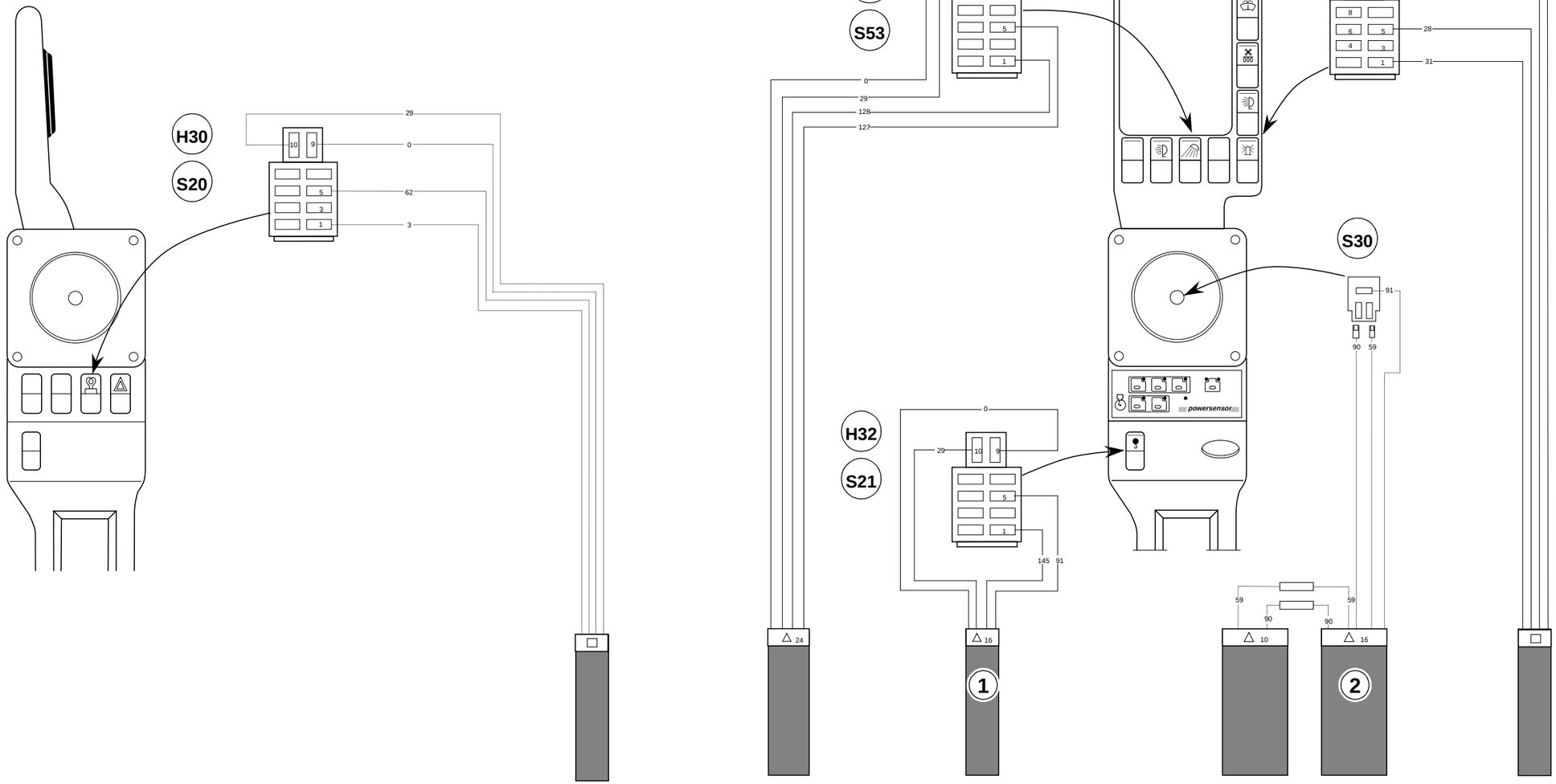

S3
0
0
22
22
22
22
H15
0
140
H59
S57
29
10
9
0
5
28
1
171
S1
5
7
6
7
S24
49
49
64
147
H11
S6
38
29
10
9
0
8
7
141
6
5
136
4
3
37
2
1
38
141
H12
S26
29
10
9
0
5
1
37
40
H13
S27
45
29
10
9
0
5
3
1
46
41
H10
S4
28
29
10
9
0
5
1
29
powersensor

CM97C006

RIGHT-HAND CONTROL ARM, LEFT-HAND CONTROL ARM (STANDARD EQUIPMENT)

H10 Working light switch lighting
H11 Windshield wiper switch lighting
H12 Windshield washer switch lighting
H13 Heater blower switch lighting
H15 Instrument panel audible warning
H59 Upperstructure working light switch lighting
S1 Key switch
S3 Horn switch
S4 Working light switch
S6 Windshield wiper switch
S24 Pilot safety switch
S26 Windshield washer switch
S27 Heater blower switch
S57 Upperstructure working light switch

□ Floor harness


H30
S20
29
0
62
3
H53
S53
0
29
128
127
H31
S25
29
0
28
31
S30
91
90
59
H32
S21
145
91
59
90
1
2
powersensor

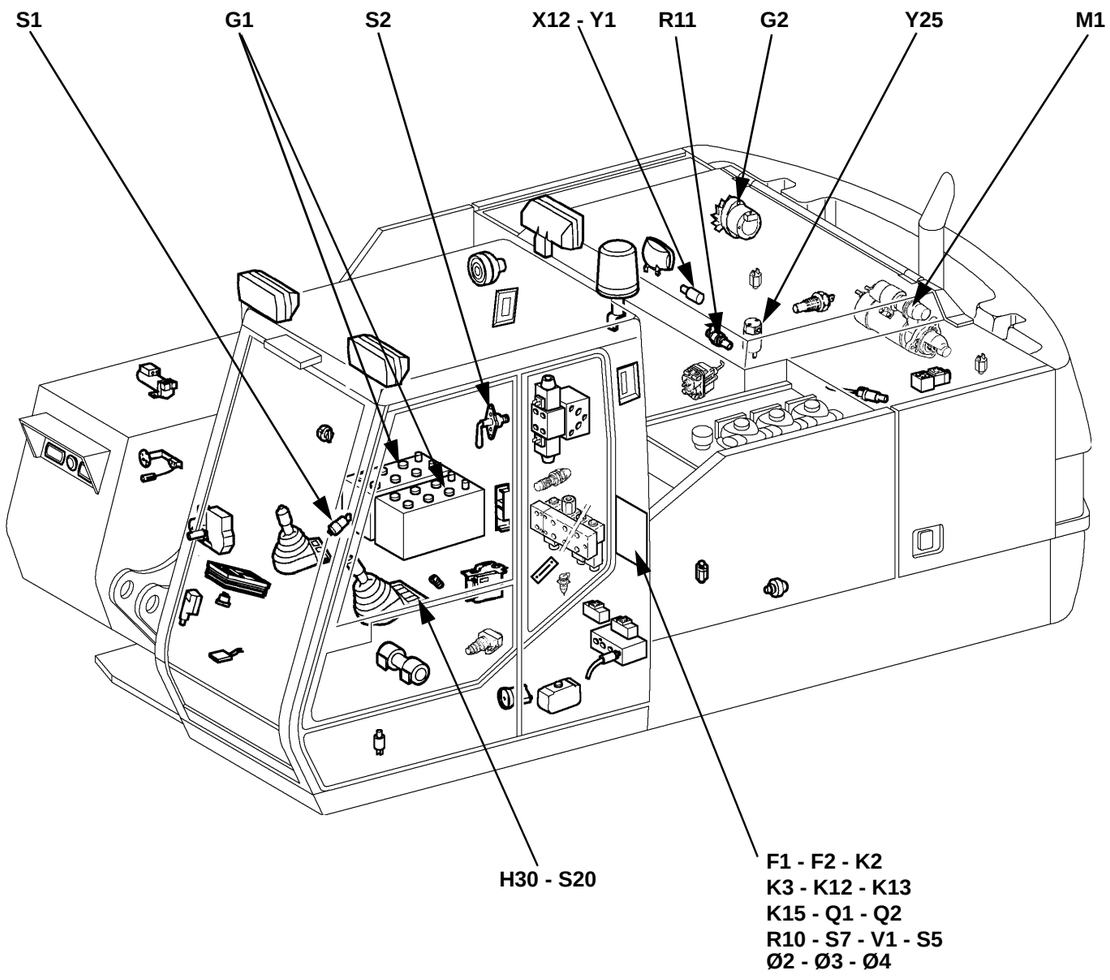
RIGHT-HAND CONTROL ARM, LEFT-HAND CONTROL ARM WIRING (OPTIONAL)

H30 Cold start assistance switch lighting
H31 Rotary switch lighting
H32 Overload indicator switch lighting
H53 Front working light switch lighting
S20 Cold start assistance switch
S21 Overload indicator switch
S25 Rotary light switch
S30 Articulated boom control switch **(1488 excavators only)**
S53 Front working lights switch

□ Rotary light and cold start assistance harness

△ **10** Articulated boom harness **(1488 excavators only)**
△ **16** **(1)** Overload indicator harness
△ **16** **(2)** Articulated boom harness **(1488 excavators only)**
△ **24** Front working light harness

ELECTRICAL SCHEMATIC (PLATE 2)



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ELECTRICAL CABINET

F1 Fuse, 30A, cold start assistance
F2 Fuse, starter switch (5A)
K2 General contact relay 24V, 50A
K3 Hourmeter relay, ignition warning lamp
K12 Starter motor solenoid relay
K13 Injection pump solenoid relay
K15 Cold start assistance relay
Q1 Circuit breaker, 40A, starter motor
Q2 Circuit breaker, 40A, injection pump solenoid
R10 Resistor, 0.85 Ohm
Sh5, Sh7 Shunts not used
V1 General contact diode
Ø2 Starter connection
Ø3 Solenoid/injection pump connection
Ø4 Printed circuit earth

FLOOR

H30 Cold start assistance switch lighting (optional)
S1 Key switch
S20 Cold start assistance momentary switch (optional)

□△▽▲ : see page 4.

UPPERSTRUCTURE

G1 Batteries
S2 Battery master switch

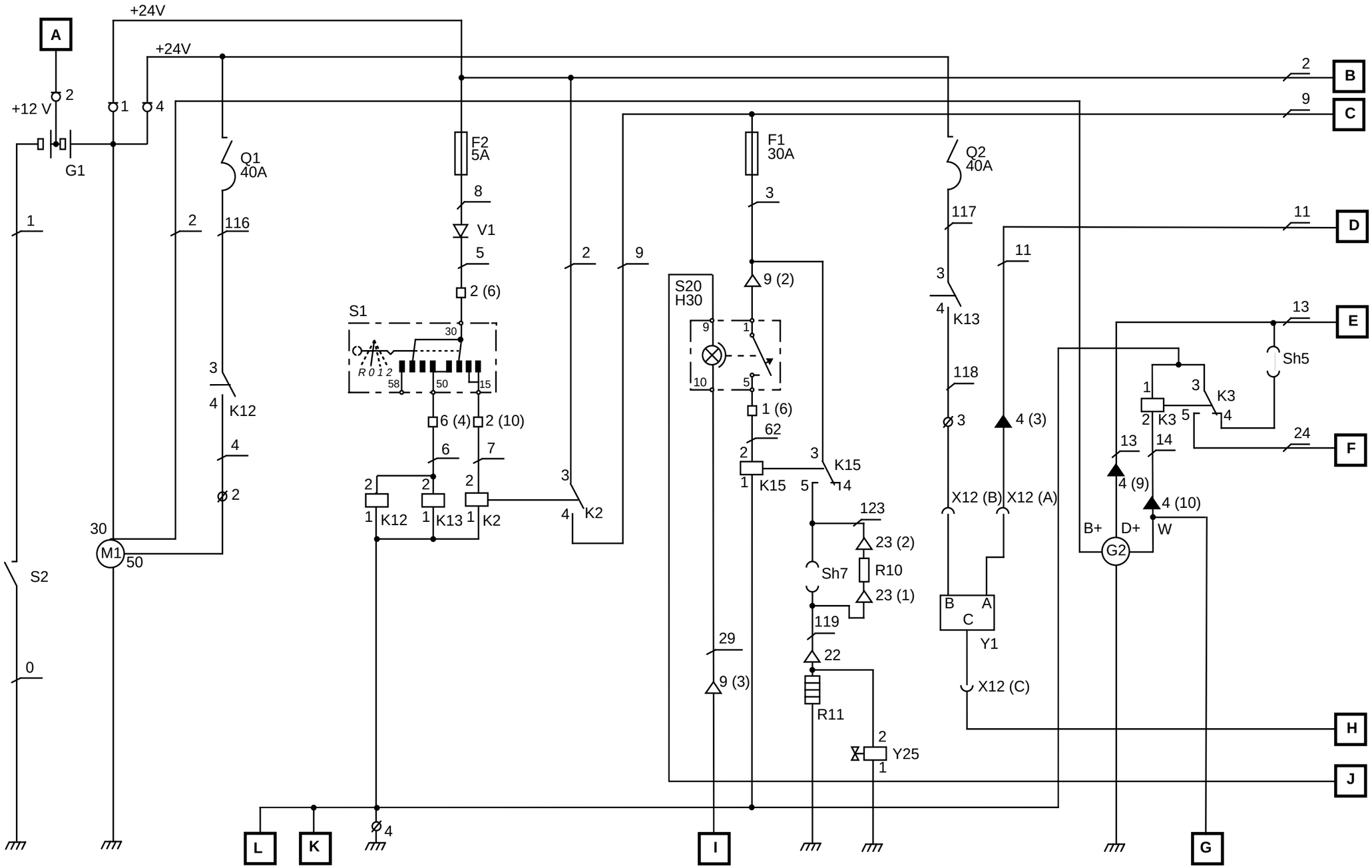
ENGINE

G2 Alternator
M1 Starter motor
R11 Pre-heater plug
X12 Injection pump solenoid connector
Y1 Injection pump solenoid
A Red
B White
C Black
Y25 “Thermostart” cold start assistance system solenoid valve (optional)

WIRING CONNECTIONS BETWEEN SCHEMATICS

A See schematic plate 5 page 22
B See schematic plate 2 page 16
C See schematic plate 2 page 16
D See schematic plate 2 page 16
E See schematic plate 2 page 16
F See schematic plate 2 page 16
G See schematic plate 5 page 22
H See schematic plate 2 page 16
I See schematic plate 2 page 16
J See schematic plate 2 page 16
K See schematic plate 4 page 20
L See schematic plate 6 page 24

BATTERY MASTER SWITCH | BATTERIES STARTER MOTOR | STARTER SWITCH KEY BATTERY RELAY | COLD STARTING ASSISTANCE THERMOSTART (OPTIONAL) | INJECTION PUMP SOLE-NOID | ALTERNATOR



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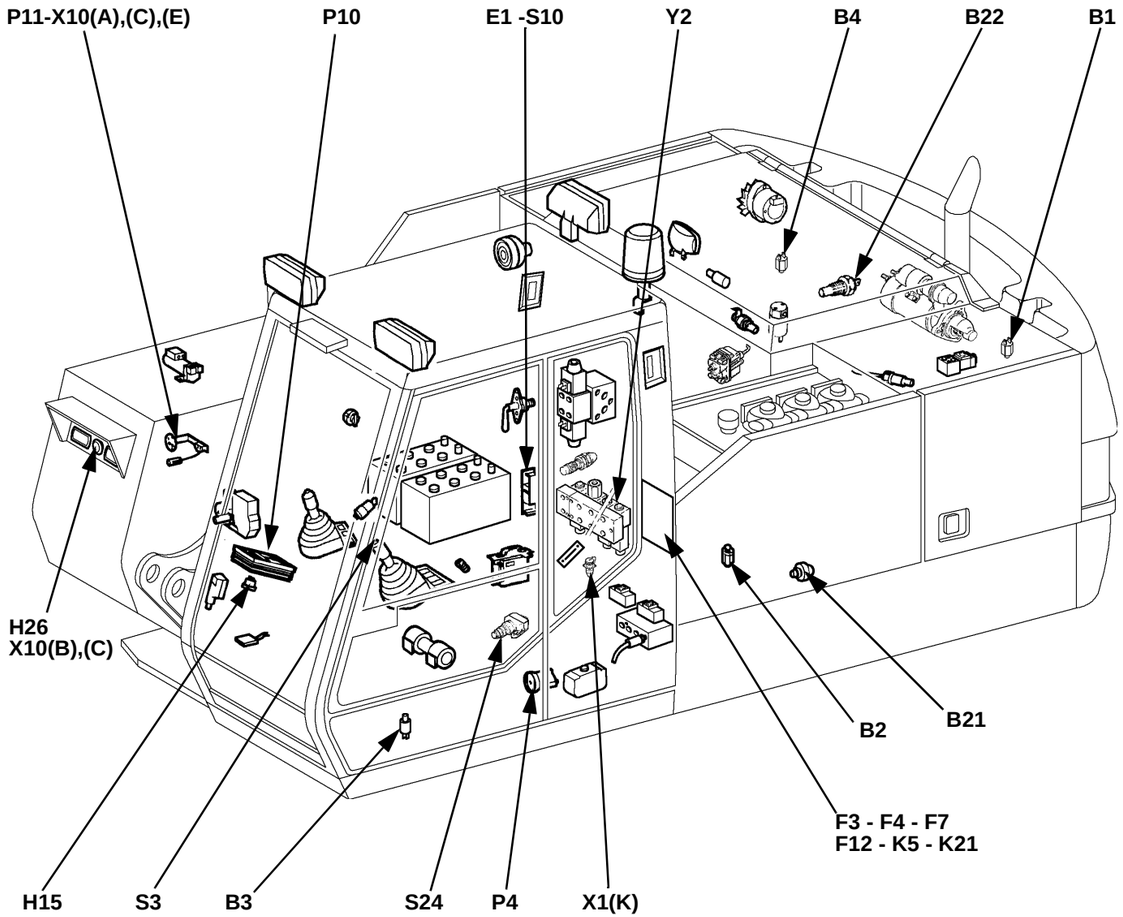


CI97C006

ELECTRICAL SCHEMATIC (PLATE 3)

INSTRUMENT PANEL

P10 Instrument panel (See schematic plate 1)

ELECTRICAL CABINET

F3 Fuse, 7.5A, instrument panel, injection pump sender, alternator
F4 Fuse, 5A, cab lighting, horn relay
F7 Fuse, 10A, horn
F12 Pilot safety relay
K5 Horn relay
K21 Fuse, 15A, pilot safety

CAB

E1 Cab lighting
S10 Cab lighting switch
X1(K) Cab floor/cab, operator's compartment light

□△▼▲ : see page 4.

FLOOR

B3 Pilot pressure pressostat
H15 Instrument panel audible warning
P4 Hourmeter
S3 Horn switch
S24 Pilot safety switch
Y2 Pilot safety solenoid valve

UPPERSTRUCTURE

B1 Air filter restriction pressostat
B2 Hydraulic oil filter restriction pressostat
B21 Hydraulic oil temperature sender
H26 Horn
P11 Fuel level indicator
X10 (A),(C),(E) Fuel level indicator
X10 (B), (E) Horn connector

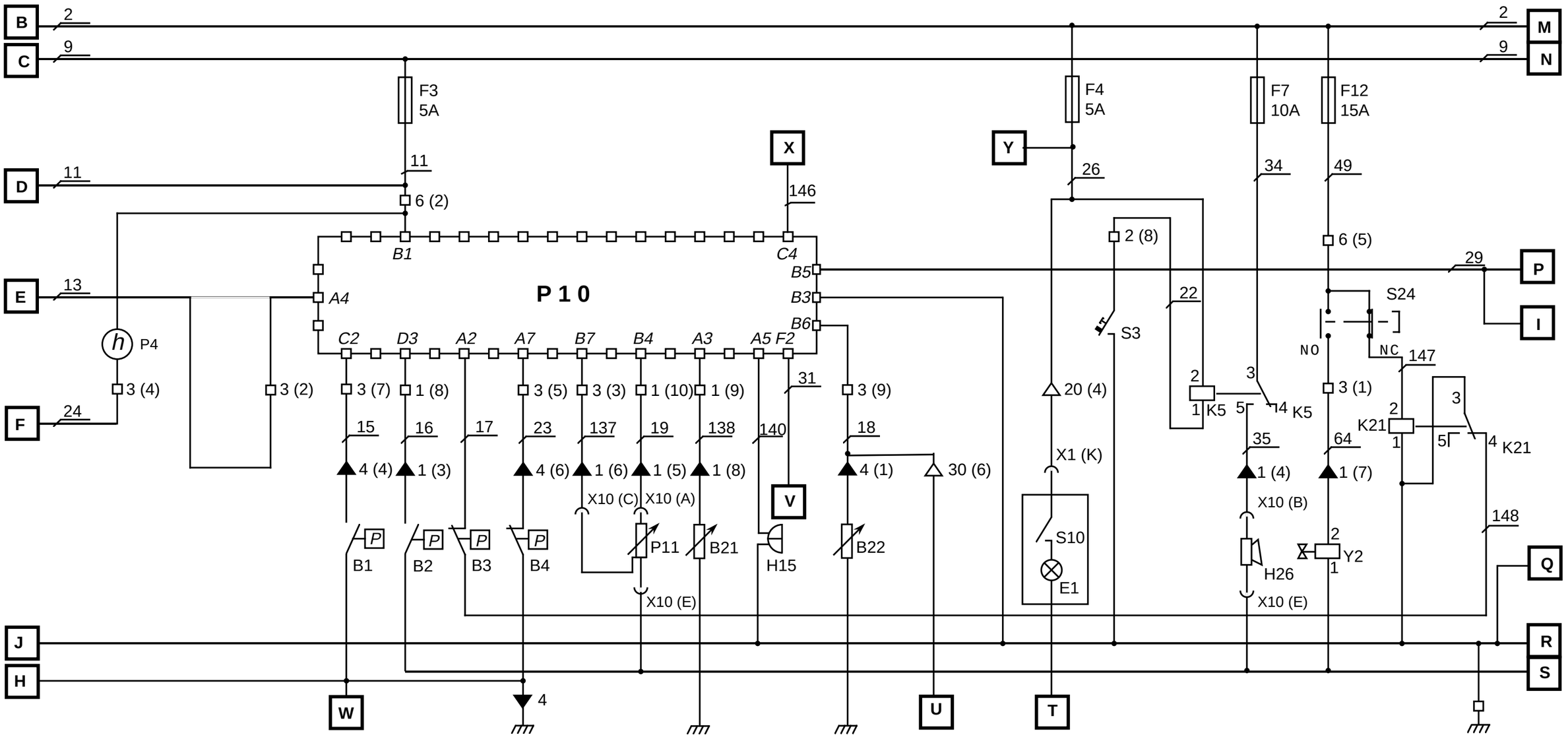
ENGINE

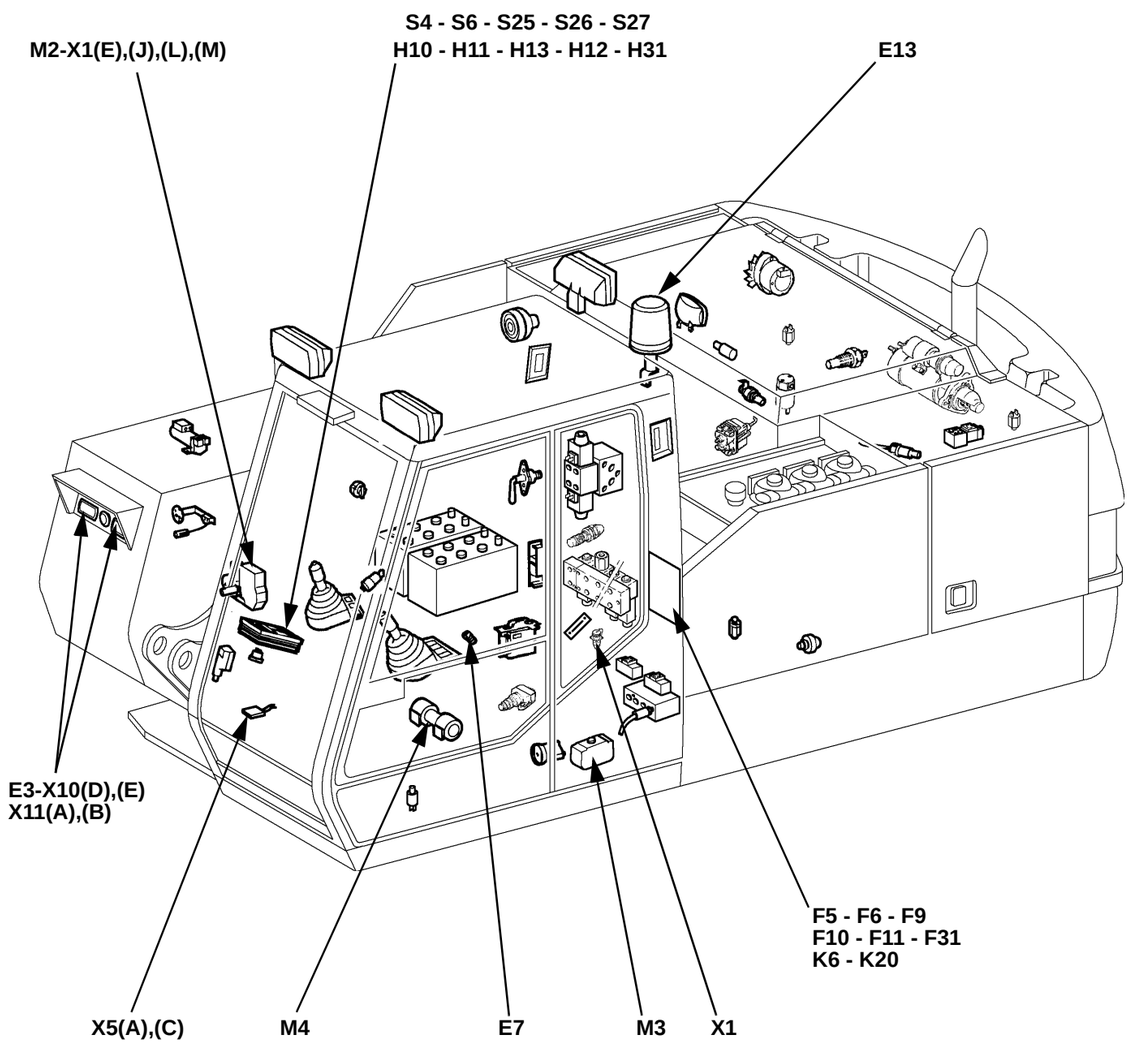
B4 Engine oil pressure pressostat
B22 Engine coolant temperature sender

WIRING CONNECTIONS BETWEEN SCHEMATICS

B	See schematic plate 2 page 16	**I**	See schematic plate 2 page 16	**R**	See schematic plate 5 page 22
C	See schematic plate 2 page 16	**J**	See schematic plate 2 page 16	**S**	See schematic plate 4 page 20
D	See schematic plate 2 page 16	**M**	See schematic plate 4 page 20	**T**	See schematic plate 4 page 20
E	See schematic plate 2 page 16	**N**	See schematic plate 4 page 20	**U**	See schematic plate 6 page 24
F	See schematic plate 2 page 16	**P**	See schematic plate 4 page 20	**V**	See schematic plate 4 page 20
H	See schematic plate 2 page 16	**Q**	See schematic plate 4 page 20	**W**	See schematic plate 5 page 22
				X	See schematic plate 5 page 22
				Y	See schematic plate 5 page 22

HOURMETER | INSTRUMENT PANEL: AIR FILTER RESTRICTION | HYDRAULIC OIL FILTER RESTRICTION | PILOT PRESSURE | ENGINE OIL PRESSURE | FUEL LEVEL RESERVE ALERT | HYDRAULIC OIL TEMPERATURE | INSTRUMENT PANEL AUDIBLE WARNING DEVICE | ENGINE TEMPERATURE | CAB LIGHTING | HORN | PILOT SAFETY





CI97C006

ELECTRICAL SCHEMATIC (PLATE 4)

INSTRUMENT PANEL

H10 Working light switch lighting
H11 Windshield wiper switch lighting
H12 Windshield washer switch lighting
H13 Heater blower switch lighting
H31 Rotary light switch lighting (optional)
S4 Working light switch
S6 Windshield wiper switch
S25 Rotary light switch (optional)
S26 Windshield washer switch
S27 Heater blower switch

ELECTRICAL CABINET

F5 Fuse, 10A, working light, rotary light relay (optional)
F6 Fuse, 20A, upperstructure working lights
F9 Fuse, 15A, windshield washer, windshield wiper
F10 Fuse, 15A, ventilation, heater
F11 Fuse, 7.5A, cigarette lighter
F31 Fuse, 15A, windshield wiper intermittent action
K6 Attachment and upperstructure working light relay
K20 Windshield wiper intermittent action

□△▽▲▼ : seepage 4.

CAB

E13 Rotary light (optional)
M2 Windshield wiper motor
E : Blue
J : White
L : Grey
M : Black
X1 (F) Rotary light cab floor/cab connector (optional)
X1 (E), (L), (M), (J) Windshield wiper motor cab floor/cab connector

FLOOR

E7 Cigarette lighter
M3 Windshield washer motor
M4 Heater blower motor

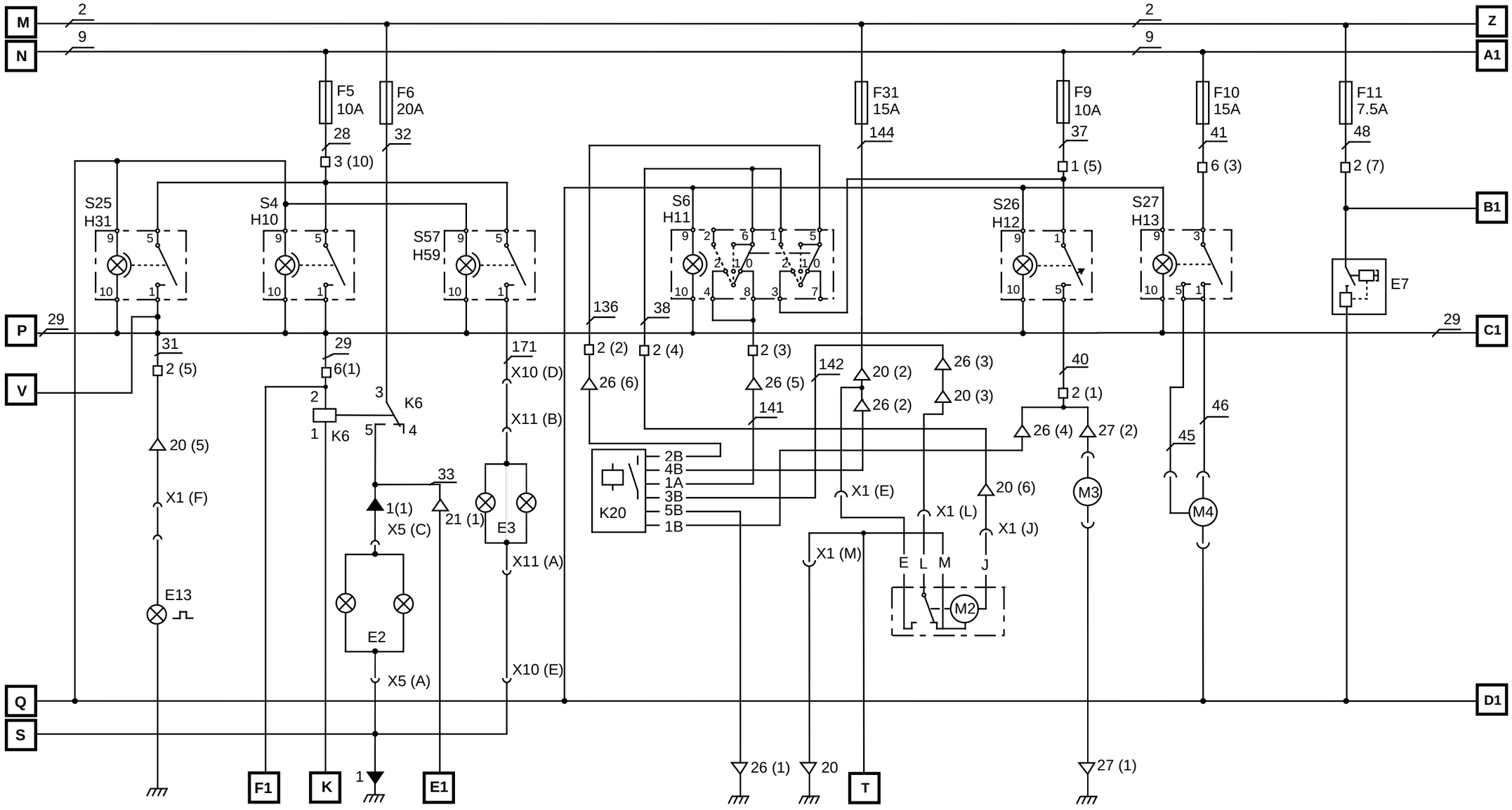
UPPERSTRUCTURE

E2 Attachment working lights (on boom)
E3 Upperstructure working light
X5 (A), (C) Attachment working light power connection
X10 (E), (D) Connector
X11 (A), (B) Upperstructure working light power connection

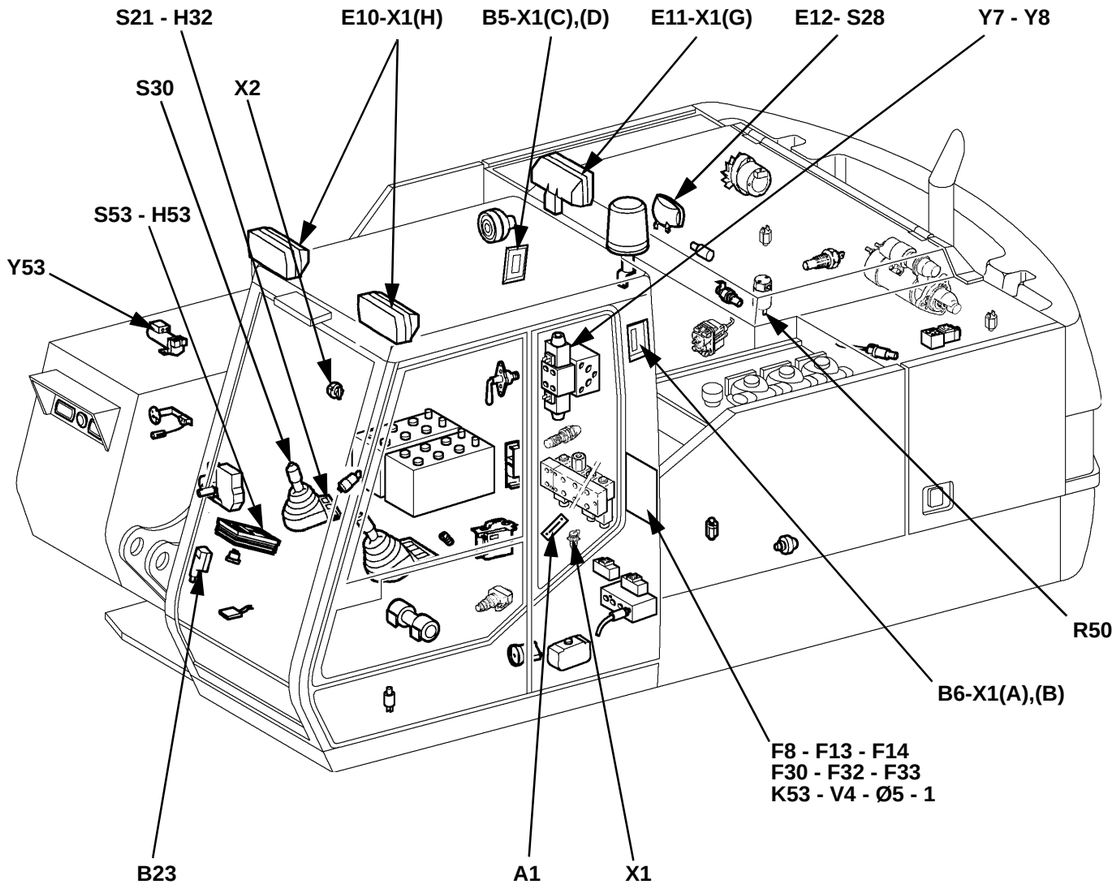
WIRING CONNECTIONS BETWEEN SCHEMATICS

K	See schematic plate 2 page 16	**A1**	See schematic plate 5 page 22
M	See schematic plate 2 page 16	**B1**	See schematic plate 5 page 22
N	See schematic plate 2 page 16	**C1**	See schematic plate 5 page 22
P	See schematic plate 2 page 16	**D1**	See schematic plate 5 page 22
Q	See schematic plate 2 page 16	**E1**	See schematic plate 5 page 22
S	See schematic plate 2 page 16	**F1**	See schematic plate 6 page 24
T	See schematic plate 2 page 16		
U	See schematic plate 2 page 16		
Z	See schematic plate 5 page 22		

ROTARY LIGHT (OPTIONAL) | WORKING LIGHTS: ATTACHMENT | UPPERSTRUCTURE | WINDSHIELD WIPER | WINDSHIELD WASHER | HEATER BLOWER CHAUFFAGE | CIGARETTE LIGHTER



CM97C012



CI97C006

ELECTRICAL SCHEMATIC (PLATE 5)

ELECTRICAL CABINET

F8 Fuse, 30A, upperstructure power point
F13 Fuse, 5A, overload indicator, articulated boom (optional)
F14 Fuse, 5A, radio
F30 Fuse, 20A, cab working lights (optional)
F32 Fuse, 15A, fuel heater
F33 Fuse, 7.5A, electronic control box, diagnostic socket
K53 Fuel heater relay (optional)
V4 Radio diode (optional)
Ø5 Upperstructure power line connection

INSTRUMENT PANEL

H53 Front working light switch lighting (optional)
S53 Front working lights switch (optional))

FLOOR

A1 Radio (optional)

H32 Overload indicator switch lighting (optional)
S21 Overload indicator switch (optional)
S30 Articulated boom control switch (optional) **(1488 excavators only)**
1 Standard 4 terminal bar

□△▽▲ : see page 4.

CAB

B5 RH loudspeaker (optional)
B6 LH loudspeaker (optional)
E10 Front working lights (optional))
E11 Rear working light
M6 Ventilator motor (optional)
S29 Blower switch (optional)
X1(A),(B),(C),(D) RH and LH loudspeaker connector
X1(H),(G) Front working light, rear working light connectors (optional)
X14 (1),(2) Ventilator motor connector (optional)

UPPERSTRUCTURE

B23 Overload indicator pressure switch, on boom foot (optional)
X2 Upperstructure power connection
Y7 Articulated boom extending solenoid valve (optional) **(1488 excavators only)**
Y8 Articulated boom retracting solenoid valve **(1488 excavators only)**
Y53 Fuel pump (optional)

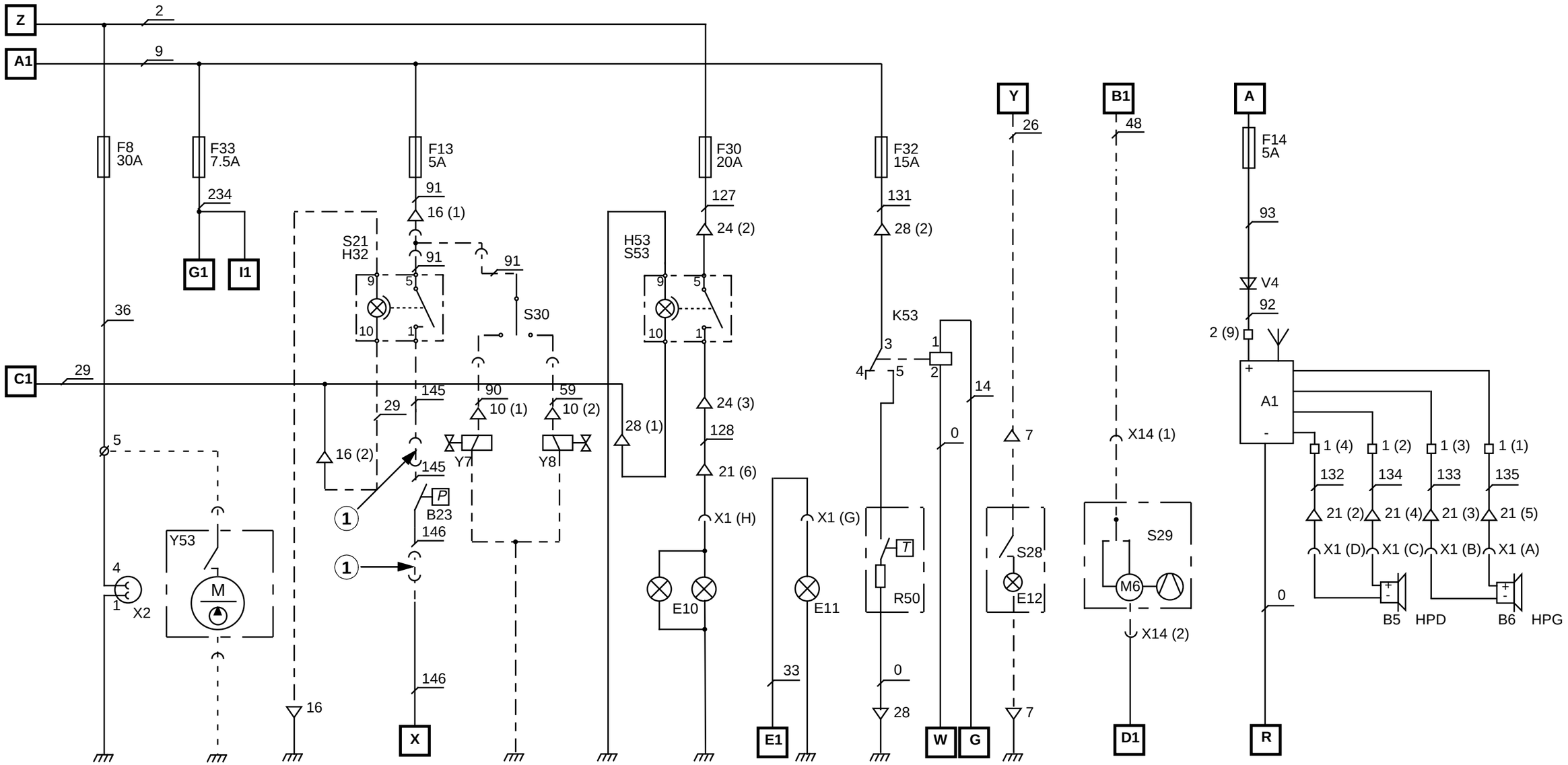
ENGINE

E12 Engine compartment light (optional)
S28 Engine compartment light switch (optional)
R50 Fuel heater (optional)

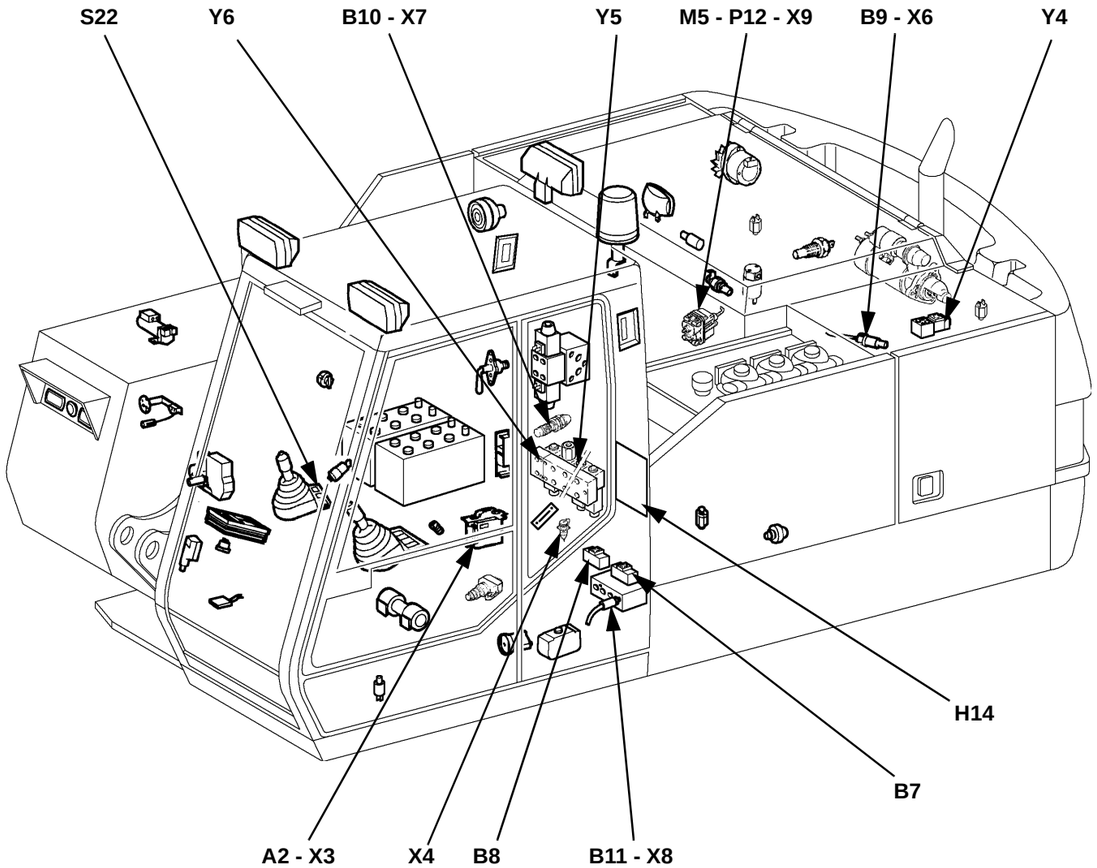
WIRING CONNECTIONS BETWEEN SCHEMATICS

A	See schematic plate 2 page 16	**A1**	See schematic plate 4 page 20
G	See schematic plate 2 page 16	**B1**	See schematic plate 4 page 20
R	See schematic plate 2 page 16	**C1**	See schematic plate 4 page 20
W	See schematic plate 2 page 16	**D1**	See schematic plate 4 page 20
X	See schematic plate 2 page 16	**E1**	See schematic plate 4 page 20
Y	See schematic plate 2 page 16	**G1**	See schematic plate 6 page 24
Z	See schematic plate 4 page 20	**I1**	See schematic plate 6 page 24

UPPERSTRUCTURE	SUPPLY: TROUBLESHOOTING SOCKET / ELECTRONIC CONTROL BOX / FUEL FILLER PUMP	OVERLOAD INDICATOR (OPTIONAL)	ARTICULATED BOOM (OPTIONAL) **(1488 EXCAVATORS ONLY)**	CAB WORKING LIGHTS: FRONT (1288 OPTIONAL) (1488 STANDARD) / REAR	FUEL HEATER (OPTIONAL)	HOOD LIGHT (OPTION)	HEATER BLOWER FOR CAB (OPTIONAL)	RADIO



CM97C013



CI97C006

ELECTRICAL SCHEMATIC (PLATE 6)

ELECTRICAL CABINET

H14 Diagnostic (LED) lamp

CAB

A2 Electronic control box
S22 Control panel
X3 Connector 35 -way
X4 Diagnostic socket

FLOOR

B8 Travel detector pressostat

UPPERSTRUCTURE

B7 Swing detector pressostat
B10 Swing motor speed detector
B11 Hydraulic pressure sender
X7 Swing motor speed connector
Y5 Upperstructure brake release control solenoid valve
Y6 Travel motor displacement change solenoid valve (two-speed excavators only)

ENGINE

B9 Engine speed detector
M5 Injection pump servo-motor
P12 Servo-motor potentiometer
X6 Engine speed detector connector
X8 Hydraulic pressure connector
X9 Injection pump servo-motor connector
Y4 DRE 4 proportional pressure reduction valve

WIRING CONNECTIONS BETWEEN SCHEMATICS

L See schematic plate 2 page 16

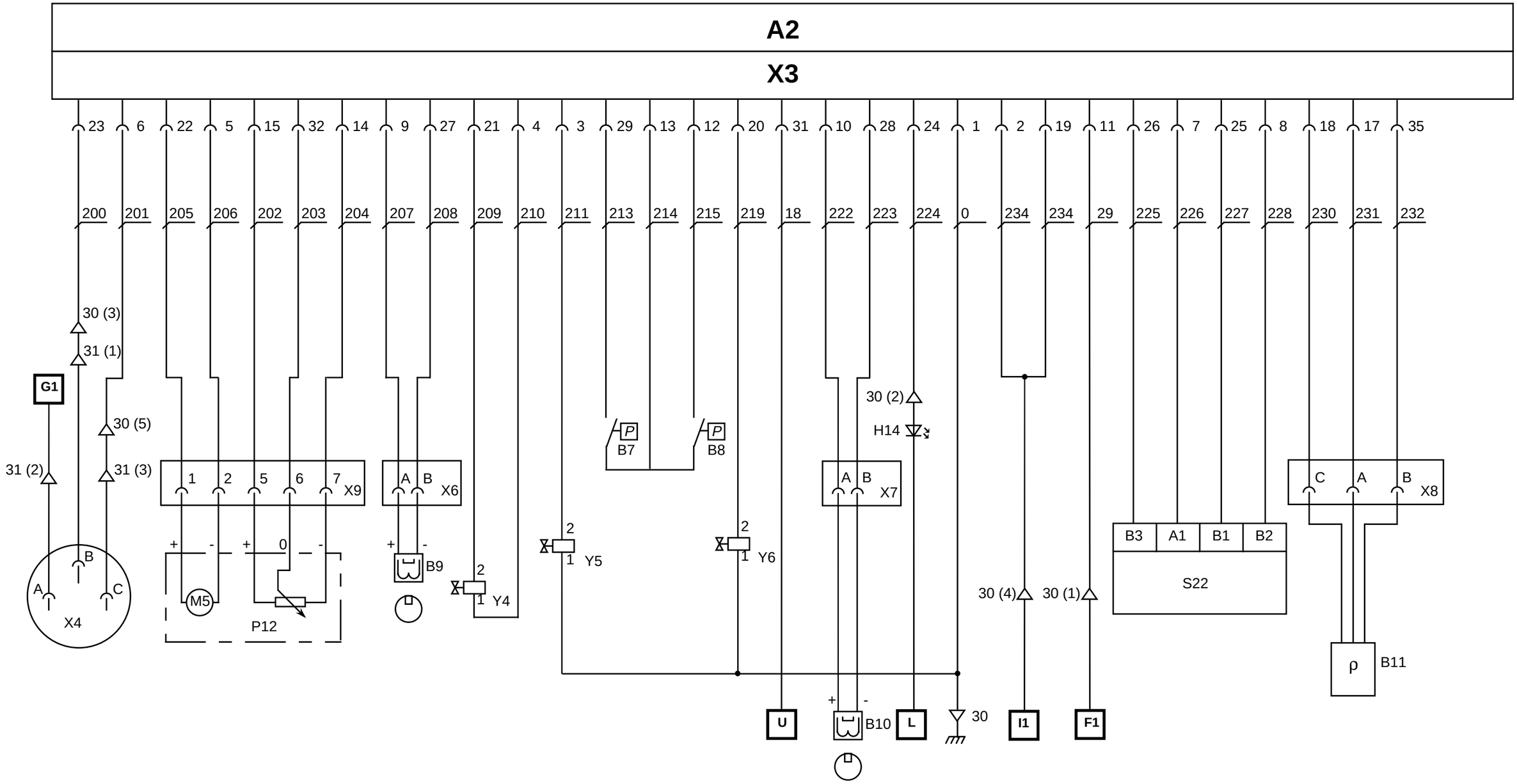
U See schematic plate 2 page 16

F1 See schematic plate 4 page 20

G1 See schematic plate 5 page 22

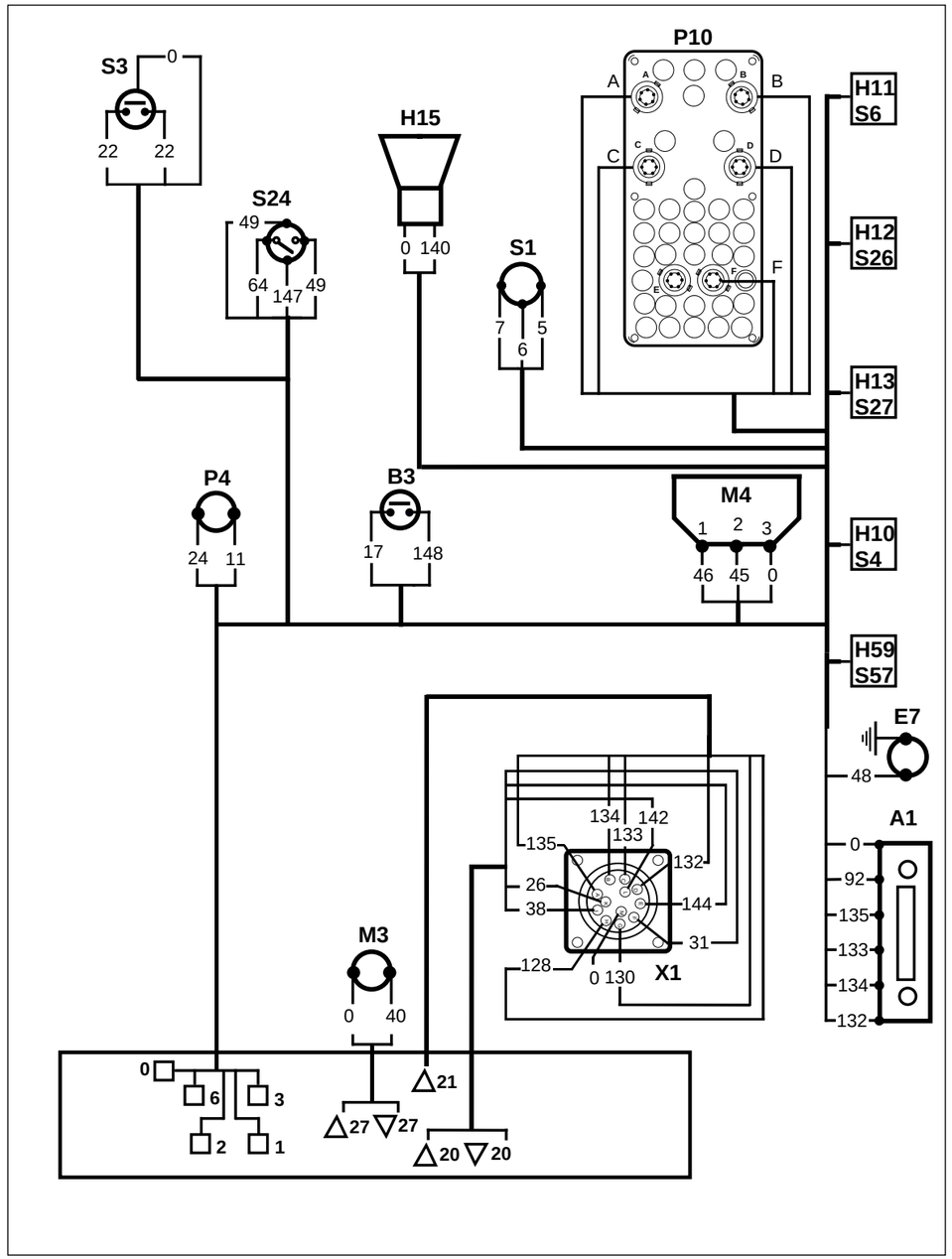
I1 See schematic plate 5 page 22

TROUBLESHOOTING SOCKET | INJECTION PUMP SERVOMOTOR | ENGINE SPEED DETECTOR | DRE4 PRESSURE REDUCER | SWING BRAKE RELEASE SOLENOID VALVE | PRESSURE SWITCH: SWING / TRAVEL | TRAVEL DISPLACEMENT CHANGE SOLENOID VALVE | COOLANT TEMPERATURE | UPPERSTRUCTURE SWING SPEED ROTATION TOURELLE | DIAGNOSTIC LED | 0V BATTERY | +28V BATTERY | +28V INSTRUMENT PANEL LIGHTING | INSTRUMENT PANEL | PRESSURE SENDER

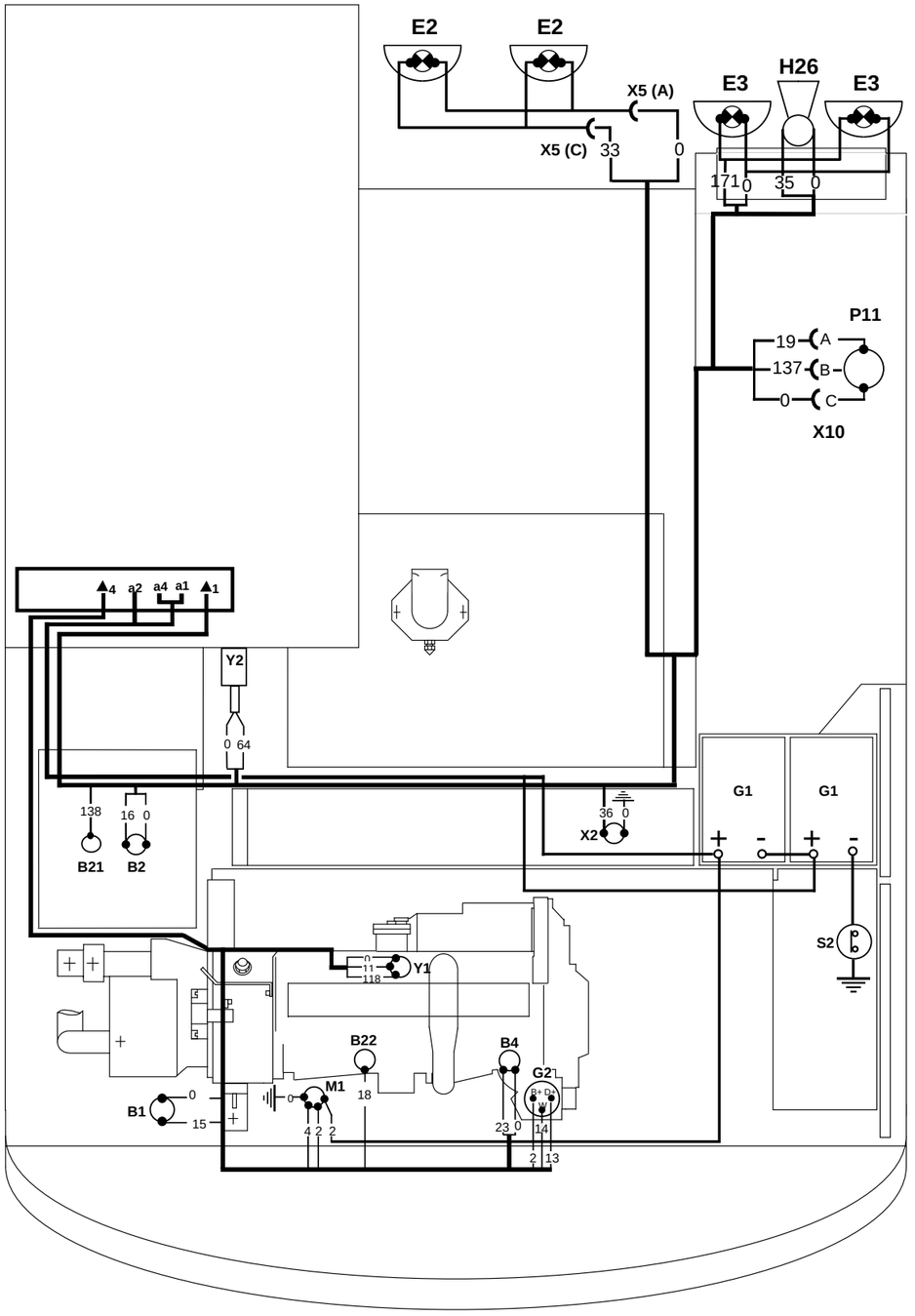


CAB FLOOR WIRING (STANDARD)

NOTA : *The wiring of the electronic system is not shown in these schematics. Refer to page 28 for electronic system wiring.*



ENGINE MODULE AND UPPERSTRUCTURE WIRING (STANDARD)



CAB FLOOR WIRING (STANDARD)

ELECTRICAL CABINET

△ **20,** ▽**20,** △**21,** ▽ **27,** △ **27 :** see page 4

☐**1,** ☐ **2,** ☐ **3,** ☐ **6** et ☐ **0 :** see page 4

FLOOR

A1 Radio (optional)
B3 Pilot pressure pressostat
E7 Cigarette lighter
H10 Working light switch lighting
H11 Windshield wiper switch lighting
H12 Windshield washer switch lighting
H13 Heater blower switch lighting
H15 Instrument panel audible warning
H59 Upperstructure working light switch lighting
M3 Windshield washer motor
M4 Heater blower motor
P4 Hourmeter
P10 Instrument panel
S1 Key switch
S3 Horn switch
S4 Working light switch
S6 Windshield wiper switch
S22 Control panel
S24 Pilot safety switch
S26 Windshield washer switch
S27 Heater blower switch
S57 Upperstructure working light switch
X1 Cab floor/cab power connector

ENGINE MODULE AND UPPERSTRUCTURE WIRING (STANDARD EQUIPMENT)

ELECTRICAL CABINET

1 24 Volts supply before contact
2 12 volts supply before contact
4 24 Volts supply before contact

▲**1** et ▲**4**: voir page 4

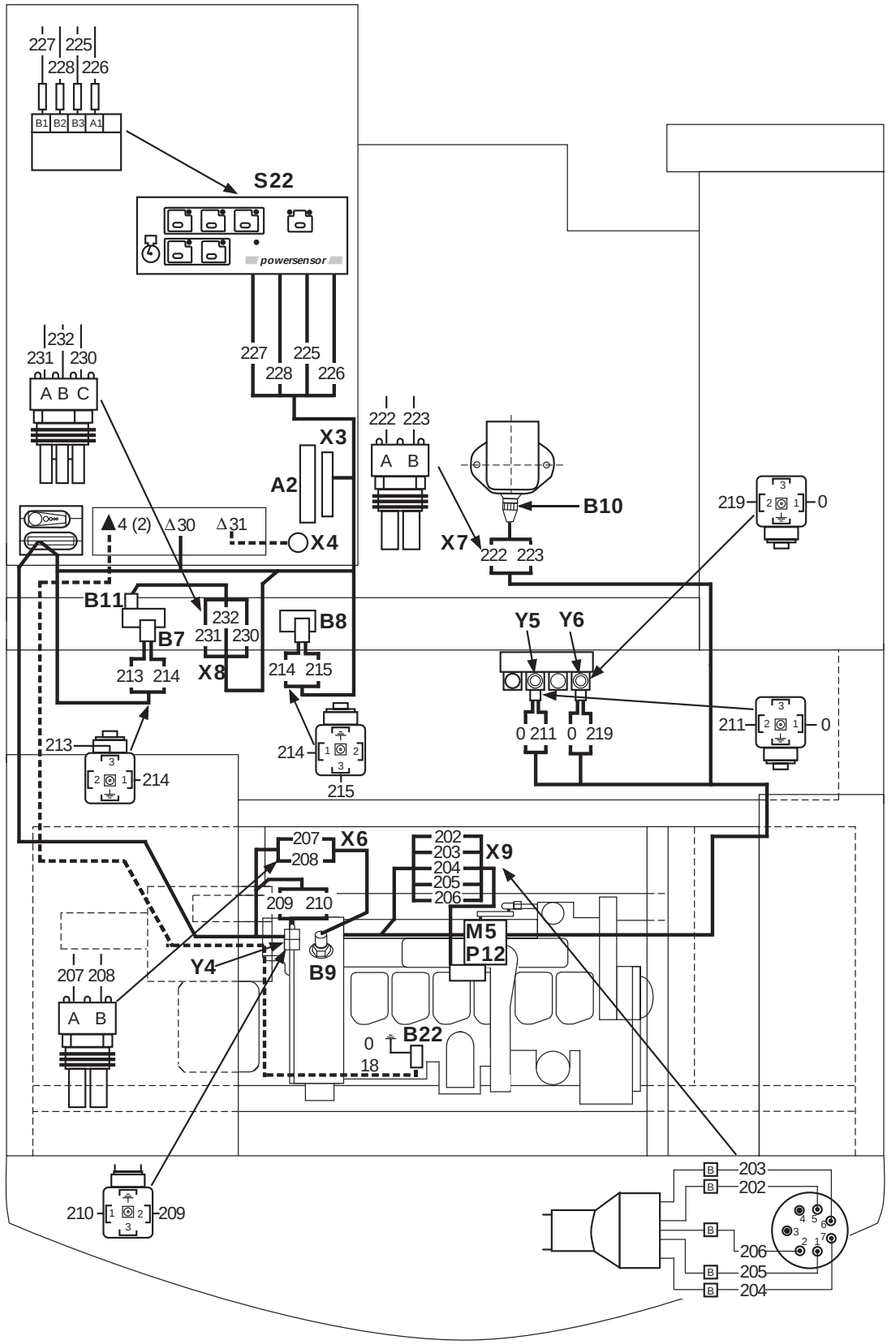
UPPERSTRUCTURE

B1 Air filter restriction pressostat
B2 Hydraulic oil filter pressostat
B21 Hydraulic oil temperature sender
E2 Attachment working lights
E3 Upperstructure working light
G1 Batteries
H26 Horn
P11 Fuel level indicator
S2 Battery master switch
X2 Upperstructure power line connection
X5(A),(C) Attachment working light power point
X10(A),(B),(C) Fuel level indicator connector
Y2 Pilot safety solenoid valve

ENGINE

B4 Engine oil pressure pressostat
B22 Engine coolant temperature sender
G2 Alternator
M1 Starter motor
Y1 Engine stop solenoid valve

ELECTRONIC SYSTEM WIRING



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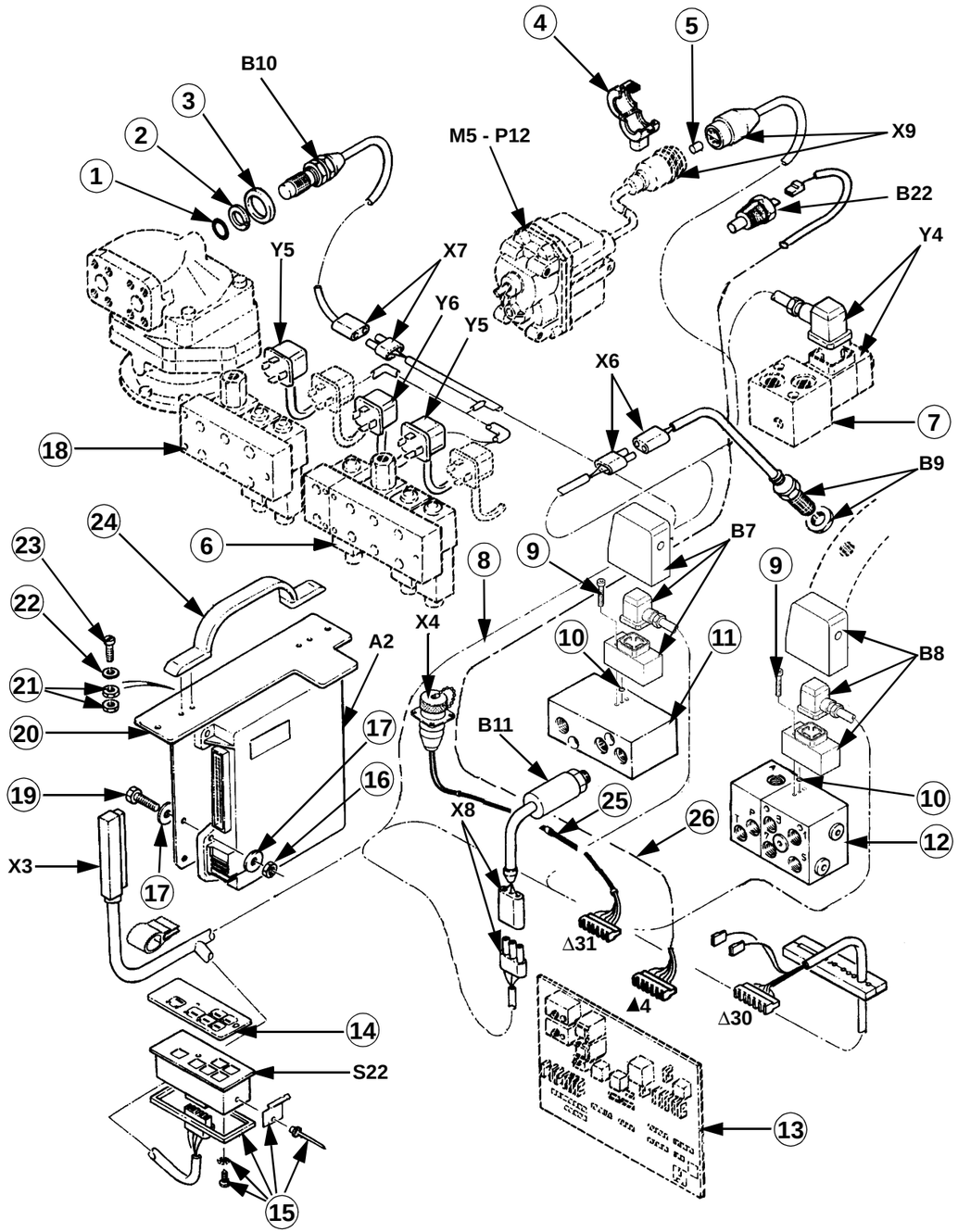


CS97D015

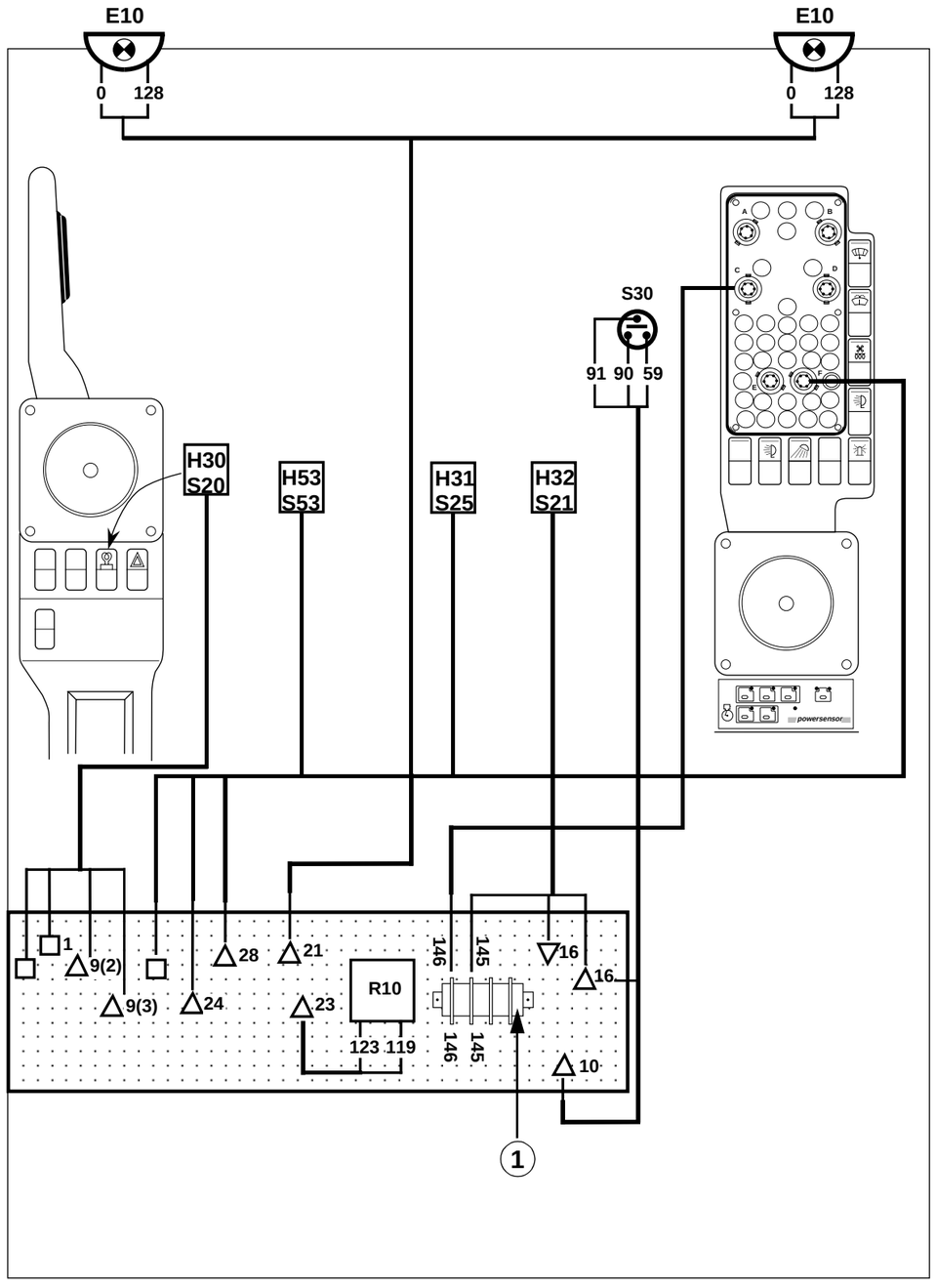
ELECTRONIC SYSTEM WIRING

A2 Electronic control box
B7 Swing detection pressostat
B8 Travel detection pressostat
B9 Engine speed detector
B10 Swing motor speed detector
B11 Hydraulic pressure sender
B22 Engine coolant solution temperature sender (standard system)
M5 Injection pump servo-motor
P12 Servo-motor potentiometer
S22 Control panel
X3 Connector 35 -way
X4 Diagnostic socket
X6 Engine speed detector connector
X7 Upperstructure swing speed detector connector
X8 Hydraulic pressure sender connector
X9 Injection pump servo-motor connector
Y4 DRE 4 proportional pressure reduction valve
Y5 Upperstructure brake release control solenoid valve
Y6 Displacement change solenoid valve (two-speed excavators only)

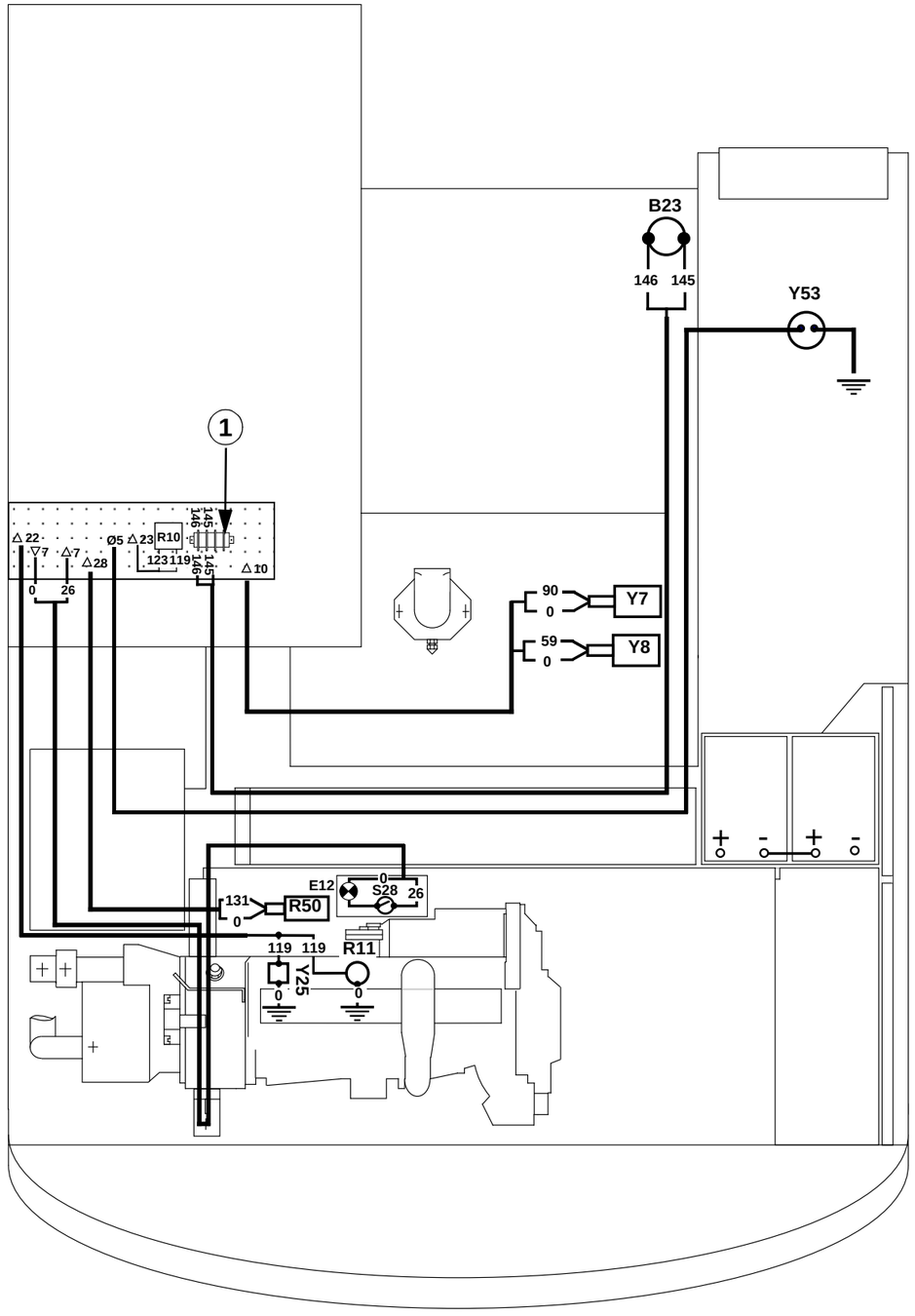
∆**30** Harness, 6-way connector, electronic control box
∆**31** Harness, 3-way connector, diagnostic socket
4 Harness, 10-way connector, engine (standard system)
▲

1 O-ring
2 Ring
3 Washer
4 Lock
5 Plug
6 Two-speed selector (two-speed excavators only)
7 Pressure reduction valve
8 Electronic harness
9 Screw
10 O-ring
11 Travel block
12 Swing block
13 Printed circuit card
14 Decal
15 Control panel fixing hardware
16 Nut
17 Washer
18 Mono-speed selector **(1288 excavators only)**
19 Screw
20 Bracket
21 Nuts
22 Washer
23 Screw
24 Handle
25 Diagnostic socket harness
26 Engine harness

CAB FLOOR WIRING (OPTIONAL)



ENGINE MODULE AND UPPERSTRUCTURE WIRING (OPTIONAL)



CM97C015

CAB FLOOR WIRING (OPTIONAL)

ELECTRICAL CABINET

1 4 terminal block

△**9,** △**10,** △**16,** △ **21,** △ **24,** △ **23,** ▽ **16,** △ **28** **:** see page 4

☐**1,** ☐**0 :** see page 4

INSTRUMENT PANEL

E10 Front working lights on cab
H30 Cold start assistance switch lighting
H31 Rotary light switch lighting (specific to certain countries)
H32 Overload indicator switch lighting
H53 Front working light switch lighting
S20 Cold start assistance switch
S21 Overload indicator switch
S25 Rotary light switch (specific to certain countries)
S30 Articulated boom control switch (optional) **(1488 excavators only)**
S53 Front working lights switch

ENGINE MODULE AND UPPERSTRUCTURE WIRING (OPTIONAL)

ELECTRICAL CABINET

1 4 terminal block

▽ **7,** △ **7,** △**10,** △ **22,** △ **23 (1) (2),** △**28** **:** see page 4

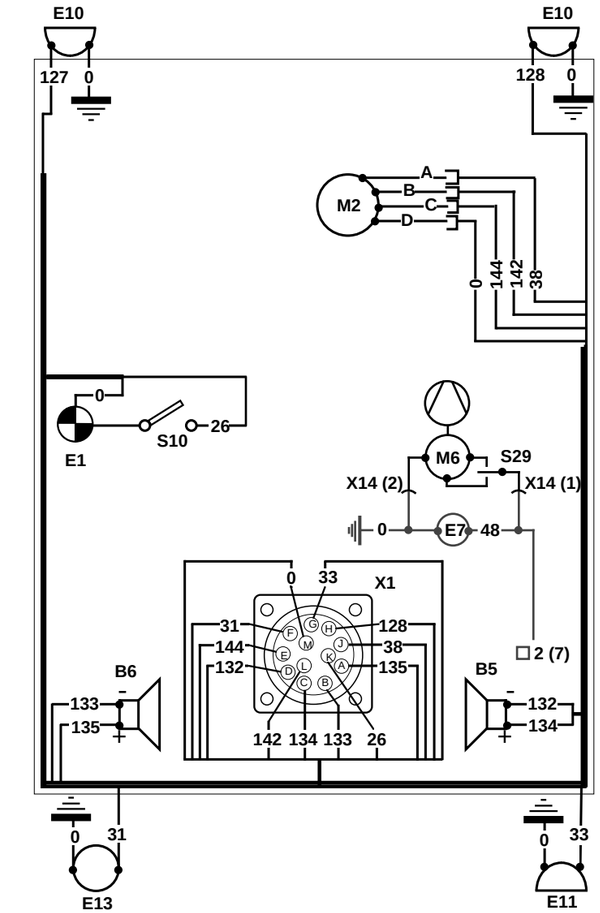
UPPERSTRUCTURE

B23 Overload indicator
K53 Fuel heater relay
R50 Fuel heating device
Y7 Articulated boom extending solenoid valve (optional) **(1488 excavators only)**
Y8 Articulated boom retracting solenoid valve **(1488 excavators only)**
Y53 Fuel filler pump

ENGINE

E12 Engine compartment light
R10 Cold start assistance resistor
R11 Cold start assistance glow plug
S28 Engine compartment light switch
Y25 “Thermostart” cold start assistance system solenoid valve

CAB AND CAB OPTION WIRING



PDH0228

A White cable, windshield wiper motor
B Grey cable, windshield wiper motor
C Blue cable, windshield wiper motor
D Black cable, windshield wiper motor
E1 Cab lighting
E7 Cigarette lighter (see wiring pages 28)
E10 Front working lights (optional))
E11 Rear working light (optional)
E13 Rotary light (optional)
B5 RH loudspeaker (optional)
B6 LH loudspeaker (optional)
M2 Windshield wiper motor
M6 Cab blower motor (optional)
S10 Cab lighting switch
S29 Cab lower switch (optional)

X1 (A) (B) (C) (D) Cab floor/cab LH and RH loud-speaker connector
X1 (H) (G) Cab floor/cab front and rear working lights connector (optional)
X1 (E) (J) (M) (L) Cab floor/cab working light and windshield wiper connector
X1 (F) Cab floor/cab rotary light connector (specific to certain countries)
X1 (K) Cab floor/cab operator's compartment lighting
X14 (1) (2) Cab blower plug (optional)
□ **2 (7)** Connector, 10-way (see printed circuit wiring page 5)

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BASIC PRINCIPLES OF THE HYDRAULIC CIRCUIT

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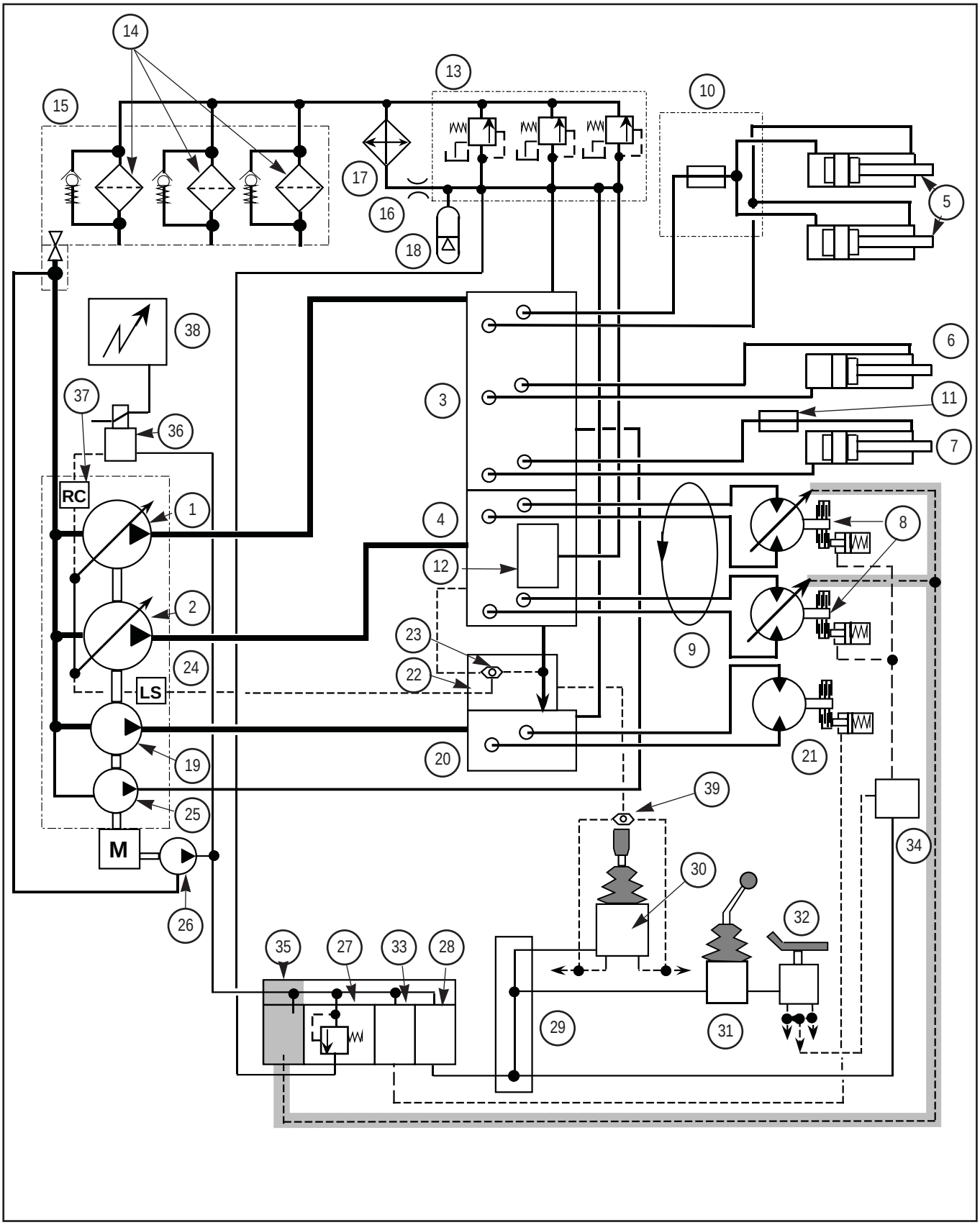
THE HYDRAULIC CIRCUIT

1288 simplified hydraulic circuit



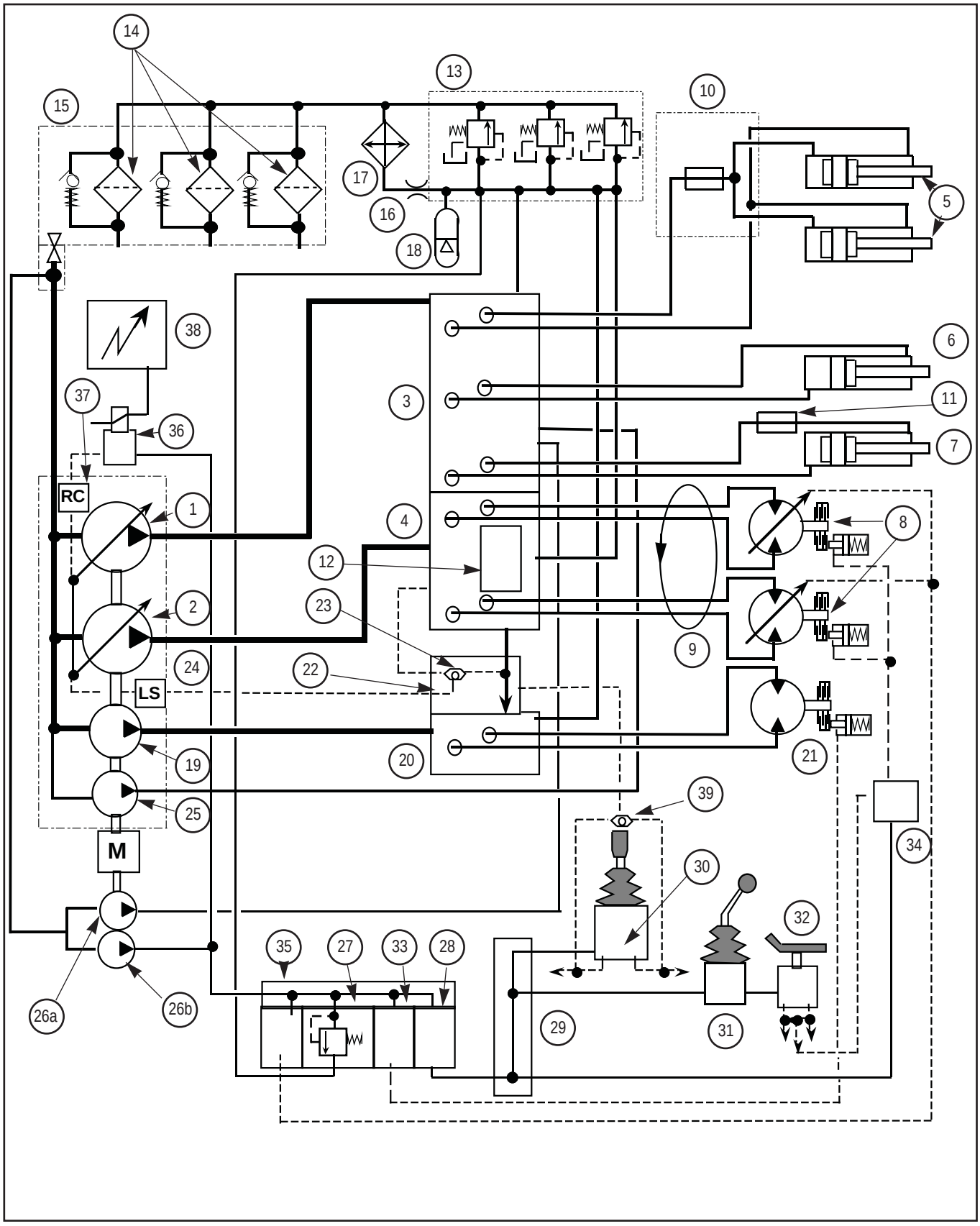
BASIC PRINCIPLES OF THE HYDRAULIC CIRCUIT

Feed system to the various hydraulic components 1288

- Two variable displacement high pressure pump bodies, **1** and **2**, feed two linked single-element control valves, **3** and **4**. These are of the parallel type with centre and exit ports closed at rest (neutral) position.
- Control valve **3** consists of three elements
  - The first for feeding the boom cylinders **5**
  - The second for feeding the bucket cylinder **6**
  - The third for feeding the dipper cylinder **7**
- Control valve **4** consists of two elements for feeding the travel motors **8**.
  This is done via the turning joint **9**. Depending on the configuration of the excavator, these can be fixed displacement or variable displacement type (so as to obtain two travel speeds).
- The return flows from the large and small chambers of the boom cylinders and from the small chamber of the dipper cylinder pass via the flow limiters **10** and **11**.
- The return flow from the travel motors takes place in a speed limiter **12**, integral with control valve **4.**
- All these return circuits pass through three pressure limiters **P10** (**13**) mounted in parallel and three filters **14**, before returning to the tank **15**, which is self-pressurized.
- Part of the return circuits flow , limited by a calibrated orifice **16** mounted on a by-pass, passes through the oil cooler **17**.
- A hydraulic accumulator **18**, which acts as an energy reserve, provides a force-feed (anti-cavitation) function for all the excavator's components.
- A fixed displacement high pressure pump body **19** feeds a parallel-type open-centre control valve element **20**, with exit ports closed at rest position, which feeds the hydraulic swing motor **21**.
- There is a balance and a selector **22** attached to this control valve.
  The selector is piloted by pressure information coming from the swing pilot circuit via the shuttle ball **23**. At that moment, the balance limits the flow coming from the variable displacement pump bodies **1** and **2**,which is reinjected into swing control valve **20** and added to the flow coming from fixed displacement pump .
- The return from the swing circuit passes through the three **P10** (**13**) and the filters **14**, before returning to the tank **15**.
- The pressure information which comes from the **LOAD SENSING** valve **24** (spring side) comes from a circuit selector 25 which takes the highest pressure out of the attachment control valve elements, the travel function control valve elements and the swing control valve element.
- A low pressure pump body **26** feeds the return circuits manifold, before the **P10**, to take care of force-feeding.
- A low pressure pump body **27** feeds the assistance circuit, the pressure of which is controlled by a pressure limiter **P35** (**28**). The return from this passes through the **P10's**.
- An electro-control valve **29** feeds control levers **31** and manual travel control block **32** in parallel, via a manifold **30**. The manual travel control block limits, depending on its slant angle, the pressure in the feed circuit for the control pedals **33**.
- An electro-control valve **37**, controlled by the electronic control housing **35**, takes care of swing braking and swing brake release.
- Automatic travel braking and travel brake release is provided by selector **36**, hydraulically piloted via the outlet pressure from control pedals **33**.
- Automatic displacement change for the travel motors **8** (only on 2-speed excavators) is provided by an electro-control valve **37**, controlled by electronic control housing **35**.
- The torque regulation valve **39** on variable displacement pumps **1** and **2** is piloted by an electro-hydraulic proportional valve **38**, controlled by the electronic control housing **35**.
  This enables the hydraulic power to be adjusted to suit the engine power.

THE HYDRAULIC CIRCUIT

1488 simplified hydraulic circuit



BASIC PRINCIPLES OF THE HYDRAULIC CIRCUIT

Feed system to the various hydraulic components 1488

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- The return flows from the large and small chambers of the boom cylinders and from the small chamber of the dipper cylinder pass via the flow limiters **10** and **11**.
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- All these return circuits pass through three pressure limiters **P10** (**13**) mounted in parallel and three filters **14**, before returning to the tank **15**, which is self-pressurized.
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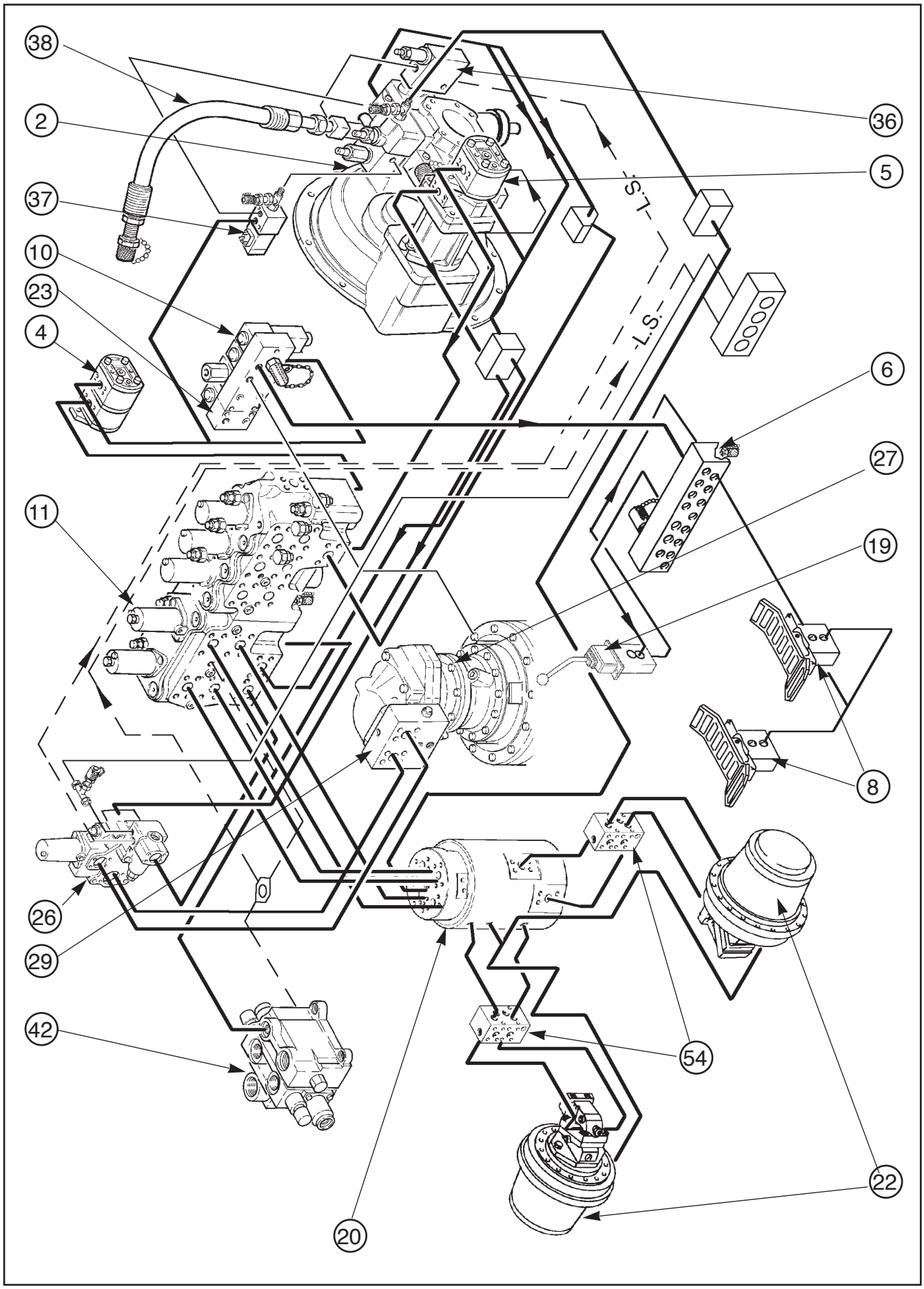
- A hydraulic accumulator **18**, which acts as an energy reserve, provides a force-feed (anti-cavitation) function for all the excavator's components.
- A fixed displacement high pressure pump body **19** feeds a parallel-type open-centre control valve element **20**, with exit ports closed at rest position, which feeds the hydraulic swing motor **21**.
- There is a balance and a selector **22** attached to this control valve.
  The selector is piloted by pressure information coming from the swing pilot circuit via the shuttle ball **23**. At that moment, the balance limits the flow coming from the variable displacement pump bodies **1** and **2**,which is reinjected into swing control valve **20** and added to the flow coming from fixed displacement pump .
- The return from the swing circuit passes through the three **P10** (**13**) and the filters **14**, before returning to the tank **15**.
- The pressure information which comes from the **LOAD SENSING** valve **24** (spring side) comes from a circuit selector 25 which takes the highest pressure out of the attachment control valve elements, the travel function control valve elements and the swing control valve element.
- Two low pressure pump bodys **25** and **26A** feeds the return circuits manifold, before the **P10**, to take care of force-feeding.
- A low pressure pump body **27** feeds the assistance circuit, the pressure of which is controlled by a pressure limiter **P35** (**28**). The return from this passes through the **P10's**.
- An electro-control valve **29** feeds control levers **31** and manual travel control block **32** in parallel, via a manifold **30**. The manual travel control block limits, depending on its slant angle, the pressure in the feed circuit for the control pedals **33**.
- An electro-control valve **37**, controlled by the electronic control housing **35**, takes care of swing braking and swing brake release.
- Automatic travel braking and travel brake release is provided by selector **36**, hydraulically piloted via the outlet pressure from control pedals **33**.
- Automatic displacement change for the travel motors **8** is provided by an electro-control valve **37**, controlled by electronic control housing **35**.
- The torque regulation valve **39** on variable displacement pumps **1** and **2** is piloted by an electro-hydraulic proportional valve **38**, controlled by the electronic control housing **35**.
  This enables the hydraulic power to be adjusted to suit the engine power.



LOCATION OF MAIN HYDRAULIC COMPONENTS

DESCRIPTION

2 Hydraulic power group
- 1 assembly of two bodies of a variable displacement pump for attachment and travel functions
- 1 fixed displacement pump body for swing function
- 1 regulator box

4 Low pressure hydraulic pump for pilot circuits(on 1288) + a low pressure hydraulic pump for force-feeding on 1488

5 Low pressure hydraulic pump for force-feeding the various excavator functions

6 Feed and pilot return circuits manifold

8 travel control block (control pedals)

10 Electro-control valve block including:
- Sliding safety console electro-control valves
- Swing brake release electro-control valve
- Pressure limiter forthe pilot circuits (**P35**)

11 Group of control valves including:
- 1 three-element control block for attachment functions (boom, dipper, bucket)
- 1 two-element control valve for the travel function

19 Manual travel control block

20 Swivel joint

22 Variable displacement hydraulic travel motors (2-speed excavators)

23 Automatic displacement change electro-control valve for hydraulic travel motors (2-speed excavators)

26 Swing control valve block including:
- 1 Swing control valve element fitted with a relief valve
- Selector / flow limiter for reinjecting flow into swing circuit

27 Fixed displacement hydraulic swing motor

29 Safety / anti-cavitation swing function block

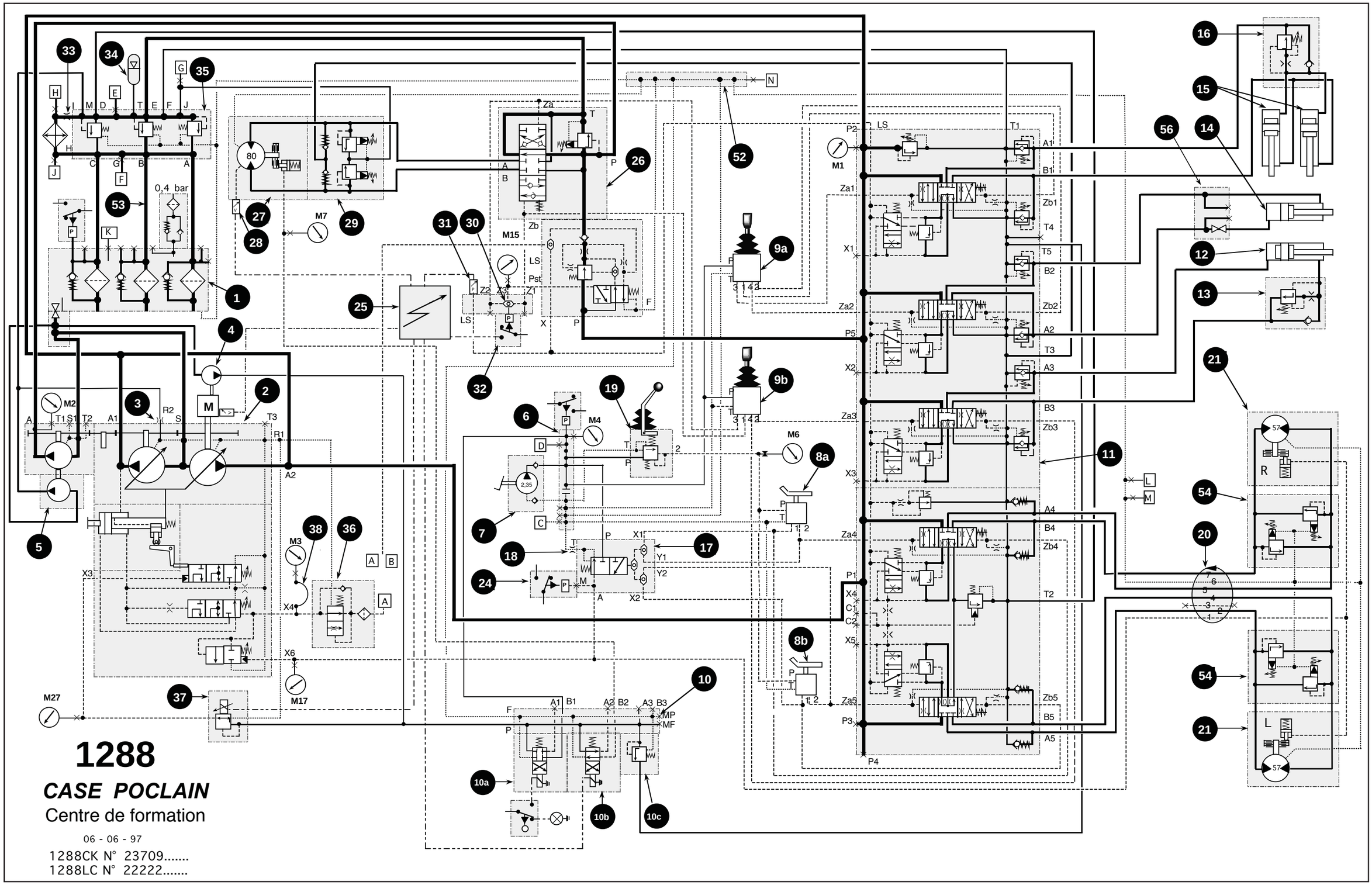
36 LS valve anti-pumping block

37 Electro-hydraulic proportional valve

38 LS valve circuit capacity

42 Low flow option control valve block

54 Hydraulic travel motors safety blocks



1288 SINGLE-SPEED EXCAVATOR HYDRAULIC CIRCUIT

DESCRIPTION

1 Hydraulic tank including:
- 3 cartridge filters fitted with by-pass
- 1 shut-off valve
- 1 self-pressurizing breather with filter

2 Hydraulic power group comprised of:
- 1 assembly of 2 bodies of a variable displacement pump for attachment and travel functions and for partial reinjection of flow into the swing circuit.
- 1 fixed displacement pump body for the swing funtion
- 1 control box assembly, consisting of:
. 1 LOAD-SENSING valve
. 1 torque regulating valve
. 1 flow cancelling valve, piloted by the travel function

3 Calibrated orifice (**Ø 3** mm) for oil irrigation of piston pump bodies

4 Low pressure hydraulic pump for pilot circuits

5 Low pressure hydraulic pump for force-feeding of the various functions of the excavator.

6 Feed and pilot return circuits manifold

7 Emergency foot pump

8 Travel control block (control pedals)

8a Left-hand travel control

8b Right-hand travel control

9 Attachment and swing function control block

9a Boom and bucket control

9b Dipper and swing control

10 Electro-control valves block, comprised of:

10a Sliding safety console electro-control valve

10b Swing brake release electro-control valve

10c pilot circuits pressure limiter (**P35**)

11 Group of control valves comprised of:
- 1 three-element control valve fort the attachment functions (boom, dipper, bucket). The relief valve is incorporated in this control valve block.
- 1 control valve block of 2 elements for the travel function
(this includes : travel speed limiter and the LS information circuit decompression selector)
each control valve element consists of :
. a compensator/pressure selector
. a control valve spool
. safety valves on the attachment functions
. anti-cavitation valves on the travel valves.

12 Dipper cylinder

13 Flow limiter on emptying circuit of dipper cylinder small chamber

14 Bucket cylinder

15 Boom cylinders

16 Flow limiter on emptying circuit of boom cylinders large chamber

17 Travel motors automatic brake release selector block

18 Calibrated orifice (Ø 1,5 mm.) to delated the travel brake release selector

19 Manual travel control block

20 Swivel joint (7 ways)

21 Fixed displacement hydraulic travel motors

24 Pressure sensor (**6** bar) for **AUTO-IDLE** function

25 Electronic control housing

26 Swing control valve block, comprising:
- 1 swing control valve element fitted with relief valve
- 1 selector / flow limiter for reinjecting flow into swing circuit

27 Fixed displacement hydraulic swing motor

28 Hydraulic swing motor speed sensor

29 Safety / force-feed block for swing

30 Swing brake release selector block

31 LS information circuit pressure sensor

32 Pressure switch (**6** bar) for the automatic swing brake and brake release circuit

33 Calibrated orifice (**Ø 9,5**mm.) for oil cooler circuit

34 Force-feed (anti-cavitation) circuit accumulator

35 Pressure limiters (**P10**) on the return circuits

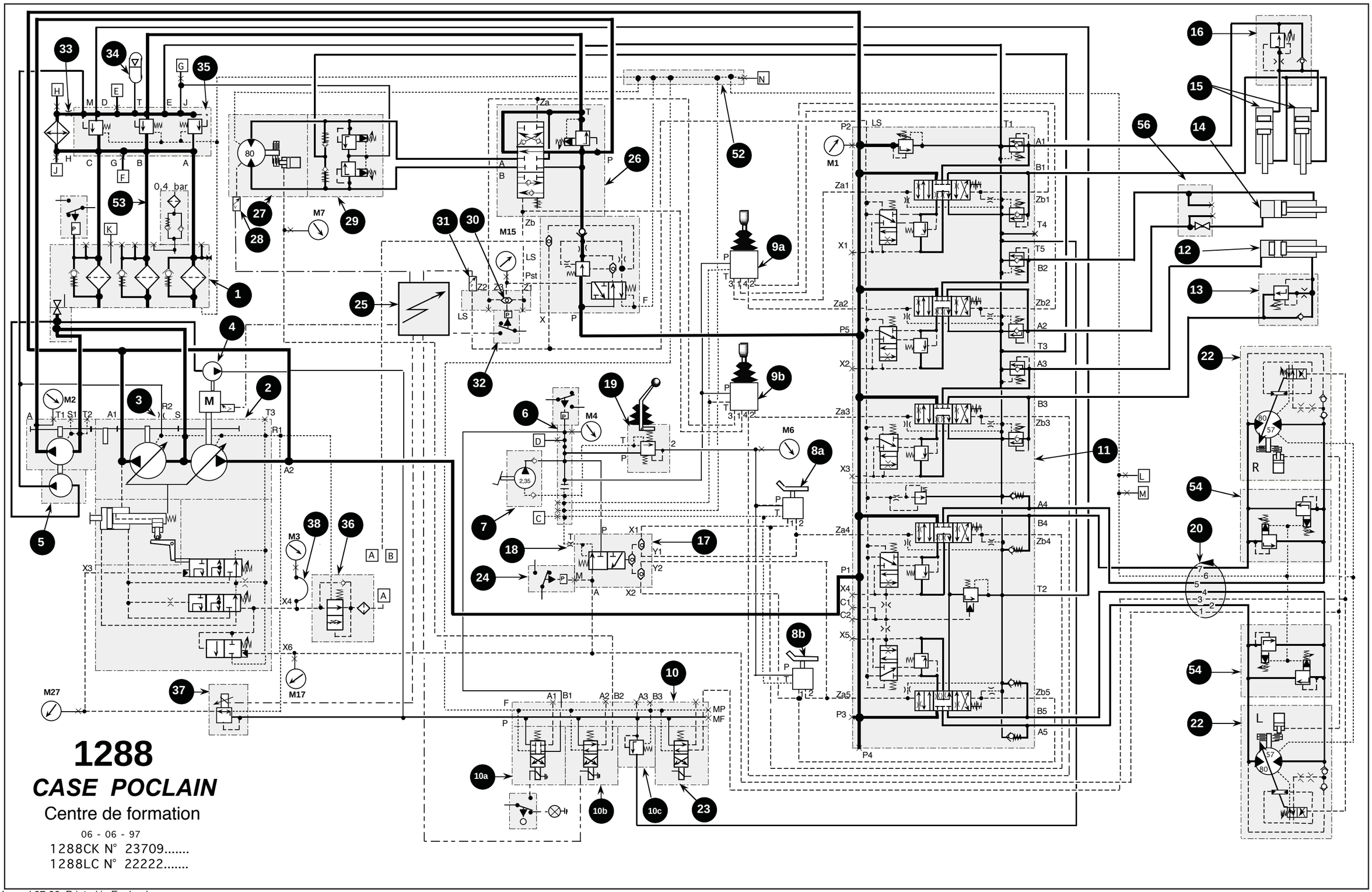
36 LS valve anti-pumping block

37 Electro-hydraulic proportional valve

38 Capacity on **LS** valve circuit

53 Manifold

54 Hydraulic travel motors safety blocks



1288 TWO-SPEED EXCAVATOR HYDRAULIC CIRCUIT

DESCRIPTION

1 Hydraulic tank including:
- 3 cartridge filters fitted with by-pass
- 1 shut-off valve
- 1 self-pressurizing breather with filter

2 Hydraulic power group comprised of:
- 1 assembly of 2 bodies of a variable displacement pump for attachment and travel functions and for partial reinjection of flow into the swing circuit.
- 1 fixed displacement pump body for the swing funtion
- 1 control box assembly, consisting of:
  .1 LOAD-SENSING valve
  . 1 torque regulating valve
  . 1 flow cancelling valve, piloted by the travel function

3 Calibrated orifice (Ø.**3** mm) for oil irrigation of piston pump bodies

4 Low pressure hydraulic pump for pilot circuits

5 Low pressure hydraulic pump for force-feeding the various functions of the excavator.

6 Feed and pilot return circuits manifold

7 Emergency foot pump

8 Travel control block (control pedals)

8a Lleft-hand travel control

8b Right-hand travel control

9 Attachment and swing function control block

9a Boom and bucket control

9b Dipper and swing control

10 Electro-control valves block, comprised of:

10a Sliding safety console electro-control valve

10b Swing brake release electro-control valve

10c pilot circuits pressure limiter (**P35**)

11 Group of control valves comprised of:
- 1 three-element control valve for the attachment functions (boom, dipper, bucket).
  .The relief valve is incorporated in this control valve block.
- 1 control valve block of 2 elements for the travel function (this includes : travel speed limiter and the LS information circuit decompression selector)
  each control valve element consists of :
  . a compensator/pressure selector
  . a control valve spool
  . safety valves on the attachment functions
  . anti-cavitation valves on the travel valves.

12 Dipper cylinder

13 Flow limiter on emptying circuit of dipper cylinder small chamber

14 Bucket cylinder

15 Boom cylinders

16 Flow limiter on emptying circuit of boom cylinders large chamber

17 Travel motors automatic brake release selector block

18 Calibrated orifice (Ø **1,5** mm dia.) for shock absorbing at travel brake release selector

19 Manual travel control block

20 Swivel joint (7 ways)

22 Variable displacement hydraulic travel motors (2-speed excavators)

23 Hight speed electro control valve

24 Pressure sensor (**6** bar) for changing displacement of hydraulic travel motors and for **AUTO-IDLE** function

25 Electronic control housing

26 Swing control valve block, comprising:
- 1 swing control valve element fitted with relief valve
- 1 selector / flow limiter for reinjecting flow into swing circuit

27 Fixed displacement hydraulic swing motor

28 Hydraulic swing motor speed sensor

29 Safety / force-feed block for swing

30 Swing brake release selector block

31 LS information circuit pressure sensor

32 Pressure switch (**6** bar) for the automatic swing brake and brake release circuit

33 Calibrated orifice (Ø **9,5** .) for oil cooler circuit

34 Force-feed (anti-cavitation) circuit accumulator

35 Pressure limiters (**P10**) on the return circuits

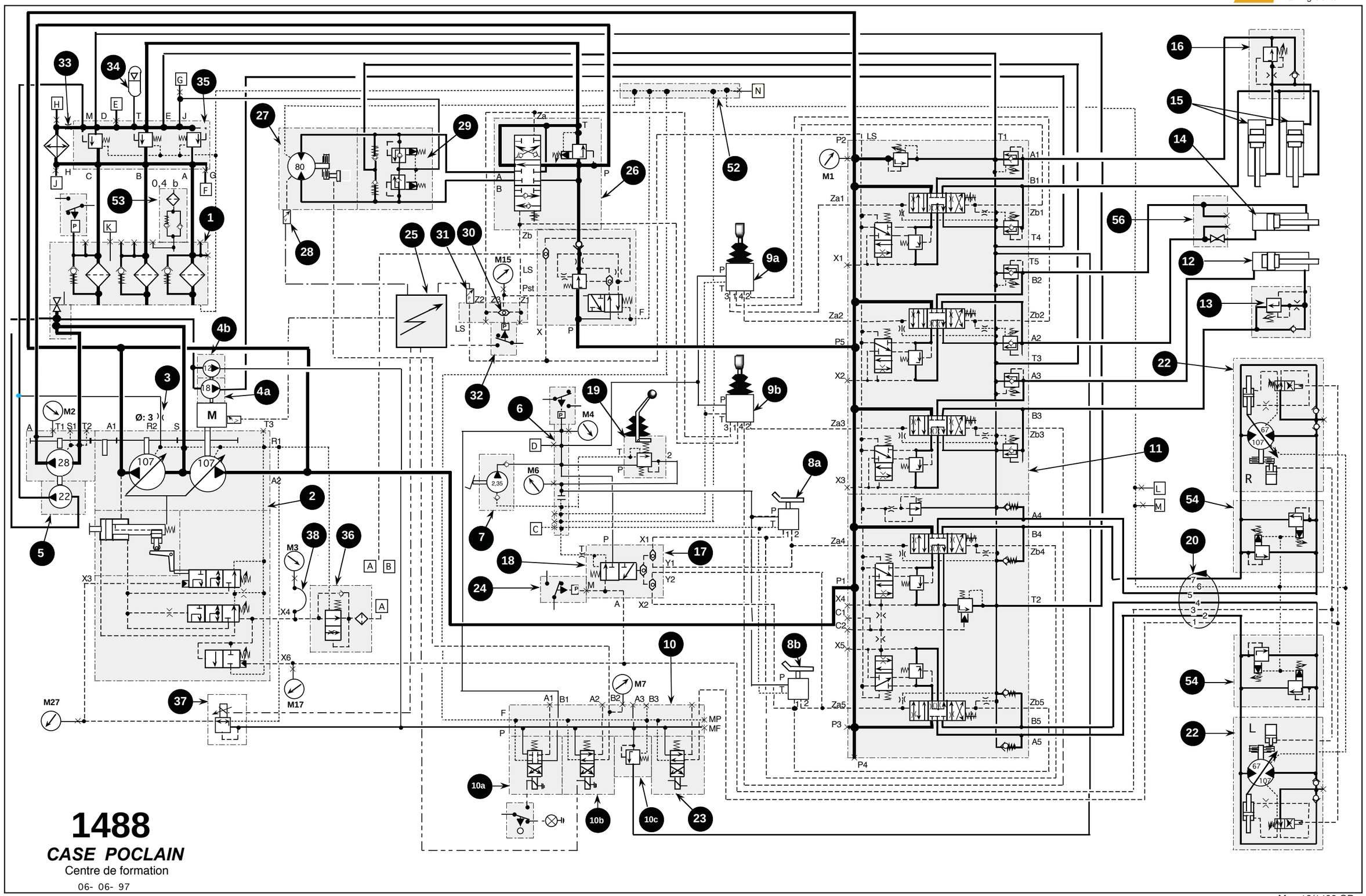
36 LS valve anti-pumping block

37 Electro-hydraulic proportional valve

38 Capacity on LS valve circuit

53 Manifold

54 Hydraulic travel motors safety blocks



1488 EXCAVATOR HYDRAULIC CIRCUIT

DESCRIPTION

1 Hydraulic tank including:
- 3 cartridge filters fitted with by-pass
- 1 shut-off valve
- 1 self-pressurizing breather with filter

2 Hydraulic power group comprised of:
- 1 assembly of 2 bodies of a variable displacement pump for attachment and travel functions and for partial reinjection of flow into the swing circuit.
- 1 fixed displacement pump body for the swing funtion
- 1 control box assembly, consisting of:
  .1 LOAD-SENSING valve
  . 1 torque regulating valve
  . 1 flow cancelling valve, piloted by the travel function

3 Calibrated orifice (Ø.**3** mm) for oil irrigation of piston pump bodies

4 Low pressure hydraulic pump for pilot circuits

5 Low pressure hydraulic pump for force-feeding the various functions of the excavator.

6 Feed and pilot return circuits manifold

7 Emergency foot pump

8 Travel control block (control pedals)

8a Lleft-hand travel control

8b Right-hand travel control

9 Attachment and swing function control block

9a Boom and bucket control

9b Dipper and swing control

10 Electro-control valves block, comprised of:

10a Sliding safety console electro-control valve

10b Swing brake release electro-control valve

10c Pilot circuits pressure limiter (**P35**)

11 Group of control valves comprised of:
- 1 three-element control valve for the attachment functions (boom, dipper, bucket).
  .The relief valve is incorporated in this control valve block.
- 1 control valve block of 2 elements for the travel function (this includes : travel speed limiter and the LS information circuit decompression selector)
  each control valve element consists of :
  . a compensator/pressure selector
  . a control valve spool
  . safety valves on the attachment functions
  . anti-cavitation valves on the travel valves.

12 Dipper cylinder

13 Flow limiter on emptying circuit of dipper cylinder small chamber

14 Bucket cylinder

15 Boom cylinders

16 Flow limiter on emptying circuit of boom cylinders large chamber

17 Travel motors automatic brake release selector block

18 Calibrated orifice (Ø **1,5** mm dia.) for shock absorbing at travel brake release selector

19 Manual travel control block

20 Swivel joint (7 ways)

22 Variable displacement hydraulic travel motors

23 Hight speed electro control valve

24 Pressure sensor (**6** bar) for changing displacement of hydraulic travel motors and for **AUTO-IDLE** function

25 Electronic control housing

26 Swing control valve block, comprising:
- 1 swing control valve element fitted with relief valve
- 1 selector / flow limiter for reinjecting flow into swing circuit

27 Fixed displacement hydraulic swing motor

28 Hydraulic swing motor speed sensor

29 Safety / force-feed block for swing

30 Swing brake release selector block

31 LS information circuit pressure sensor

32 Pressure switch (**6** bar) for the automatic swing brake and brake release circuit

33 Calibrated orifice (Ø **9,5** .) for oil cooler circuit

34 Force-feed (anti-cavitation) circuit accumulator

35 Pressure limiters (**P10**) on the return circuits

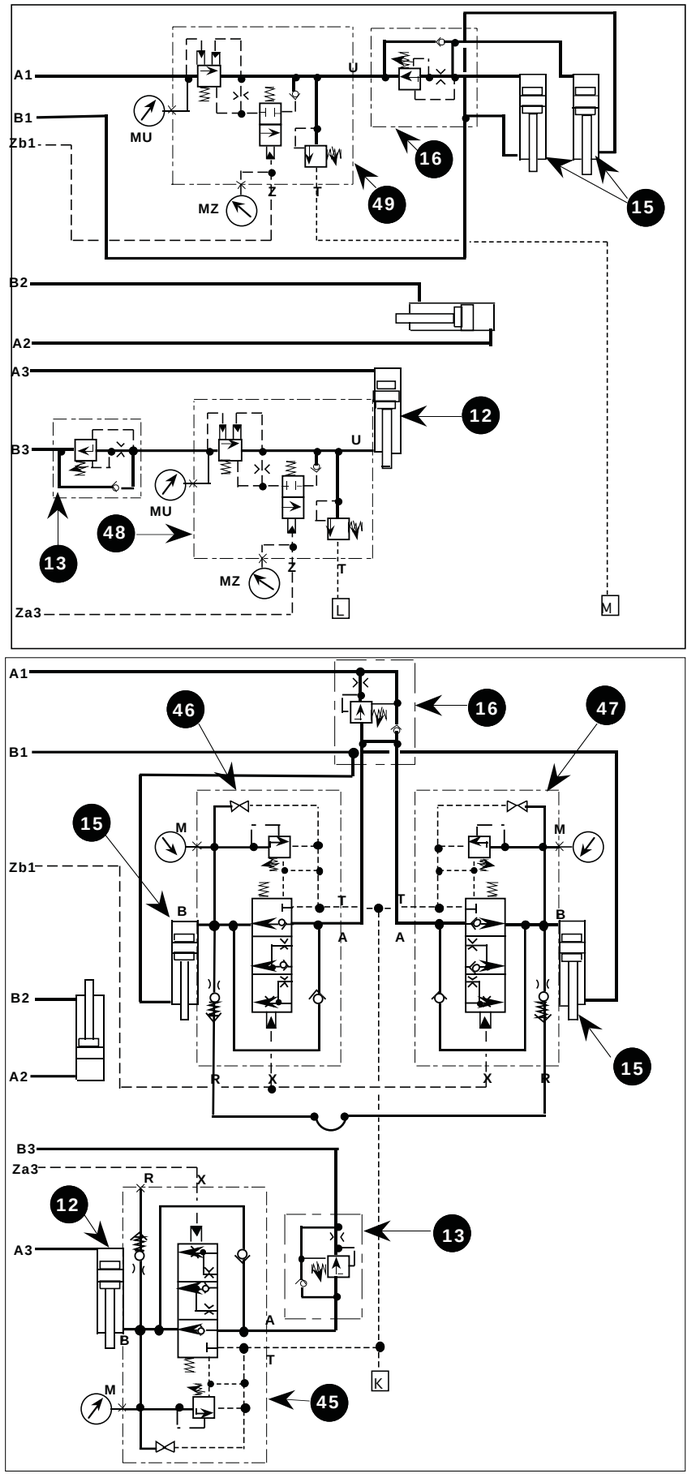
36 LS valve anti-pumping block

37 Electro-hydraulic proportional valve

38 Capacity on LS valve circuit

53 Manifold

54 Hydraulic travel motors safety blocks



HYDRAULIC SCHEMATIC OF OPTIONS

DESCRIPTION

A LOW FLOW OPTION CONTROL VALVE BLOCK (E.G. CLAM ROTATION)

This is fed in parallel with the attachments / travel control valve block, via orifice **P3**

8c Option control pedal block
42 Option control valve block including:
- in the entry plate, a balance valve which limits the option flow to **30** litres/min
- a control valve element fitted with safety valves on each circuit
- a closing plate

43 Hydraulic motor (ORBIT type) for rotating the hydraulic clam
44 Safety valves block for clam rotating motor
55 Circuit selector on LS information circuit

B HIGH FLOW OPTION CONTROL VALVE BLOCK

This is fed in parallel with the attachments / travel control valve block, via orifice **P4**

8c Option control pedal block
42 Option control valve block including:
- an inlet plate
- a control valve element fitted with:
- a balance valve which limits the flow to the optionto **130** litres/min
- a control valve element fitted with safety valves on each circuit
- safety valves on each circuit

55 Circuit selector on LS information circuit

C HYDRAULIC HAMMER OPTION CONTROL VALVE

This is fed in parallel with the attachments / travel control valve block, via orifice **P4**

8c Option control pedal block
42 Option control valve block including:
- an inlet plate
- a control valve element fitted with:
- a balance valve which limits flow to the option to **50** to **170** litres
- a safety valve on the hammer feed circuit

55 Circuit selector on LS information circuit

D LOAD HOLDING OPTION BLOCKS

15 The boom cylinders
16 The flow limiter on the large chambers of the boom cylinders
49 Load holding blocks on the large chamber of the boom cylinders
12 Dipper cylinder
13 Flow limiter on the emptying side of the dipper cylinder small chamber
48 Load holding block on the small chamber of the dipper cylinder

E SAFETY VALVE AND LOAD HOLDING OPTIONS

15 Boom cylinders
16 Flow limiter on emptying side of boom cylinder large chambers
46 Safety block on large chamber of left-hand boom cylinder
12 Boom cylinder
13 Flow limiter on emptying side of dipper cylinder small chamber
45 Laod holding block on dipper cyylinder small chamber

F THERMOSTATIC VALVE ON COOLING VCIRCUIT

1 Tank
27 Swing motor
28 Swing speed sensor
29 Anticavitation and safety swing block
34 Accumulator on return circuit
35 Pressure limiter block **3P10**
59 Thermostatic valve on cooling circuit

1288 /1488 GENERAL HYDRAULICS

CONTENTS .....PAGE

12/1488 GENERAL HYDRAULICS

GENERAL HYDRAULICS SPECIFICATIONS

POWER GROUP

- Engine : 2000 r.p.m. under load
- Constant torque, variable displacement, axial piston pump with following systems:
  . speed-sensing on the attachment, travel, swing and option functions.
  . load sensing on the attachment and travel functions, and partially on the swing.
  . flow cancelling and pressure maintenance on the attachment and option functions.
  . pressure limiters on travel and swing.
- Fixed displacement axial piston pump on the upper structure swing function.

PILOT AND FORCE-FEEDING (ANTI-CAVITATION) CIRCUITS

- Low pressure gear pumps

HYDRAULIC TANK

- Self-pressurized to reduce pollution coming from outside

FILTRATION

- On return circuits, with by-pass and clogging indicators
- On variable displacement pump load-sensing information circuit

CONTROL VALVES :

- Parallel type with open centre and closed outlet ports
- With proportional effect and load sensing
- Pressure compensator on each receiving component for independent movements

SWING CONTROL VALVES :

- Parallel type with open centre and closed inlet ports
- Flow regulator (balance) for reinjection of flow into the swing

LINEAR RECEIVING COMPONENTS :

- Double-acting single rod hydraulic cylinders with dash-pot and flow limiters on some chambers

ROTARY RECEIVING COMPONENTS :

- Fixed displacement hydraulic motor for swing function, fitted with automatic static brake
- Fixed or variable displacement on 1288 (only hydraulic variable displacement on 1488) motors on travel function, fitted with automatic static brakes

FORCE-FEEDING (ANTI-CAVITATION) :

- All the receiving components are force-fed
- Counter-pressure valves on the return circuits of the attachamnt, travel, swing, options and pilot control valves.

COOLING :

- Cooling of part of the return flow from the attachment, travel, pilot and swing circuits.
- Cooling by air from engine fan.

PLUMBING, CONNECTIONS :

- A great number of flexible hoses are used.
- S.A.E. couplings with I.S.O. seals on pipes of Ø. equal to or greater than 20 mm.
- .A.E. couplings with O.R.F.S. system seals on pipes of Ø. smaller than 20 mm.

1288 TECHNICAL SPECIFICATIONS

INSTALLED HYDRAULIC POWER (ENGINE UNDER LOAD)

- **MAX** mode (2000 r.p.m.) ..... **110 Kw (149 HP)**
- **ECO** mode (1650 r.p.m.) ..... **88 Kw (119 HP)**
- **FINE** mode (1250 r.p.m.) ..... **52 Kw (71 HP)**

Pump drive speed, engine under load. ..... **2000** (r.p.m.)

HYDRAULIC PUMPS:

- Variable displacement pumps for attachments and travel
- Maximum displacement ..... **2x107** (cc/rev)
- Maximum flow ..... **414** (l/min)
- Rated pressure for attachments function ..... **360** (bar)
- Rated pressure for travel function ..... **390** (bar)
- (without flow cancelling)

- Fixed displacement pumps for the swing
- Displacement ..... **40** (cc/rev)
- Flow ..... **80** (l/min)
- Rated pressure for swing function ..... **375** (bar)

Gear pump for forced-feed (anti-cavitation)

- Displacement ..... **22** (cc/rev)
- Flow ..... **44** (l/min)
- Rated pressure for forced-feed circuit ..... **10** (bar)

Gear pump for pilot system

- Displacement ..... **12** (cc/rev)
- Flow ..... **24** (l/min)
- Rated pressure for pilot system ..... **35** (bar)

- LOAD-SENSING valve setting :
. Difference in pressure between **M1** and **M3** in static mode ..... **20** to **24** (bar)
. Difference in pressure between **M1** and **M3** in dynalic mode ..... **20** to **22** (bar)

HYDRAULIC FILTERS (Qty = 3)

- By-pass pressure setting ..... **6** (bar)
- Clogging indicator setting ..... **5** (bar)
- Total capacity of each filter ..... **480** (l/min)
- Degree of filtration ..... **10** to **25** (μ)

CONTROL VALVE BLOCKS

Attachment control valves :

- Dimension **25**
- Piloted at low pressure ..... **8** to **22** (bar)
- Rated setting :
. Relief valve ..... **390** (bar)
. All safety valves, large and small chambers ..... **415** (bar)
- Flow control:
. Boom cylinder large chambers ..... **400** (l/min)
. Dipper cylinder large chamber ..... **400** (l/min)
. Bucket cylinder large chamber ..... **260** (l/min)
. Boom cylinders small chamber ..... **100** (l/min)
. Dipper cylinder small chamber ..... **320** (l/min)
. Bucket cylinder small chamber ..... **220** (l/min)

1288 GENERAL HYDRAULICS

TECHNICAL SPECIFICATIONS (continued)

Travel control valves :

- Calibre.. ..... **25**
- Piloted at low pressure.. ..... **8** to **22** (bar)
- Rated pressure setting:
- All safety valves, large and small chambers. ..... **410** (bar)
- Flow control: (Screw adjustment on the control valve spool caps)

. Right or left travel, forward or revers) ..... **207** (l/min)
which gives in sprocket revolutions:
. Single speed excavator and 2-speed excavator in **1**st speed ..... **30** (r.p.m.)
. **2**-speed excavator in **2**nd speed ..... **40** (r.p.m.)
which for **7** complete revolutions of the tracks takes:
1288 CK single-speed excavator and **2**-speed in **1**st speed ..... **57** to **63.3** (s)
1288 CL single-speed excavator and **2**-speed in **1**st speed ..... **59** to **65.5** (s)

Swing control valves :

- Calibre **25**
- Low pressure piloted..... **8** to **22** (bar)
- Rated pressure setting:
- Relief valve ..... **400** (bar)
- Safety valves, right or left hand swing ..... **375** (bar)
- Flow control:

. Upper structure swing alone ..... **180** (l/min)
which gives an upper structure swing speed of..... **12** (r.p.m.)

Low flow option control valves :

- Calibre **12**
- Low pressure piloted..... **8** to **22** (bar)
- Rated pressure setting:
- Safety valves for clam rotation option ..... **140** (bar)
- Flow control:
- Flow regulator (balance valve) ..... **30** (l/min)

High flow option control valves :

- Calibre **20**
- Low pressure piloted..... **8** to **22** (bar)
- Rated pressure setting:
- Safety valves ..... **400** (bar)
- Flow control:
- Flow regulator (balance valve)..... **130** (l/min)
- Flow through mechanical spool stop ..... **170** (l/min)

Hydraulic hammer option control valves :

- Calibre **20**
- Low pressure piloted..... **8** to **22** (bar)
- Rated pressure setting - safety valve ..... **200** (bar)

. Flow regulator (balance valve) ..... from **50** to **170** (l/min)
depending on type of hammer used

LINEAR RECEIVING COMPONENTS

. **Boom cylinders** ..... **125** x **90** x **1270**
- fitted with dashpots on large and small chambers
and with a flow limiter in the feed block (large chamber side)

. **Bucket cylinder** ..... **125** x **90** x **1060**
fitted with dash-pot on small chamber

. **dipper cylinder** ..... **160** x **100** x **1200**
- fitted with dashpot on large and small chambers
and with a flow limiter on the piping (small chamber end)

1288 GENERAL HYDRAULICS

TECHNICAL SPECIFICATIONS (continued)
ROTARY RECEIVING COMPONENTS

- Swing motor and reduction box assembly

- Fixed displacement axial piston hydraulic motor

Displacement	**80**	(cc/rev)
Theoretical speed:		
1) Without flow reinjection (under **80** l/min)	**1000**	(r.p.m.)
2) With flow reinjection (under **180** l/min	**2250**	(r.p.m.)
Maxi ouput torque	**48**	(mdaN)

- Reduction box equipped with automatic, multi-disc, oil-bath brakebraked mechanically, with hydraulic brake release

. Reduction ratio	**1/32,7**	
. Theoretical output speed at output shaft :		
1) Without flow reinjection (under 80 l/min)	**31**	(r.p.m.)
2) With flow reinjection (under 180 l/min	**69**	(r.p.m.)
. Ouput torque	**1562**	(mdaN)
. Braking torque	**63**	(mdaN)
Maximum brake release pressure	**13**	(bar)
. Swing pinion**1**	**3** teeth, module **14**	
. Swing ring	**75** teeth, module **14**	

- Travel motor and reduction box assembly

- **Variable displacement axial piston hydraulic motor (2-speed excavators)**

. Displacement	**80 / 57**	(cc/rev.)
Theoretical speed:		
1) In 1st speed	**2587,5**	(r.p.m.)
2) In 2nd speed	**3631**	(r.p.m.)

- **Fixed displacement axial piston hydraulic motor (single-speed excavators)**

. Displacement	**80**	(cc/rev.)
Theoretical speed	**2587,5**	(r.p.m.)
. Maximum output torque	**49,7**	(mdaN)

- Reduction box equipped with automatic multi-disc, oil-bath brake, mechanically braked, with hydraulic brake release

. Reduction ratio	**1/89,86**	
. Theoretical output speed at output shaft :		
1) In 1st speed for two-speed excavator or for single-speed excavator	**28,8**	(r.p.m.)
2) In 2nd speed	**40,5**	(r.p.m.)
. Ouput torque	**44,64**	(mdaN)
. Braking torque	**52**	(mdaN)
. Brake release pressure required for complete brake release	**8**	(bar).

ALL FUNCTIONS ARE FORCE-FED (ANTI-CAVITATION)

- Force-feed pressure :

- On attachments, travel and swing	**9** to **11**	(bar)
- **Accumulator**		
- Inflation pressure	**5,7**	(bar)
- Capacity	**4,5**	(l)

NOTE

- All the above values must be checked with the oil at 50° C

CAUTION **To avoid injury or burning**
DO NOT ALLOW THE TEMPERATURE TO RISE ABOVE 60° C DURING CHECKS

1488 TECHNICAL SPECIFICATIONS

NOMINAL INSTALLED HYDRAULIC POWER (WITH ENGINE UNDER LOAD, RUN-IN)
(New engine = 3% lower power)

- **MAX** mode (2000 r.p.m.) ..... **117,6 Kw** (**159,7 HP**)
- **ECO** mode (1700 r.p.m.) ..... **92,5 Kw** (**125,6 HP**)
- **FINE** mode (1380 r.p.m.) ..... **59 Kw** (**80 HP**)

Pump drive speed, engine under load. ..... **2000** (r.p.m.)

HYDRAULIC PUMPS:

- Variable displacement pumps for attachments and travel
- Maximum displacement ..... **2x107** (cc/rev)
- Maximum flow ..... **414** (l/min)
- Rated pressure for attachments function ..... **360** (bar)
- Rated pressure for travel function ..... **390** (bar)
- (without flow cancelling)

- Fixed displacement pumps for the swing
- Displacement ..... **28** (cc/rev)
- Flow ..... **56** (l/min)
- Rated pressure for swing function ..... **375** (bar)

Gear pump for forced-feed (anti-cavitation)	*PUMP 1*	*PUMP 2*	
- Displacement	**22**	**18**	(cc/rev)
- Flow	**44**	**36**	(l/min)
- Rated pressure for forced-feed circuit	**10**	**10**	(bar)

Gear pump for pilot system

- Displacement ..... **12** (cc/rev)
- Flow ..... **24** (l/min)
- Rated pressure for pilot system ..... **35** (bar)

- LOAD-SENSING valve setting :
. Difference in pressure between **M1** and **M3** in static mode ..... **20** to **24** (bar)
. Difference in pressure between **M1** and **M3** in dynalic mode ..... **20** to **22** (bar)

HYDRAULIC FILTERS (Qty = 3)

- By-pass pressure setting ..... **6** (bar)
- Clogging indicator setting ..... **5** (bar)
- Total capacity of each filter ..... **480** (l/min)
- Degree of filtration ..... **10** to **25** (μ)

CONTROL VALVE BLOCKS

Attachment control valves :

- Dimension **25**
- Piloted at low pressure ..... **8** to **22** (bar)
- Rated setting :
. Relief valve ..... **390** (bar)
. All safety valves, large and small chambers ..... **415** (bar)
- Flow control:
. Boom cylinder large chambers ..... **400** (l/min)
. Dipper cylinder large chamber ..... **400** (l/min)
. Bucket cylinder large chamber ..... **340** (l/min)
. Boom cylinders small chamber ..... **100** (l/min)
. Dipper cylinder small chamber ..... **320** (l/min)
. Bucket cylinder small chamber ..... **290** (l/min)

1488 GENERAL HYDRAULICS

TECHNICAL SPECIFICATIONS (continued)

Travel control valves :

- Calibre.. ..... **25**
- Piloted at low pressure.. ..... **8** to **22** (bar)
- Rated pressure setting:
- All safety valves, large and small chambers. ..... **425** (bar)
- Flow control: (Screw adjustment on the control valve spool caps)

. Right or left travel, forward or revers) ..... **207** (l/min)
which gives in sprocket revolutions ..... **27,8** to **30,7** (r.p.m.)

Swing control valves :

- Calibre **25**
- Low pressure piloted ..... **8** to **22** (bar)
- Rated pressure setting:
- Relief valve ..... **400** (bar)
- Safety valves, right or left hand swing ..... **375** (bar)
- Flow control:

. Upper structure swing alone ..... **156** (l/min)
which gives an upper structure swing speed of ..... **10,3** (r.p.m.)
(via mechanical spool stop) ..... **7** to **10,3** (r.p.m)

Low flow option control valves :

- Calibre **12**
- Low pressure piloted ..... **8** to **22** (bar)
- Rated pressure setting:
- Safety valves for clam rotation option ..... **140** (bar)
- Flow control:
- Flow regulator (balance valve)
  - 1 section block (clamshell hydraulic swing) ..... **30** (l/min)
  - 2 section block (clamshell hydraulic swing and articulated boom) ..... **30** and **80** (l/min)

High flow option control valves :

- Calibre **20**
- Low pressure piloted ..... **8** to **22** (bar)
- Rated pressure setting:
- Safety valves ..... **400** (bar)
- Flow control:
- Flow regulator (balance valve) ..... **130, maxi:170** (l/min)
- Flow through mechanical spool stop ..... **130, maxi:250** (l/min)

Hydraulic hammer option control valves :

- Calibre **20**
- Low pressure piloted ..... **8** to **22** (bar)
- Rated pressure setting - safety valve ..... **200** (bar)

. Flow regulator (balance valve) ..... **130, maxi: 170** (l/min)
Flow via mechanical spool stop ..... **130, maxi: 250** (l/min)

LINEAR RECEIVING COMPONENTS

. **Boom cylinders** ..... **140** x **100** x **1200**
- fitted with dashpots on large and small chambers
and with a flow limiter in the feed block (large chamber side)

. **Bucket cylinder** ..... **140** x **100** x **1060**
fitted with dash-pot on small chamber

. **Dipper cylinder** ..... **160** x **100** x **1400**
- fitted with dashpot on large and small chambers
and with a flow limiter on the piping (small chamber end)

. **Articulated boom cylinder (optional)** ..... **160** x **100** x **1200**
- equipped with dash-pot on the large chamber sides
and with a braking valve (on the small chamber side).

1488 GENERAL HYDRAULICS

TECHNICAL SPECIFICATIONS (continued)

ROTARY RECEIVING COMPONENTS

- Swing motor and reduction box assembly

- Fixed displacement axial piston hydraulic motor

Displacement	**80**	(cc/rev)
Theoretical speed:		
1) Without flow reinjection (under **56** l/min)	**713**	(r.p.m.)
2) With flow reinjection (under **156** l/min	**1985**	(r.p.m.)
Maxi ouput torque	**48**	(mdaN)

- Reduction box equipped with automatic, multi-disc, oil-bath brakebraked mechanically, with hydraulic brake release

. Reduction ratio	**1/32,7**	
. Theoretical output speed at output shaft :		
1) Without flow reinjection (under **56** l/min)	**21,7**	(r.p.m.)
2) With flow reinjection (under **156** l/min	**60,6**	(r.p.m.)
. Ouput torque	**1464**	(mdaN)
. Braking torque	**93**	(mdaN)
Maximum brake release pressure	**26**	(bar)
. Swing pinion**1**	**13** teeth, module **14**	
. Swing ring	**75** teeth, module **14**	

- Travel motor and reduction box assembly

- **Variable displacement axial piston hydraulic motor**

. Displacement	**107 / 67**	(cc/rev.)
Theoretical speed:		
1) In 1st speed	**1887**	(r.p.m.)
2) In 2nd speed	**3013**	(r.p.m.)

- Reduction box equipped with automatic multi-disc, oil-bath brake, mechanically braked, with hydraulic brake release

. Reduction ratio	**1/108,12**	
. Theoretical output speed at output shaft :		
1) In 1st speed for two-speed excavator or for single-speed excavator	**17,5**	(r.p.m.)
2) In 2nd speed	**27,9**	(r.p.m.)
. Ouput torque	**6313**	(mdaN)
. Braking torque	**70**	(mdaN)
. Brake release pressure required for complete brake release	**12**	(bar).

ALL FUNCTIONS ARE FORCE-FED (ANTI-CAVITATION)

- Force-feed pressure :

- On attachments, travel and swing ..... **11** (bar)
- **Accumulator**
  - Inflation pressure ..... **5,7** (bar)
  - Capacity ..... **3,5** (l)

NOTE

- All the above values must be checked with the oil at 50° C

CAUTION **To avoid injury or burning**
DO NOT ALLOW THE TEMPERATURE TO RISE ABOVE 60° C DURING CHECKS

12/1488 HYDRAULIC PUMPS

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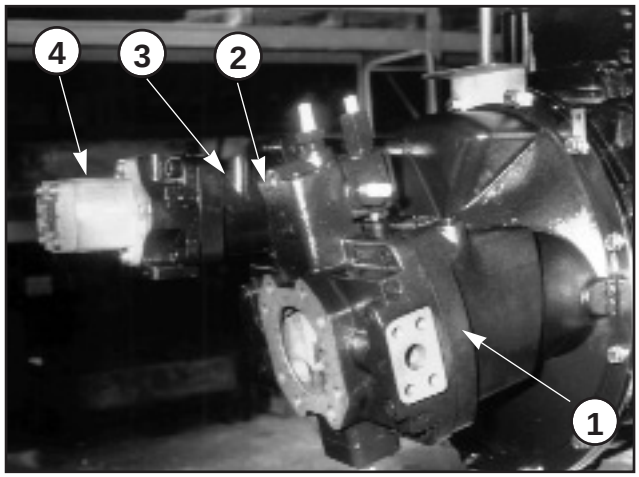
12/1488 HYDRAULIC PUMPS



The high and low pressure pump group consists of:

- 2 variable displacement axial piston pump bodies **1**
  They feed, in parallel, the attachments, travel, optons and part of the swing feed
  Specifications

Maximum displacement	**2 X 107**	(cc/rev.)
Drive speed.	**2000**	(r.p.m.)
Maximum flow	**2 x 207**	(l/min)
Rated pressure for aftachments	**360**	(bar)
Rated pressure for travel	**390**	(bar)
Rated pressure for options	**200**	(bar, max.)

The regulator block **2** is located above these two bodies. it includes
- The 'load-sensing'valve
- The torque regulafion valave
- The flow cancelling valve

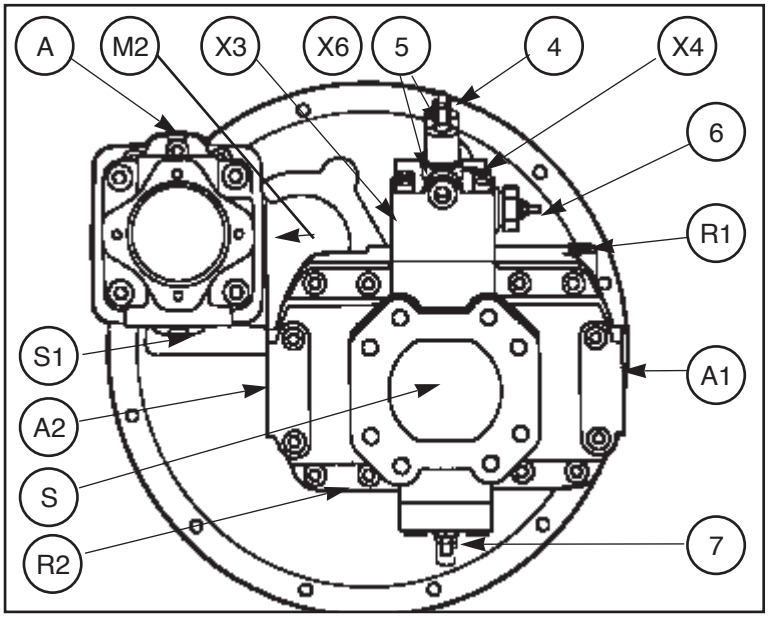
1 fixed displacement pump body **3**
which feeds the swing

Specifications	**1288**	**1488**	
Maximum displarement	**40**	**28**	(cc/rev.)
Drive speed	**2000**	**2000**	(r.p.m.)
Maximum flow	**80**	**56**	(l/min)
Rated pressure	**375**	**375**	(bar)

- 1 external toothed gear pump 4 (attached by flange to the swing pump)
It feeds the force-feed system and, via a calibrated ohhoe mounted on a by-pass, irrigates the piston pumps housing.
  Specifications

Maximum dispiacement	**22**	(cc/rev.)
Drive speed	**2000**	(r.p.m.)
Maximum flow	**44**	(l/min)
Rated pressure	**10**	(bar)

12/1488 HYDRAULIC PUMPS



Idendficatlon of orifices and adjustment polnts

Orifices

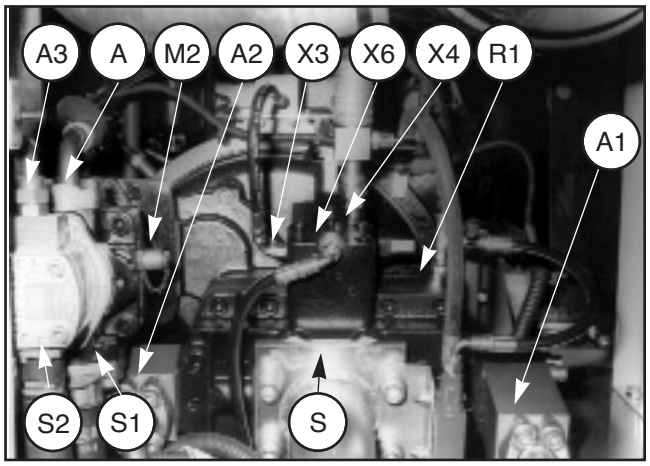
- **S** Variable displacement pump body suction
- **SI** Fixed displacement pump body suction
- **S2** Gear pump suction
- **A** Swing pump output
- **A1** Output trom one body of the attachment, travel, opfion pump
- **A2** Output from one body of the attachment, travel, opdon pump
- **A3** Force-feed and irrigation pump ouput
- **RI** Leak retum from anfi-pumping valve and proportional valve
- **R2** Piston pump irrigation
- **X4** Arrival of information from LOAD-SENSING valve
- **X3** Arrival of information from proportional valve on te torque regulaäng valve
- **X6** Arrival of over-pressure setäng informaton from flow cancelling valve

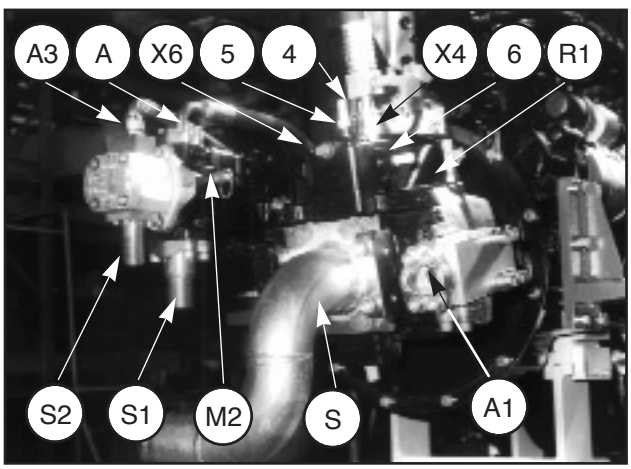
Adiustment polnts

- **4** Torque regulation valve adjustment
- **5** Flow cut-off and pressure maintaining valve adjustment
- **6** LOAD-SENSING valve adjustment
- **7** Variable displacement pump maximum displacement adjustment

Pressure checklng point

- **M2** Swing circuit pressure checking point

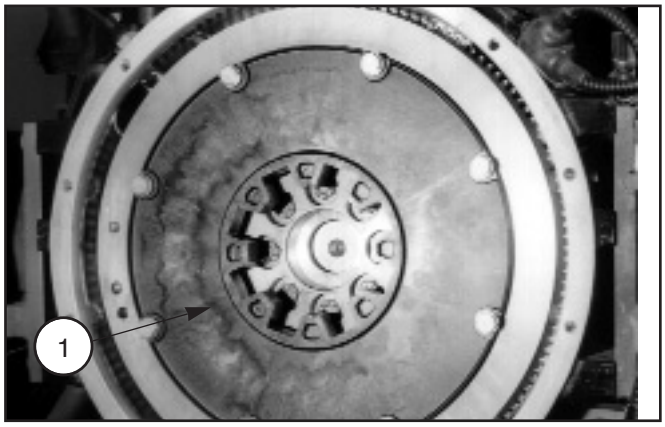


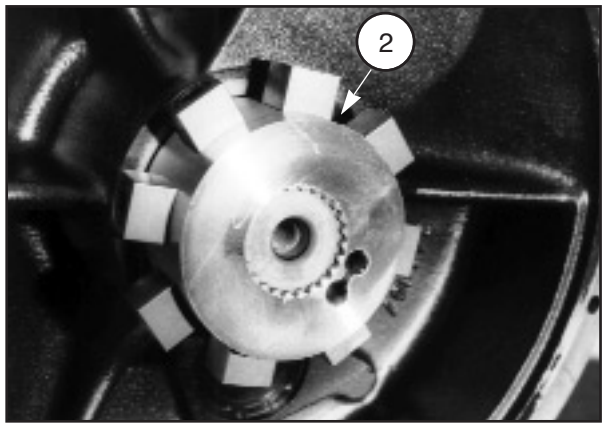


HYDRAULIC PUMPS 12/1488

ENGINE / PUMP GROUP COUPLING

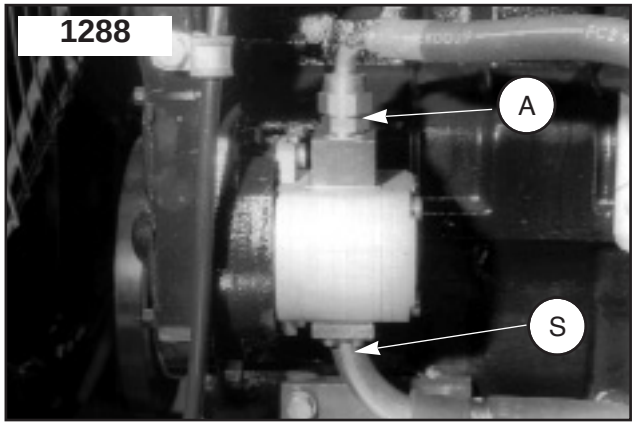
It transmits motion between the engine flywheel and the hydraulic pumps assembly.
It consists of a flexible flange 1 bolted to the engine flywheel and a splined sleeve **2** mounted on the pumps unit drive shaft

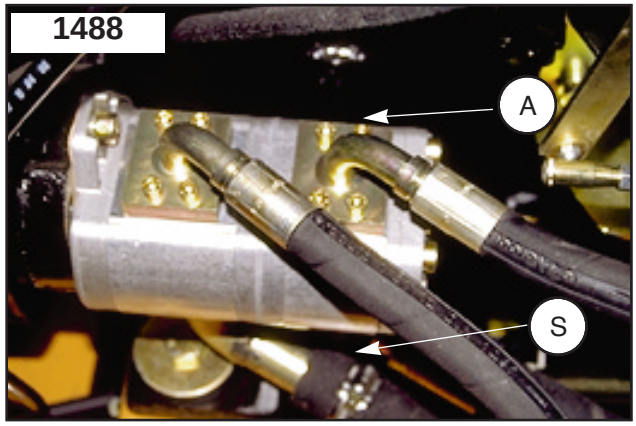




THE HYDRAULIC PLLOT PUMP

For **1288**, it is attached to the engine and driven by the engine P.T.0.
For **1488**, it is monted to a forced circuit complementary pump, attached to the engine and driven by the engine P.T.0.
It is an external-toothed gear-type pump and it feeds the pilot circuit





SpecifIcadons

Displacement	**12**	(CC/rev.)
Ddve speed	**2000**	(r.p.m.)
Max. flow	**24**	(Vmn**)**
Rated pressure.....	**35**	(bar)

Orifice Idendfication
S : Sucton
A : Output

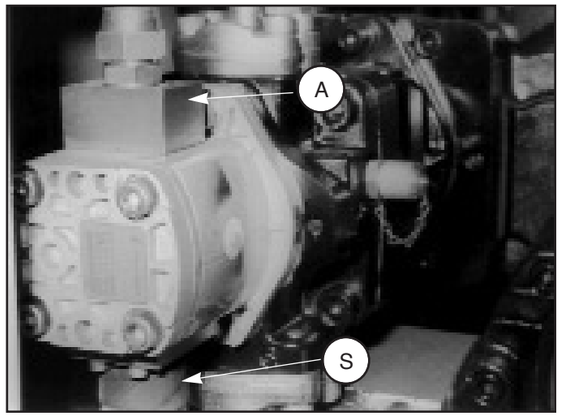
SPECIFICATIONS

Caution when disassembling this pump:
make sure on reassembly that suction orifce (biggest diameter) is underneath.
Otherwise there can be damage to the pump and such incorrect assembly will meann that there is no pilot circuit

12/1488 HYDRAULIC PUMPS

THE HYDRAULIC FORCED CIRCUIT PUMP 12/1488

lit is monted to a swing pump,
It is an external-toothed gear-type pump and it feeds the forced circui tof the différents fonctions



Specifïcadons

Displacement	**12**	(CC/rev.)
Ddve speed	**2000**	(r.p.m.)
Max. flow	**24**	(Vmn**)**
Rated pressure.....	**35**	(bar)

Orifice Idendflcation
S : Sucton
A : Output

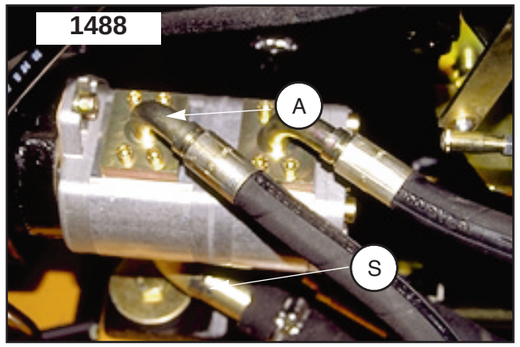
THE FORCED CIRCUIT COMPLEMENTARY PUMP 1488 (ONLY)

It is an external-toothed gear-type pump and it feeds in complément of the forced circuit pump (see above)

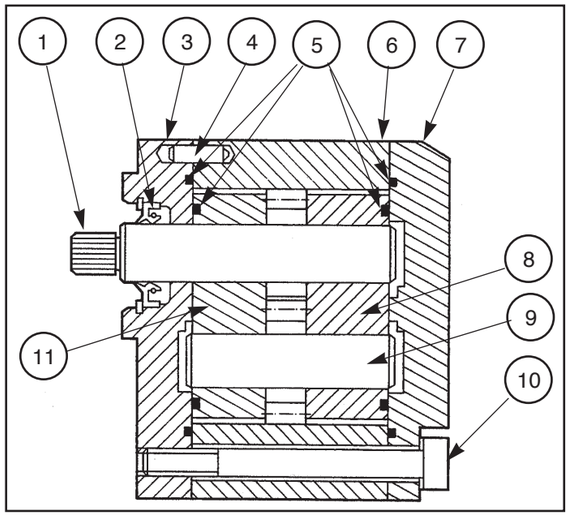
Specifïcadons

Displacement	**18**	(CC/rev.)
Ddve speed	**2000**	(r.p.m.)(
Max. flow	**36**	(Vmn**)**
Rated pressure.....	**35**	(bar)

Orifice Idendflcation
S : Sucton
A : Output



Main technical details of gear type pump (simple body)

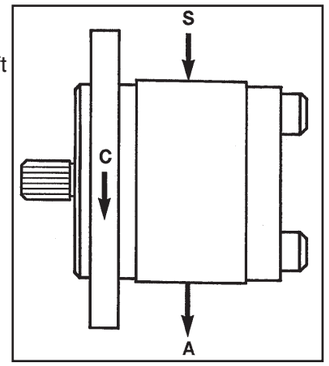


Identification of ports

S	-	Servo circuit inlet
A	-	Output to solenoid valve block
C	-	Pump direction of rotation

Description

1	-	Pinion with shaft
2	-	Lip seal
3	-	Front flange
4	-	Centring studs
5	-	Seals
6	-	Housingr
7	-	Rear flange
8	-	Rear block
9	-	Pinion
10	-	Assembly bolt
11	-	Front block

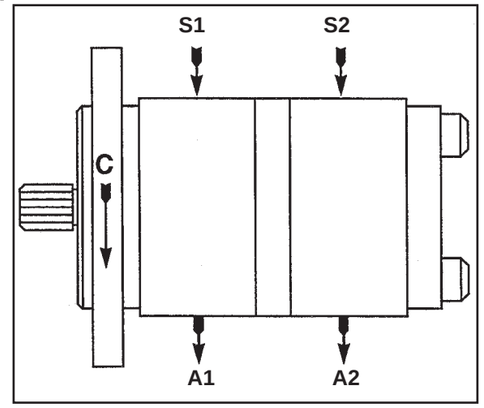


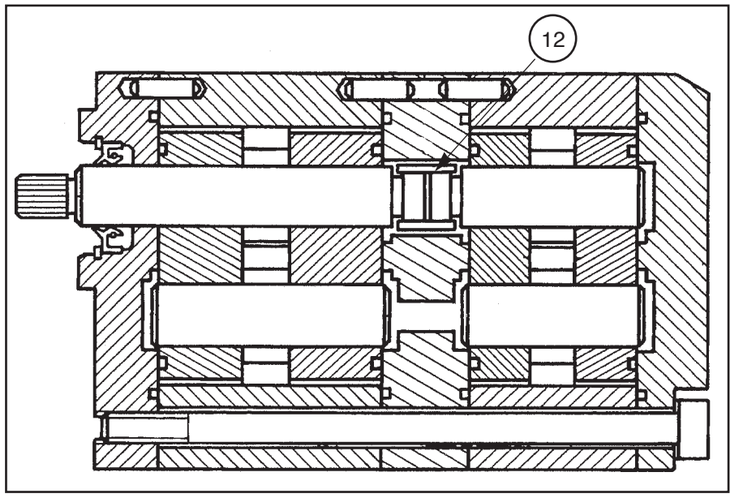
Main technical details of gear type pump (double body)

Identification of ports

S1	-	Servo circuit inlet
A1	-	Output to solenoid valve block
S2	-	Steering / braking circuit inlet
A2	-	Output to brake unit
C	-	Pump direction of rotation

Description
The design is identical for both pump bodies and each body is the same as the description shown on the previous page.
The pinion with shaft of the first body drives the minion in the second body via splined sleeve **12**.





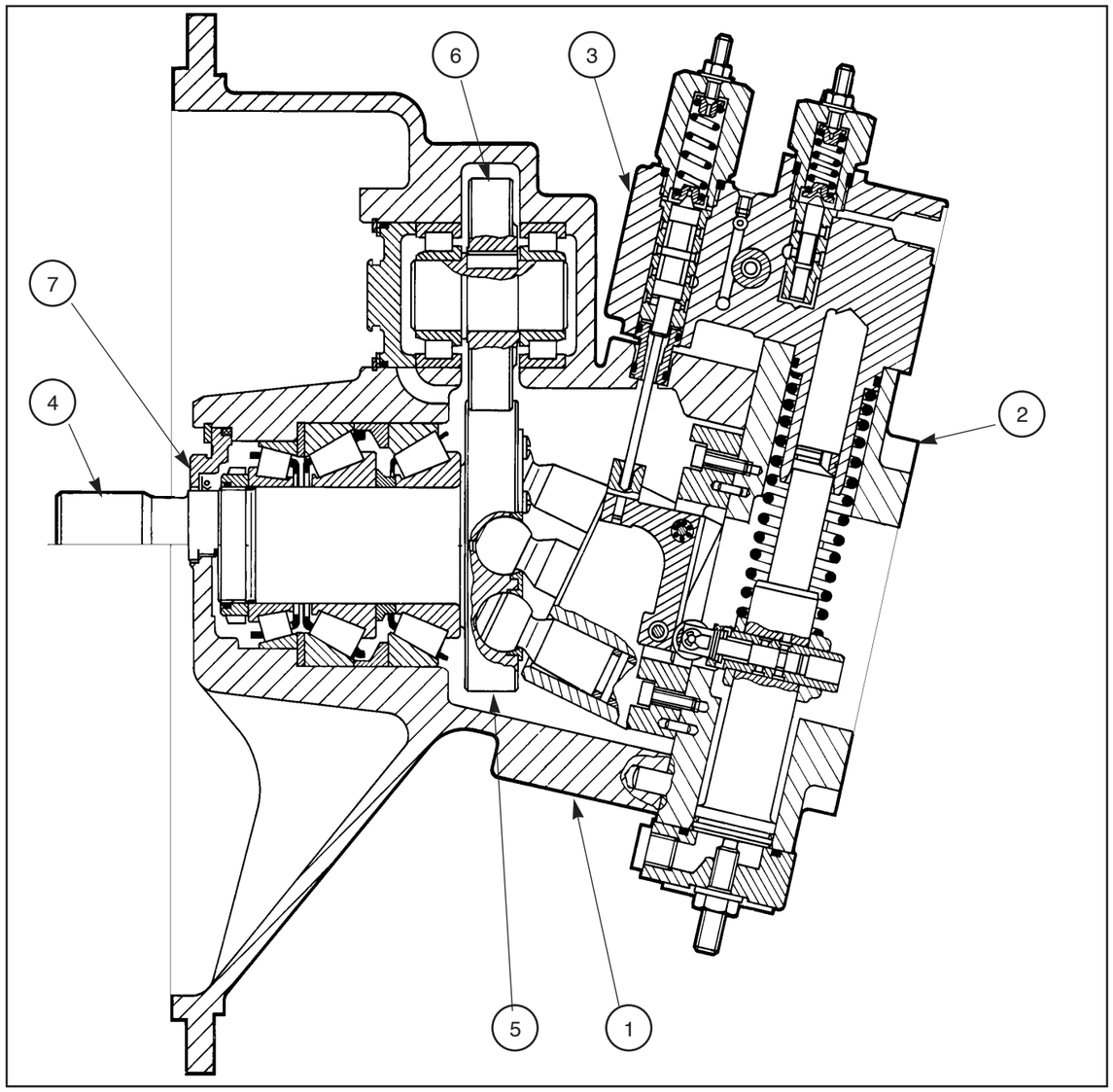
12/1488 HYDRAULIC PUMPS

Main technical details of piston pumps

Description

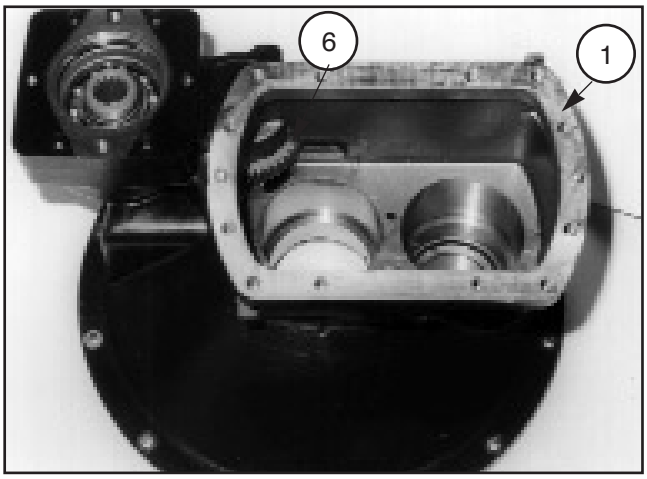
1 Housing
2 Servo-control
3 LOAD-SENSING, torque regulator and flow cancelling block
4 Drive shaft
5 Drive shaft for second variable displacement pump body
6 Fixed displacement pump body drive gear
7 Shaft sealing system (flange + lip-seal)

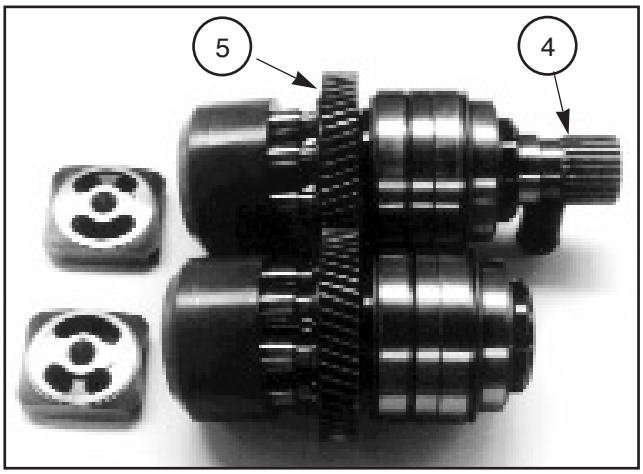
(This description applies also to the photos on the following page)

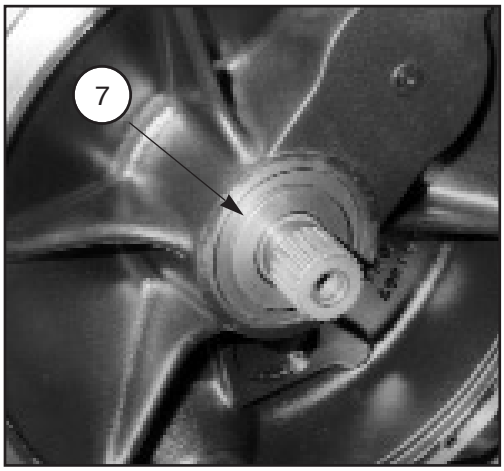


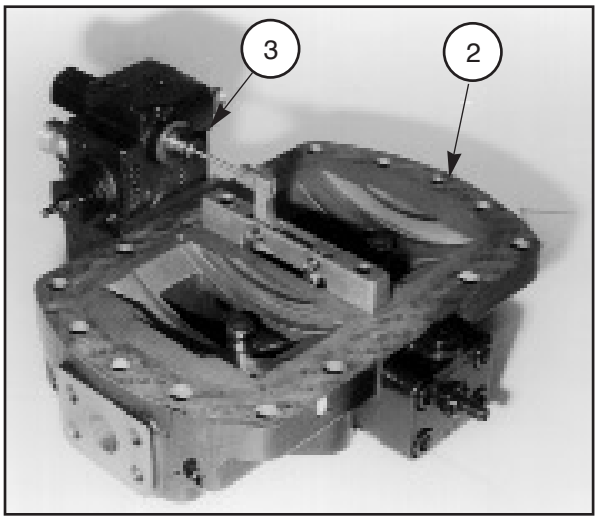
HYDRAULIC PUMPS 12/1488

PISTON PUMPS MAIN TECHNICAL DETAILS





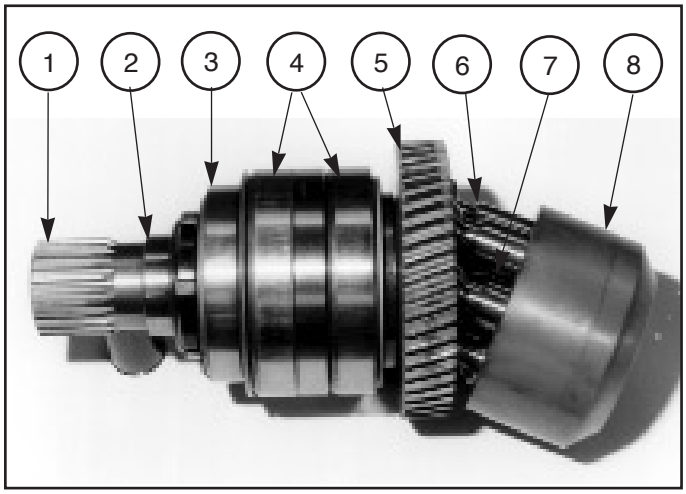




THE VARIABLE DISPLACEMENT DRIVING PUMP BODY

Description

1 Splined shaft
2 Lip seal contact surface
3 Nut
4. Taper roller bearings
5. Variable displacement pump second body drive pinion
6. Pistons with rings (quantity 7)
7 Guide piston
8 Barrel



VARIABLE DISPLACEMENT DRIVEN PUMP BODY

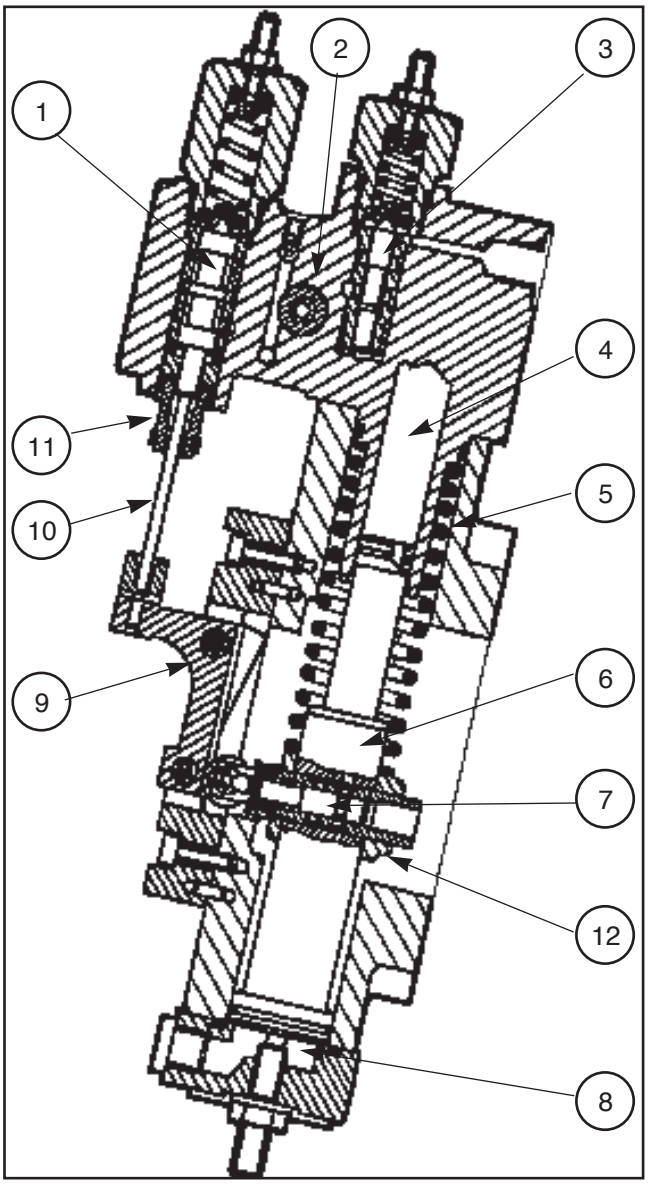
It is the same as the previous pump except there is no splined shaft

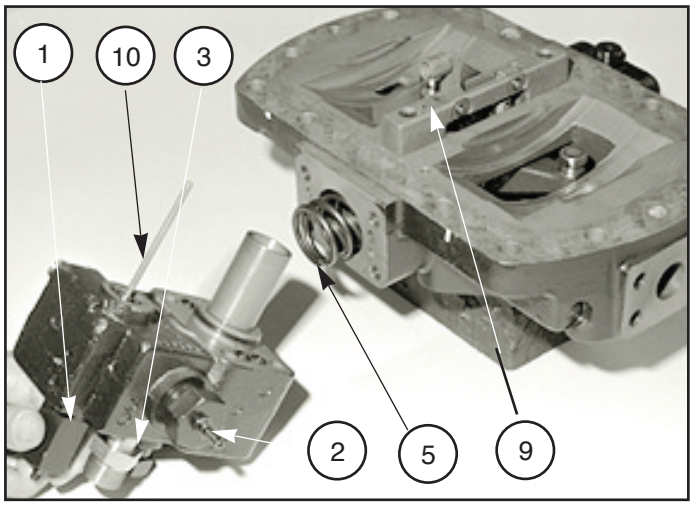
HYDRAULIC PUMPS 12/1488

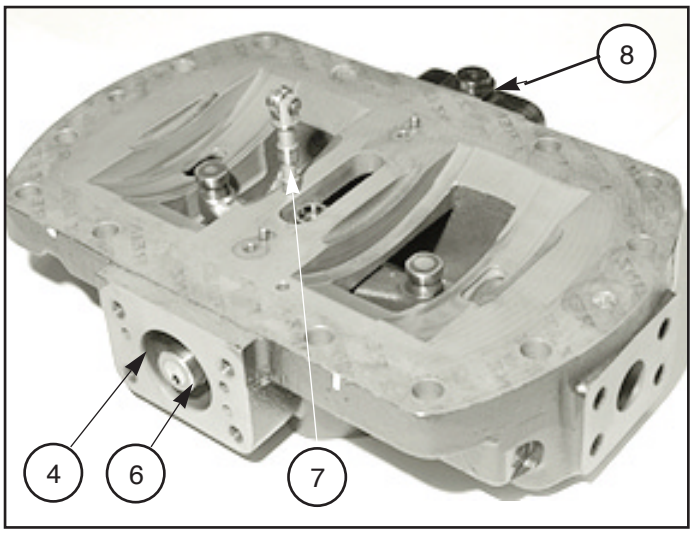
MAIN TECHNICAL DETAILS OF SERVO-CONTROLLED PISTON PUMPS AND THE VARIOUS VALVE BLOCKS

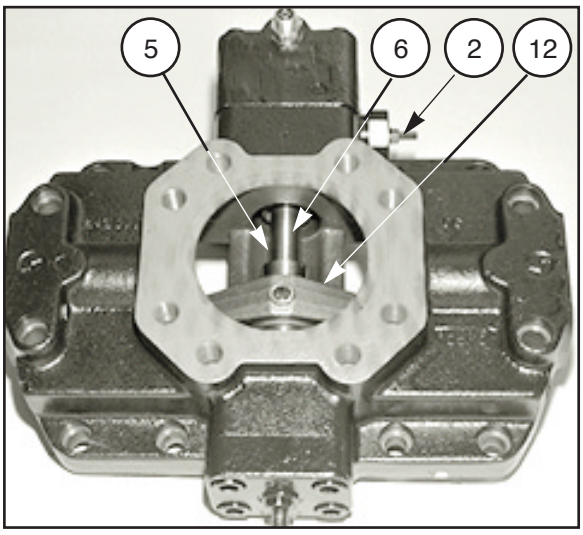
Description

1 Torque regulating valve
2 LOAD-SENSING valve
3 Flow cancelling and pressure maintaining valve
4 Servo-control piston small chamber
5 Retrun spring
6 Servo-control cylinder
7 Hydro-mechanical torque regulator pilot piston
8 Servo-control cylinder large chamber
9 Hydro-mechanical torque regulator lever arm
10 Torque regulator control rod
11 Sealing sleeve between valve block and pumps housing
12 Drive arm for barrels





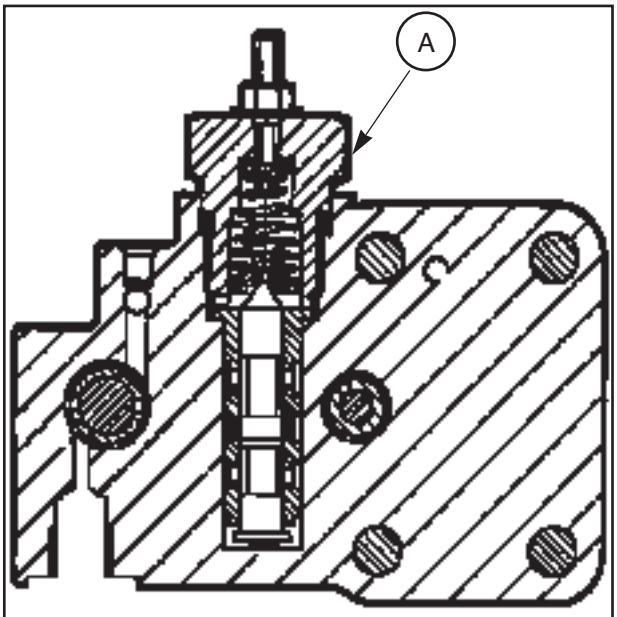


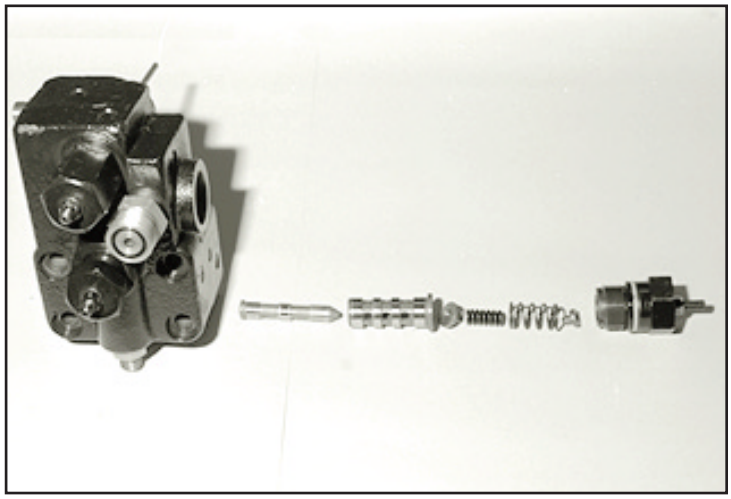


HYDRAULIC PUMPS 12/1488

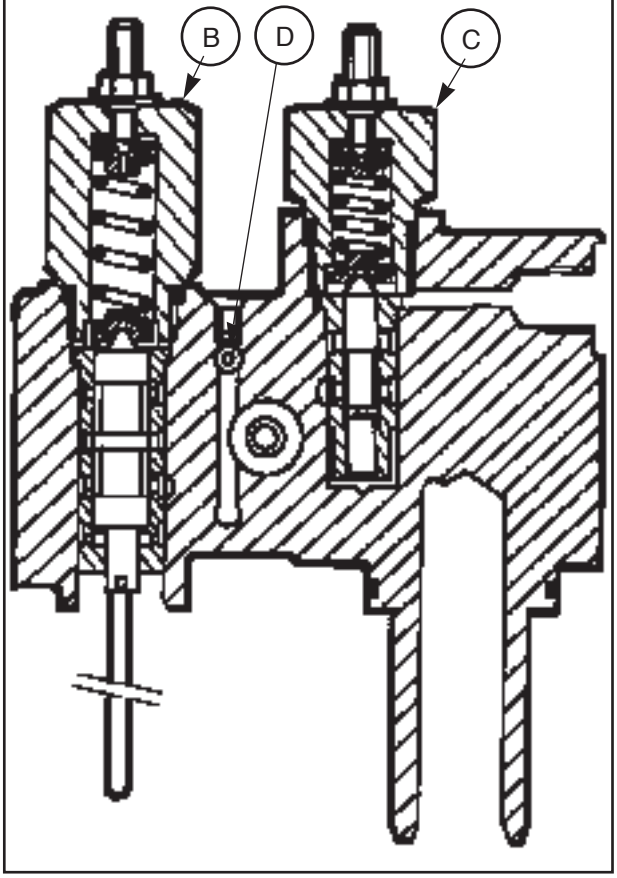
VARIOUS VALVE BLOCKS (continued)

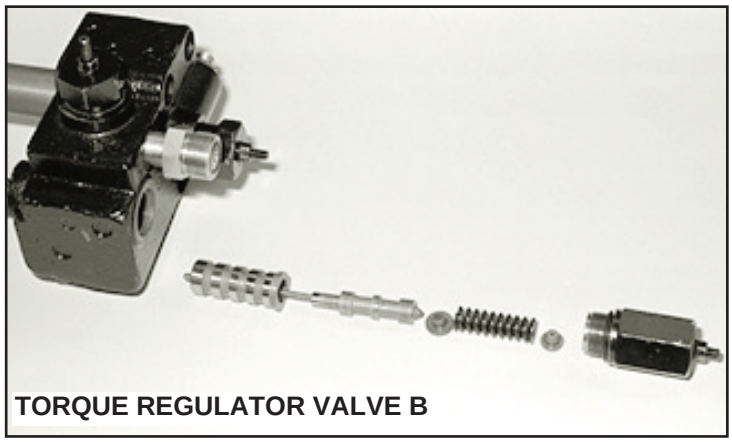
LOAD SENSING VALVE A



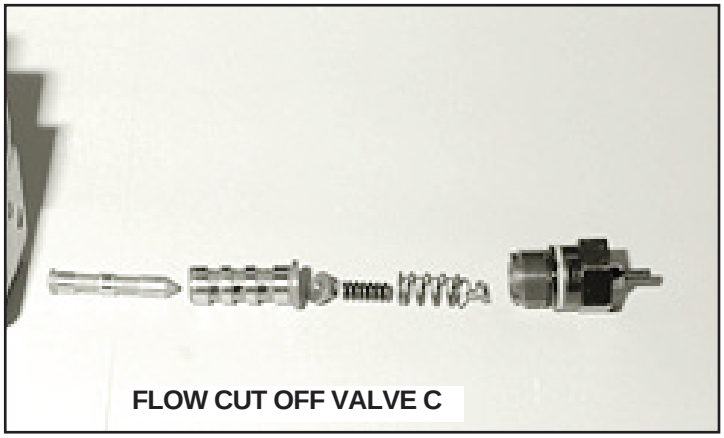


TORQUE REGULATOR VALVE B &
FLOW CUT OFF VALVE C





TORQUE REGULATOR VALVE B



FLOW CUT OFF VALVE C

NOTE

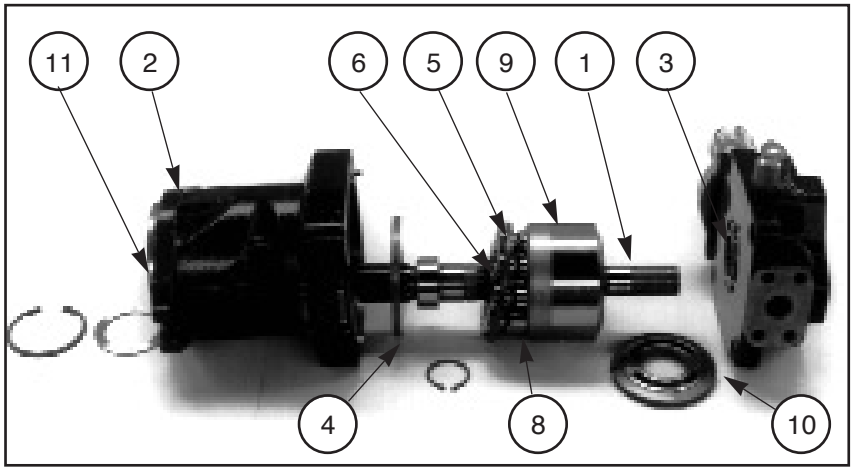
LS valve stability is insured by restrictor **D** (**A**)

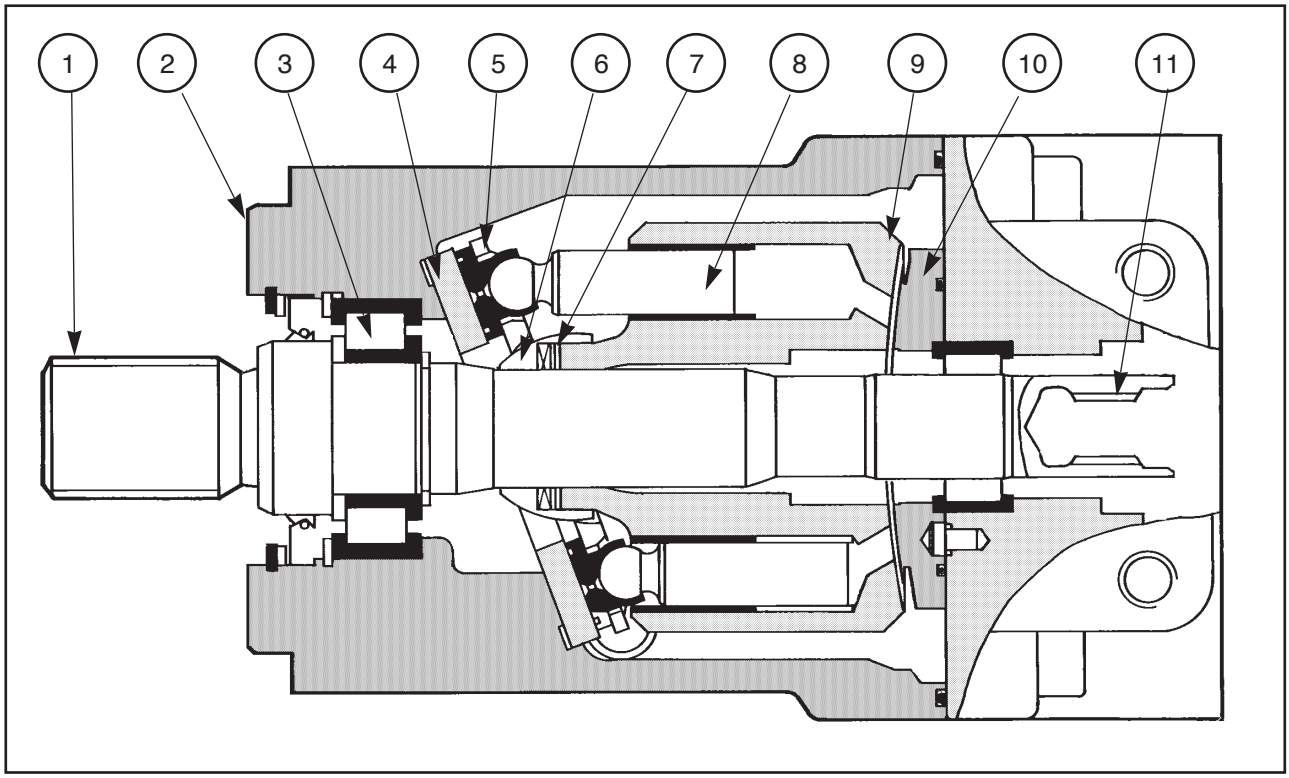
12/1488 HYDRAULIC PUMPS

MAIN TECHNICAL DETAILS OF PISTON PUMPS.
FIXED DISPLACEMENT PUMP BODY

Description

1 Pump shaft
2 Housing
3 Straight roller bearings
4 Pressure plate
5 Piston end return assembly
6 Socket
7 Belleville washers
8 Pistons with ends
9 Barrel
10 Distribution race
11 Force-feed pump drive splines



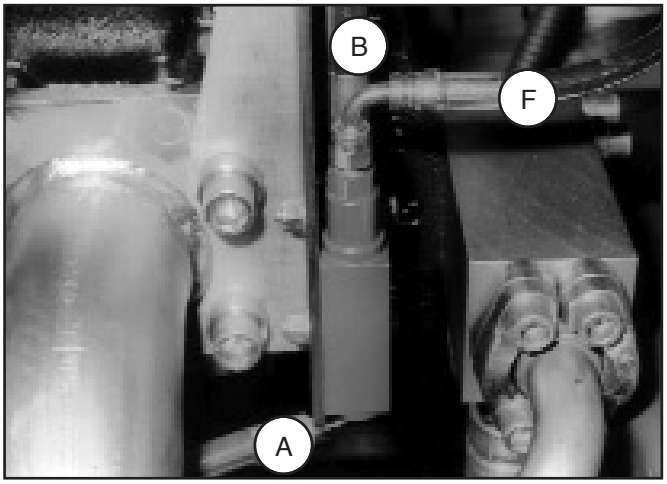


12/1488 HYDRAULIC PUMPS

LOAD-SENSING INFORMATION CIRCUIT ANTI-PUMPING VALVE

It is fitted in the LOAD-SENSING information circuit of the variable displacement pump

Its function is to stabilise the LOAD-SENSING valve



Description

1	Body
2	Spool
3	Cap
4	Push-rod
5	Spring
6	O-ring
7	Back-up ring
8	Cap (access to filter)
9	Filter maintenance spring
10	Filter
11	One-way valve cap
12	One-way valve spring
13	One-way valve
14	Sealing cap
15	Ball

Identification of orifices

A : Inlet of pressure from attachments, travel or options LS circuits

B : To LOAD-SENSING valve

F : Leak return to **R1** of pump

Working principles

a)- Feed :

The highest pressure from the LS circuits arrives at **A**, passes through filter **9**.

It pushes one-way valve **13**, to inform the pump regulator block LOAD-SENSING valve (spring end).

When the pressure reaches **25** bar, spool **2** is piloted and closes passage **C**.

b)- Stabilising the LOAD-SENSING valve :

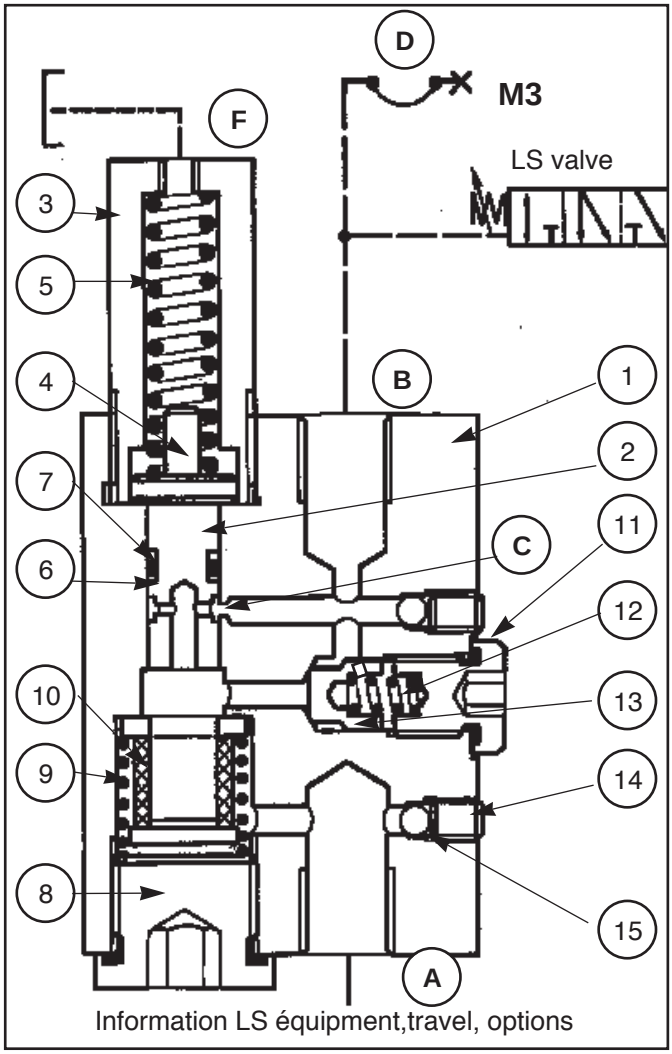
If a pumping phenomenon appears in the LS information circuit, pressure falls at **A**.

One-way valve **13** closes against its seat, thus separating the LOAD-SENSING valve from the pump.

No further pressure variations occur at the pump.

Hose **D** absorbs pressure peaks to improve the stability of the LS valve.

Pressure checking point **M3** is located at the end of this hose.



Information LS équipment,travel, options

Spécifications

The anti-pumping valve filter must be changed at the same time as the hydraulic tank filtercartridges.

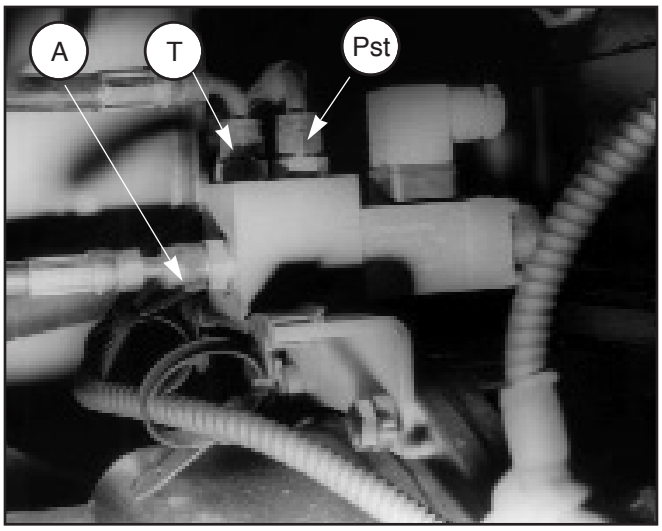
12/1488 HYDRAULIC PUMPS

THE PROPORTIONELLE VALVE

It is located over the flywheel engine
It delivred a variable pressure in relation with received intensity from electronic control box, to the regulation valve

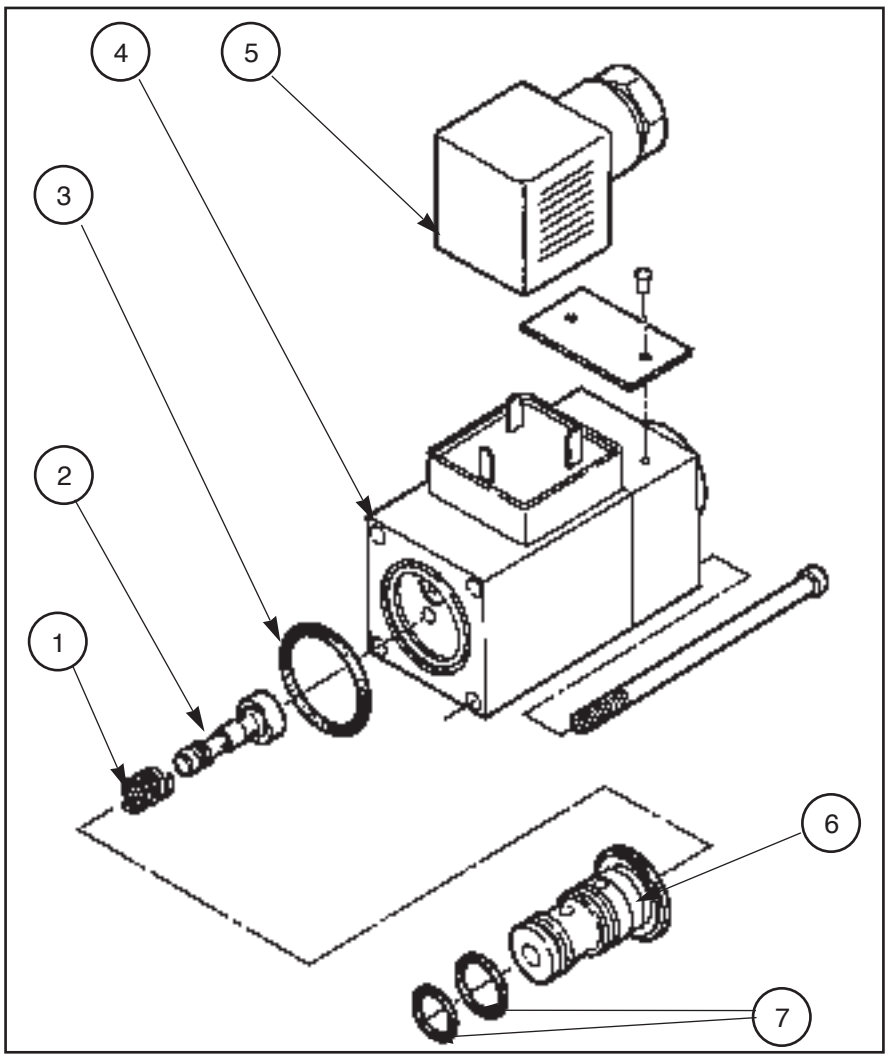
Ports location

A : Toward torque regulation valve
T : Leales return to pump **R1** port
Pst : Pilot pressure inlet (**35** bar)



Description

1 Spring
2 Spool valve
3 Seal
4 Solenoide
5 Connector
6 Spool sleve
7 Seals



LOAD-SENSING, TORQUE REGULATOR, FLOW CANCELLING AND INDEPENDENCE OF MOVEMENTS SYSTEMS

CONTENTS PAGE

LOAD-SENSING, TORQUE REGULATOR, FLOW CANCELLING AND INDEPENDENCE OF MOVEMENTS SYSTEMS

LOAD-SENSING VALVE, TORQUE REGULATOR, FLOW CANCELLING AND PRESSURE MAINTENANCE SYSTEM

A- "LOAD-SENSING".

• "Load-Sensing" valve function:

- It changes the flow from the pump to correspond to that required by the operator.
- It is not sensitive to different loads.
- It cancels the flow when the control valve spools are at rest (neutral) position .
- It cancels the flow at the maximum authorised attachments pressure

•Advantage:

- It avoids unnecessary circulation of oil in the system and thus reduced power wasted in heat.

•Basic principle:

-The flow which passes through a given section is dependent on :

a) the section of the passage and its shape

b) the pressure loss while passing through the section

- The LOAD-SENSING system maintains a constant pressure loss. The flow is therefore dependent only on the section of the passage corresponding to the position of the control valve.

B-"SPEED-SENSING" (torque regulation)

This type of regulation is widely used by excavator manufacturers. It consists of limiting the resistant torque of the pump. Current designs enable the torque to be kept constant for all pressure values.

•Function:

Make the best possible use of the installed power.

•Advantages:

. A lower-powered engine can be fitted.

. Torque regulation can exist between two separate functions (swing with attachments, travel , options).

•Basic principle:

- The resistant torque of the pump is proportional to the displacement and the pressure. It is necessary therefore to calculate the product of those values and to keep it at a constant level.
- For this we use a sensor which reads the engine speed and transmits this information to an electronic control housing.
- The housing sends a measured voltage to a proportional valve which delivers a low pressure to the torque regulation valve.
- To compensate for the response time of this system, a lever is used, to which a force is applied proportional to the pressure, at a distance with an axis proportional to the displacement. A spring is loaded against this force.

C - FLOW CANCELLING AND PRESSURE MAINTENANCE

•Function:

- It limits the pressure in the attachments and options circuits.
- It cancels the attachments flow at maximum working pressure, while maintaining the pressure at its maximum level.

•Advantages:-

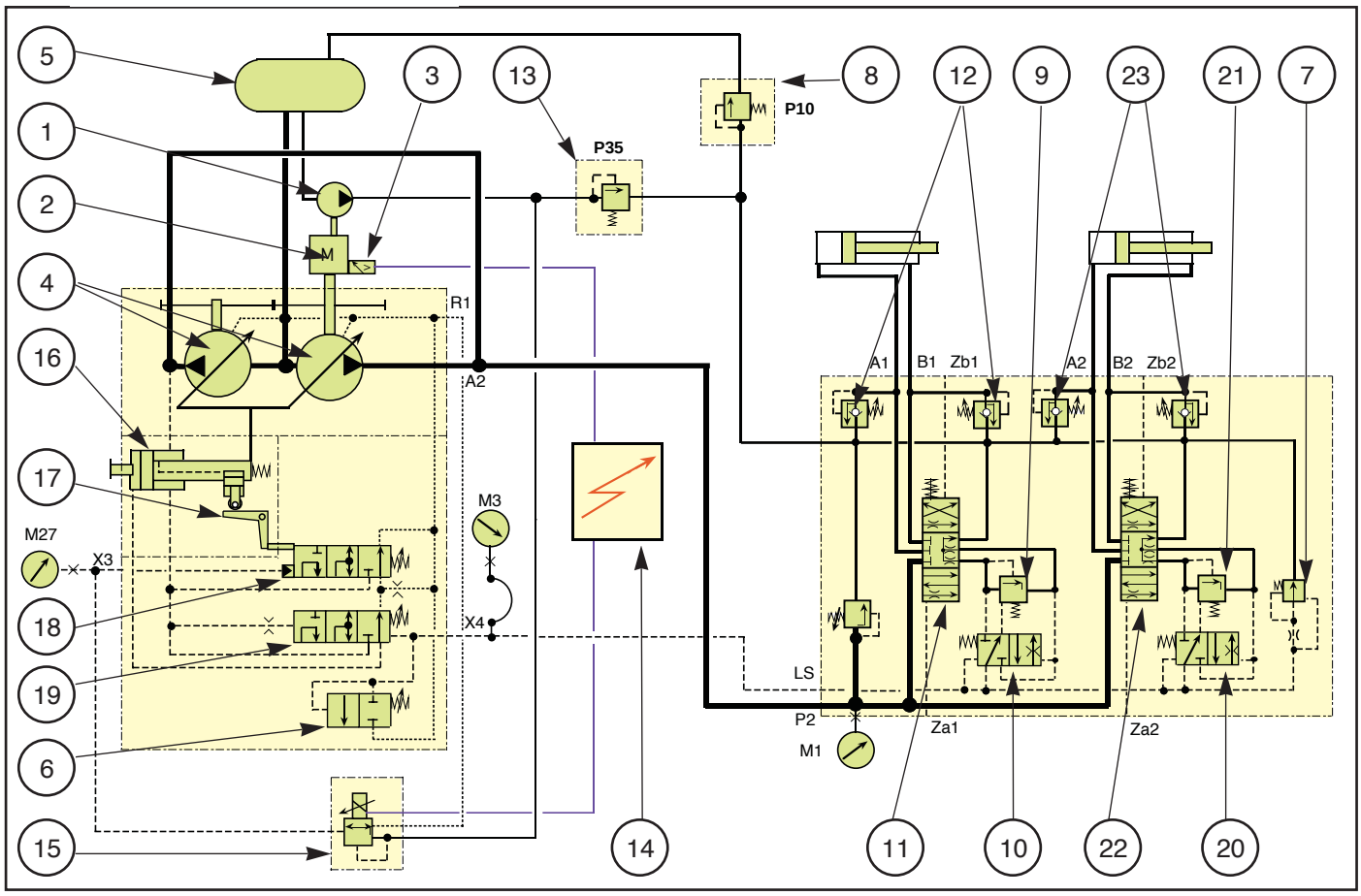
- It enables maximum pressure to be used with low power consumption.
- It reduces the power lost in heat.

•Basic principles:

- At maximum working pressure, the valve is piloted.
- That pressure is thus installed on pistons of differing sections.
- The pump barrels are at minimum slant and produce a flow equal only to the working leaks of the system.
- An intermediate position of the valve enables:
  - the pump barrels to be stabilised.
  - the pressure to be maintained.

LOAD-SENSING, TORQUE REGULATOR, FLOW CANCELLING AND INDEPENDENCE OF MOVEMENTS SYSTEMS

SYSTEM DESCRIPTION



- **1** Pilot pump
- **2** Engine
- **3** Electronic engine speed sensor
- **4** Variable displacement pumps
- **5** Hydraulic tank
- **6** Flow cut-off valve
- **7** LOAD-SENSING information decompression regulator
- **8** P10 counter-pressure valve
- **9** Pressure compensator
- **10** Pressure selector
- **11** Control valve spool with closed centre
- **12** Safety valve
- **13** P35 pressure limiter
- **14** Electronic control box
- **15** Electr-hydraulic proportional valve
- **16** Servo-control for variable flow pumps
- **17** Torque regulating lever
- **18** Torque regulating valve
- **19** LOAD-SENSING valve
- **20** Pressure selector
- **21** Pressure compensator
- **22** Control valve spool with closed centre
- **23** Safety valves

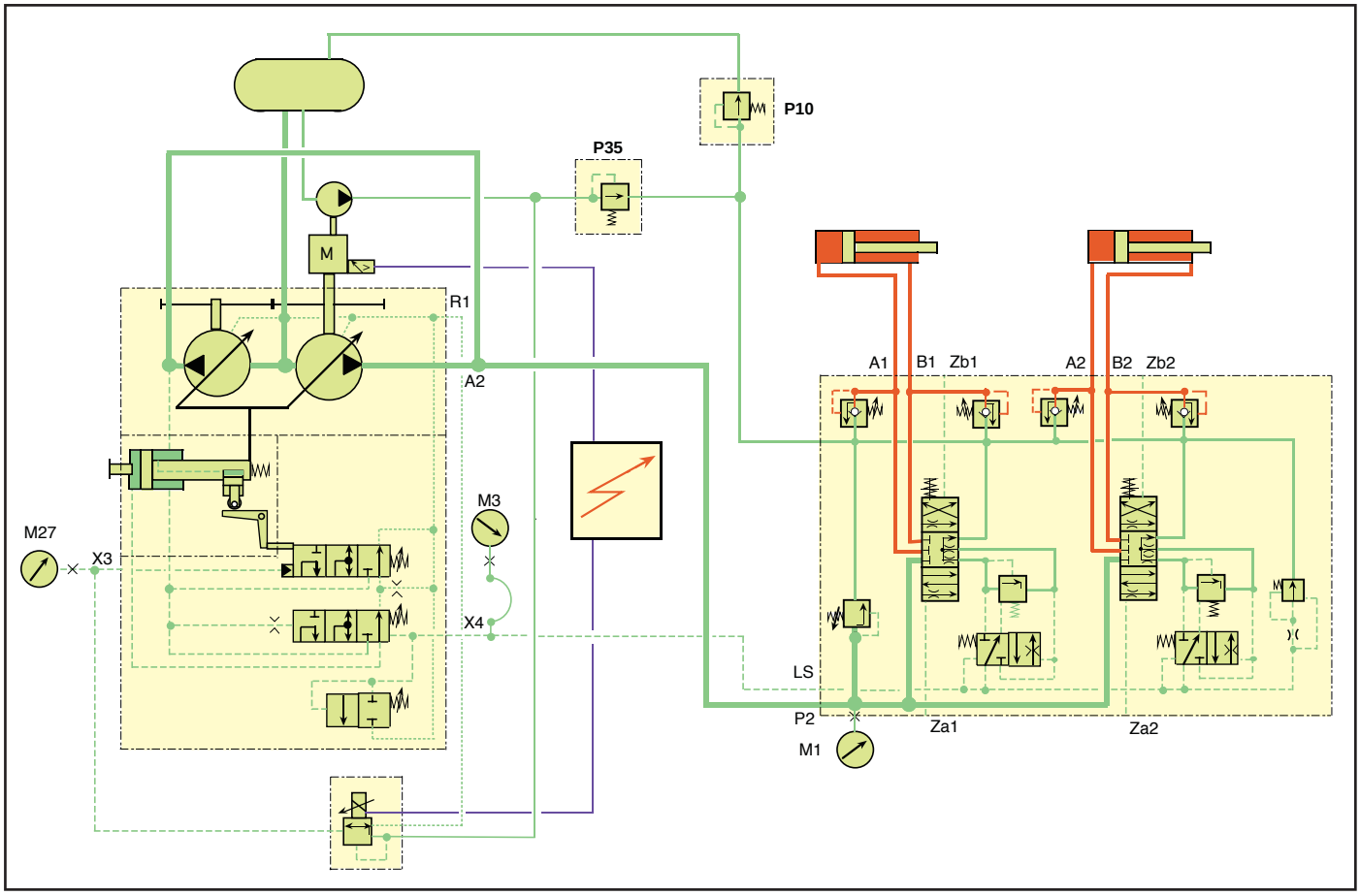
} on 1st control valve element

} On 2nd control valve element

LOAD-SENSING, TORQUE REGULATOR, FLOW CANCELLING AND INDEPENDENCE OF MOVEMENTS SYSTEMS

THE LOAD-SENSING SYSTEM

PHASE 1

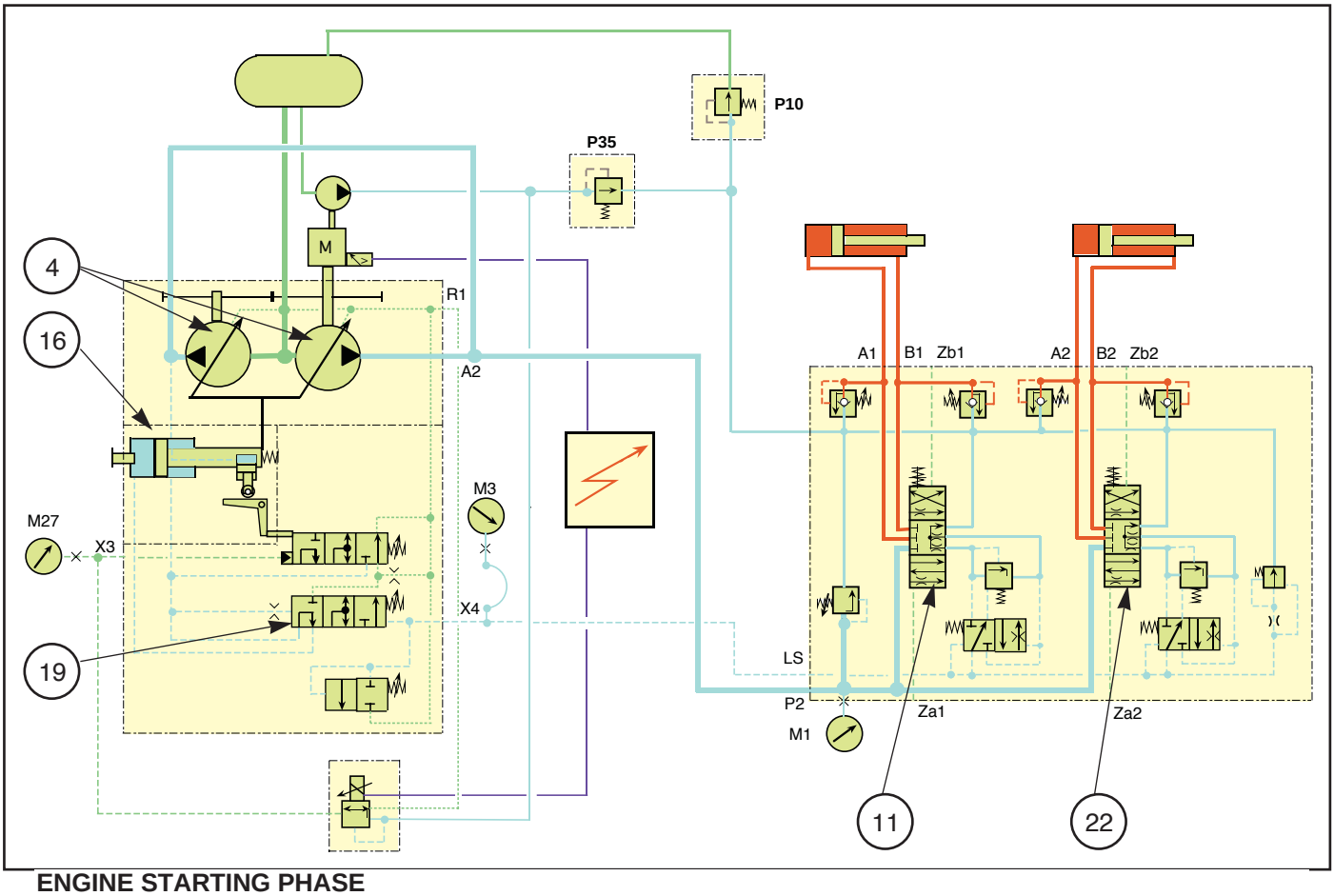


ENGINE TURNED OFF

- Under the action of the return springs, the L-S valves **19** and the torque regulator **18** are in the rest (neutral) position.
- The large chamber of servo-control **16** is at reservoir **5.**
- The return spring on the servo-control **16** puts the two variable flow pump bodies **4** in high displacement position

LOAD-SENSING, TORQUE REGULATOR, FLOW CANCELLING AND INDEPENDENCE OF MOVEMENTS SYSTEMS

THE LOAD-SENSING SYSTEM
PHASE 2



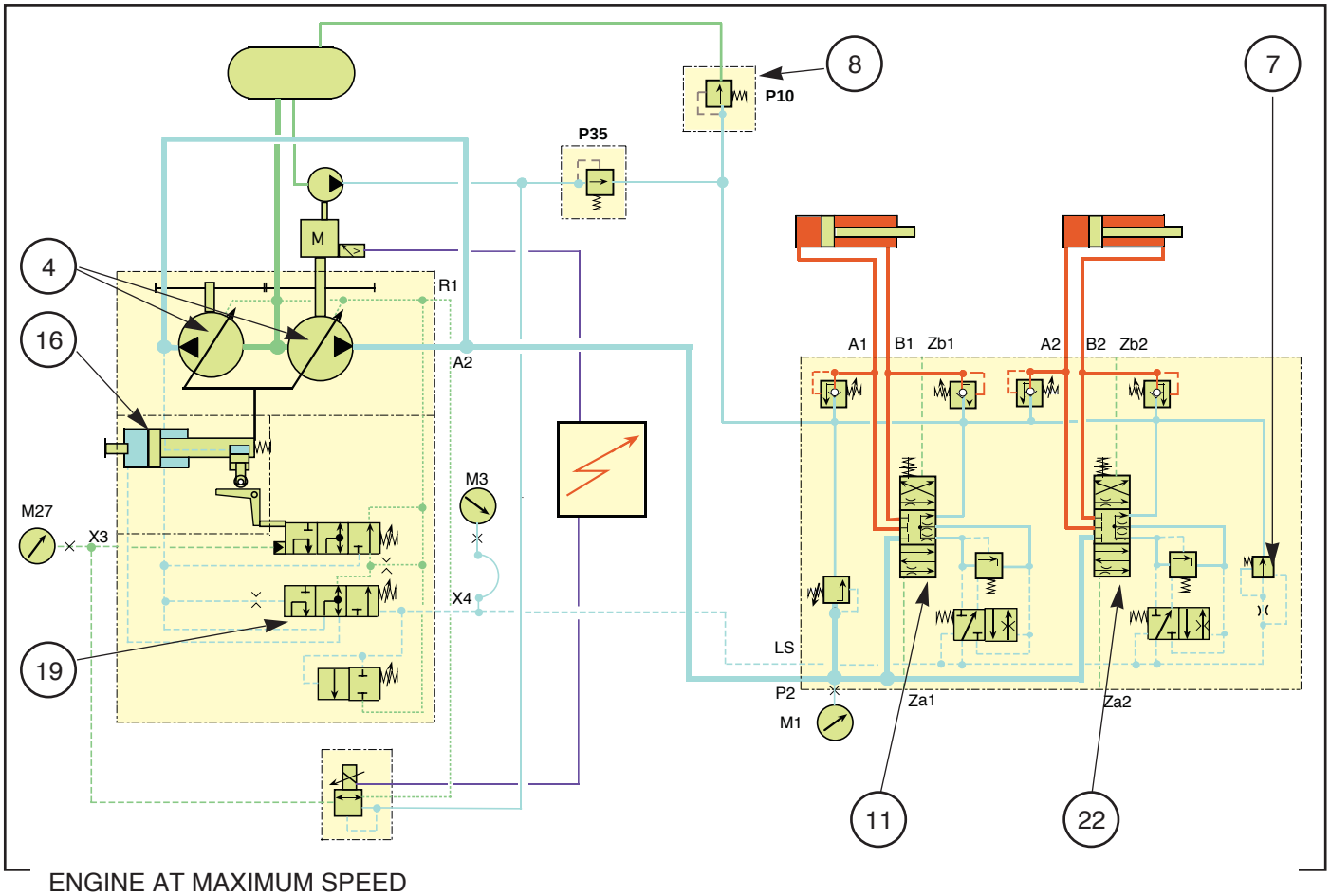
ENGINE STARTING PHASE

- When the engine starts, the variable flow pumps **4** begin to produce flow
- Since the control valves **11** and **22** have closed centres, pressure rises and pilots the L-S valve
- The small and large chambers of the servo-control **16** are subjected to the same pressure
- As the section of the two chambers is different, the greater force changes the pumps setting to minimum displacement
- The outlet pressure from the pumps begins to fall

LOAD-SENSING, TORQUE REGULATOR, FLOW CANCELLING AND INDEPENDENCE OF MOVEMENTS SYSTEMS

THE LOAD-SENSING SYSTEM

PHASE 3



ENGINE AT MAXIMUM SPEED

- The L-S valve spring **19** is stronger than the hydraulic force exerted from the other end. The spring expands and its mechanical force diminishes.
- When the hydraulic and mechanical forces applied on each end of the L-S valve are the same, the L-S valve is in a state of balance.
- This enables the large chamber of servo-control **16** to go partially to the tank, so that the pressure in the servo-control is in relation to the sections of the chambers.
- At this moment, the pumps **4** produce a flow to compensate for the working leaks and to create a pressure (in M1), between **30** and **34** bar, depending on the adjustment of the L-S valve.

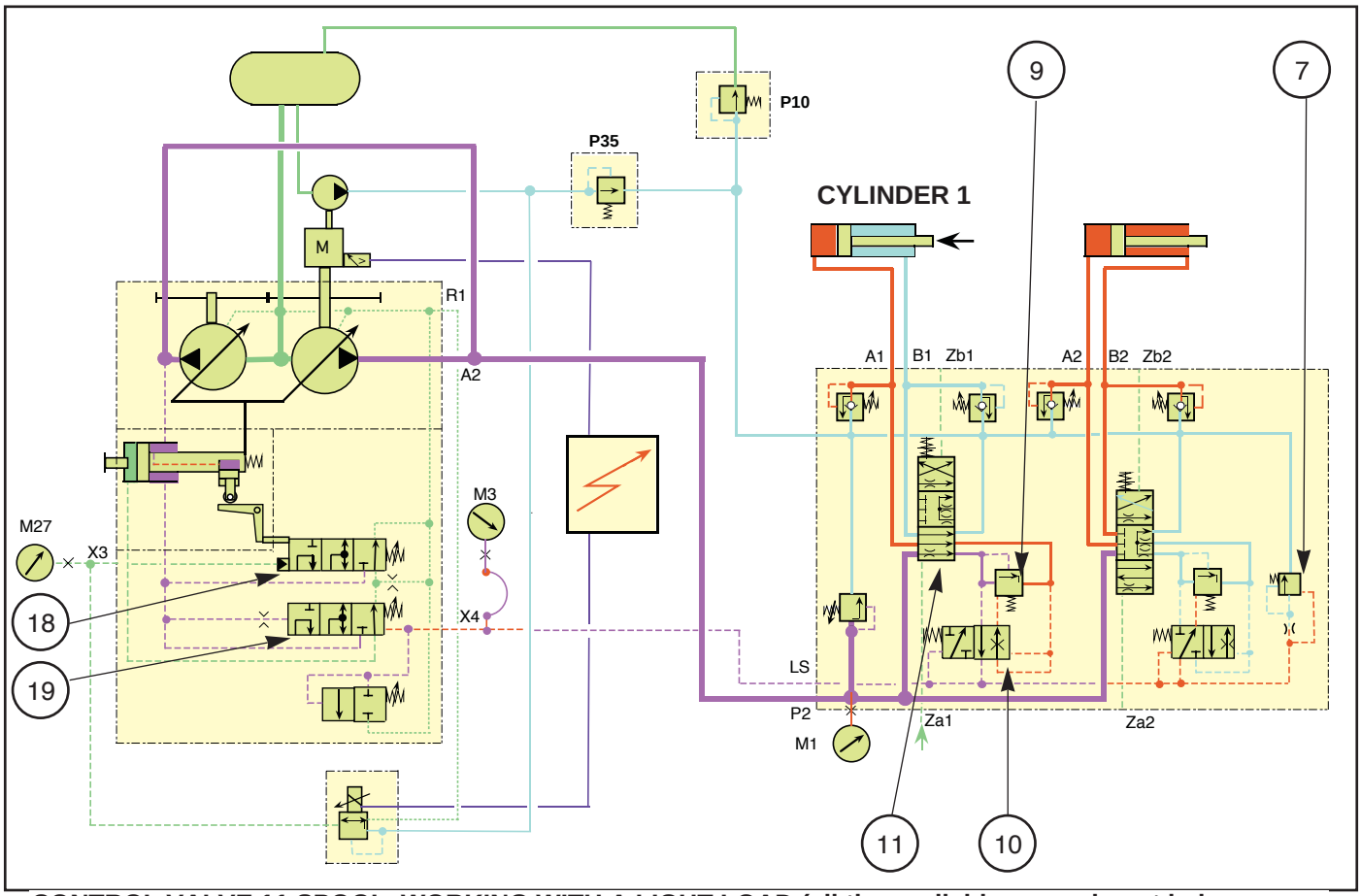
NOTA :

- When all the control valve spools **11** and **22** are in rest position, the L-S information from the spring end is brought into the P10 **8** via the flow regulator **7** which is normally open in its rest position.

LOAD-SENSING, TORQUE REGULATOR, FLOW CANCELLING AND INDEPENDENCE OF MOVEMENTS SYSTEMS

THE LOAD-SENSING SYSTEM

PHASE 4



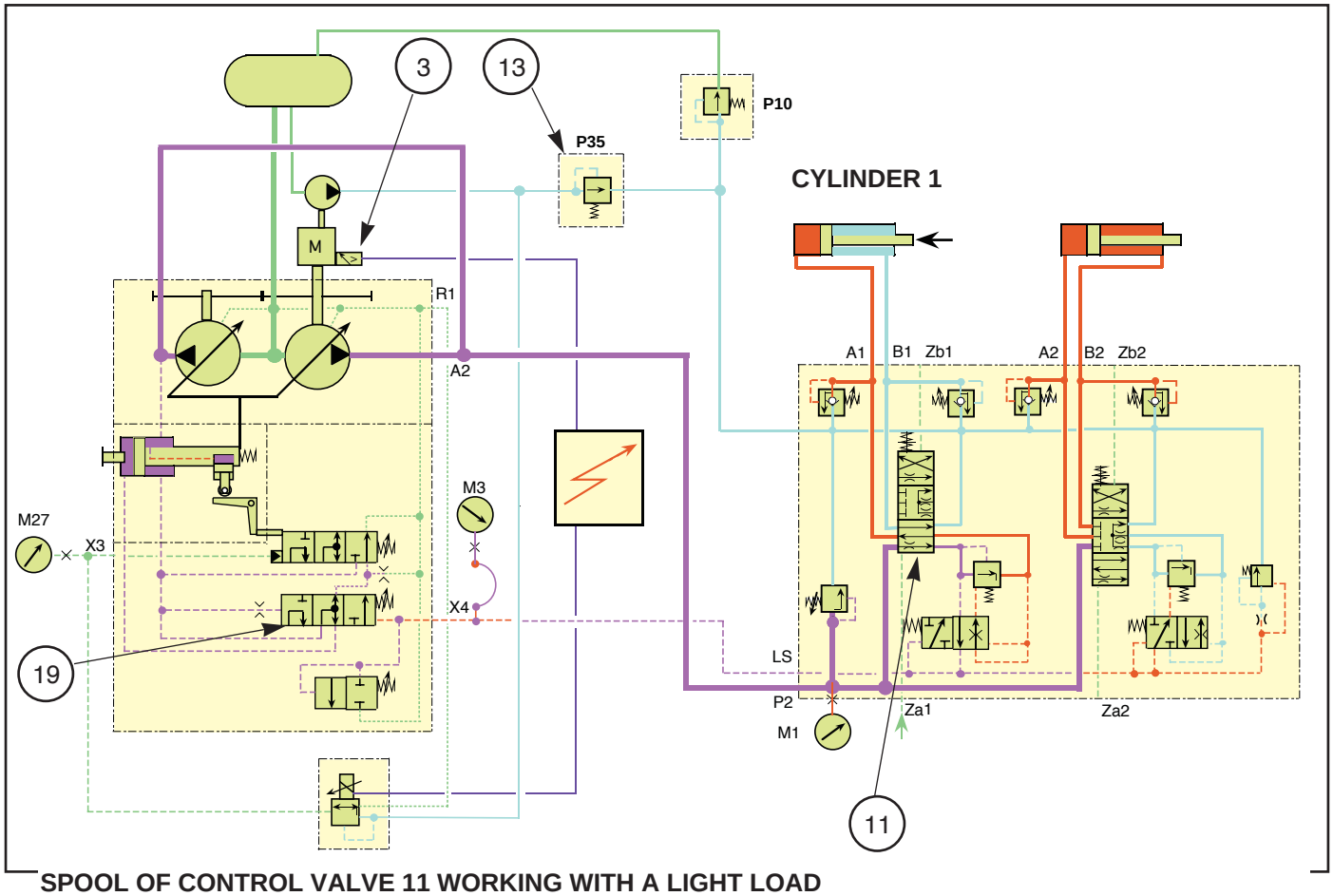
CONTROL VALVE 11 SPOOL WORKING WITH A LIGHT LOAD (all the available power is not being consumed)

The spool of control valve **11** is piloted at **Za1**. The pressure in the large chamber of cylinder **1,** produced by the load, pilots the pressure selector **10** .
The outlet pressure from the pumps, which is between **30** and **34** bar, through spool **11** and pressure selector **10,** comes into the L-S valve **19** (spring end).
The pressure drop, produced by the flow which passes through flow regulator jet **7,** closes the flow regulator, leaving only a leak of **0.4** to **0.6** l/min depending on the pressure received.
The L-S valve reverts to the rest position, because on the spring end we have between **30** and **34** bar plus the force of the spring, whereas on the other end there is the same pressure.
The large chamber of the servo-control **16** is going to the tank. The pumps can produce a flow.
For the moment, this flow from the pumps cannot go to the cylinder because the pressure compensator **9** is not open.
We note that the large chamber pressure , passing through pressure selector **10,** is acting on the pressure compensator at the spring end. Whereas on the other end, it is the outlet pressure of the pumps, between **30** and **34** bar, which is acting.
The pumps ports are therefore blocked only in the direction of the two ends of the L-S valve.
The blocking principle consists of having the same pressure on both ends of the L-S valve so that the spring puts it in the rest position, so as to force the pumps to put out flow and to increase the pressure.
As soon as that pressure which is applied on the pressure compensator (end with spring) is greater than the pressure which opposes it (large chamber of the cylinder), plus the force of the spring, at that moment the pressure compensator opens and the flows go to feed the cylinder.

LOAD-SENSING, TORQUE REGULATOR, FLOW CANCELLING AND INDEPENDENCE OF MOVEMENTS SYSTEMS

THE LOAD-SENSING SYSTEM

PHASE 5

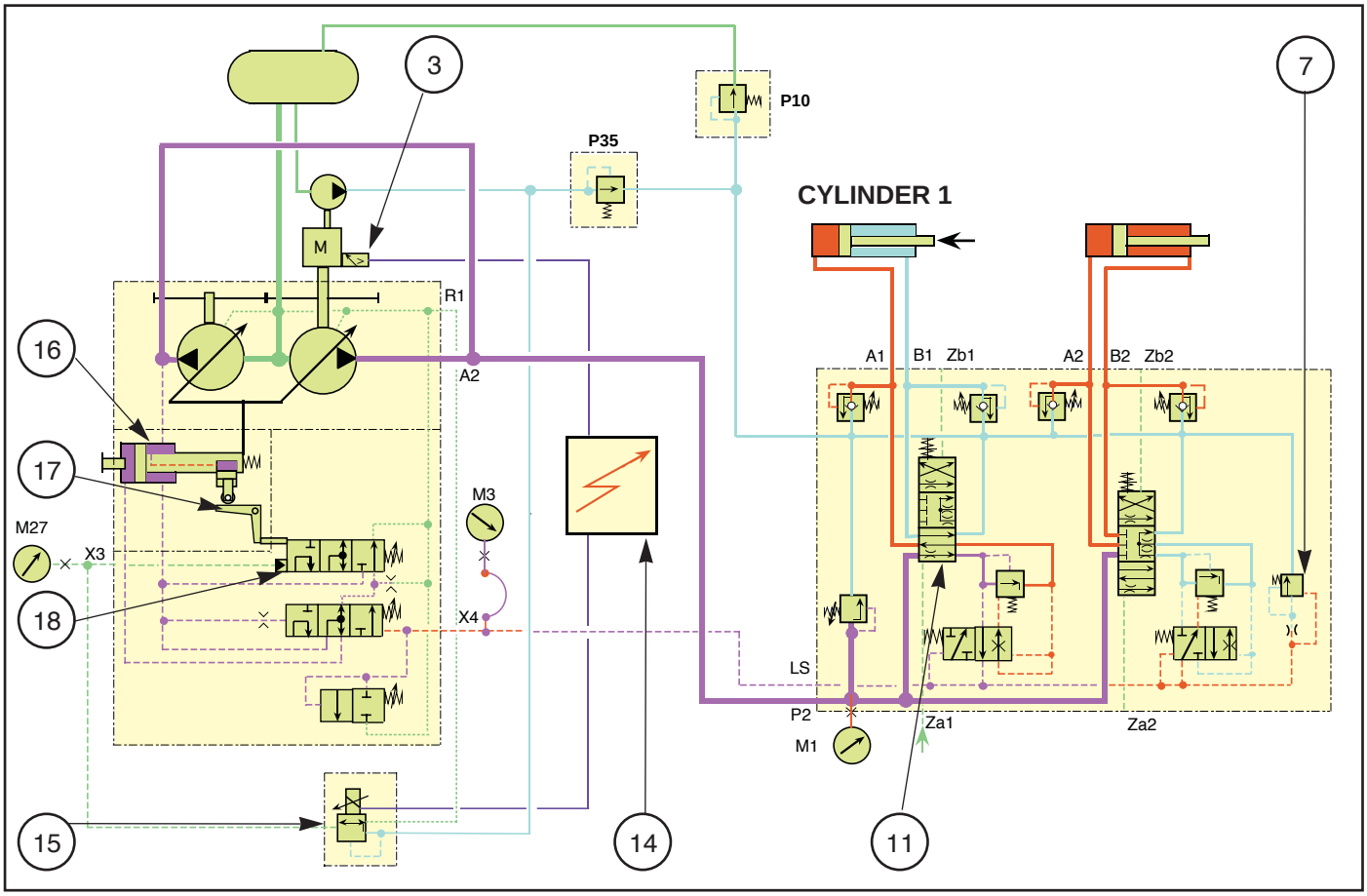


SPOOL OF CONTROL VALVE 11 WORKING WITH A LIGHT LOAD

- Now that the flow is directed to cylinder **1,** a pressure drop is brought about by the progressivity grooves on the spool of control valve **1.**
- As soon as the pressure drop is equal to the pressure setting of L-S valve **19,** i.e. between **20** and **22** bar in dynamic mode, then the required flow is constant.
- The pressure drop is read between **M1** and **M3.**

LOAD-SENSING, TORQUE REGULATOR, FLOW CANCELLING AND INDEPENDENCE OF MOVEMENTS SYSTEMS

SPEED SENSING SYSTEM (TORQUE REGULATION)
PHASE 6



SPOOL OF CONTROL VALVE 11 WORKING WITH A HEAVY LOAD (all the hydraulic power is being consumed)

- If now, the load on cylinder **1** iincreases, so does the pressure.
- If we want to consume a greater hydraulic power than that installes, then the engine speed will fall.
- The electronic sensor **3** mounted at the engine flywheel reads this fall in speed and transmits it to the electronic control housing **14.**
- The electronic housing delivers a voltage to the elctro-hydraulic proportional valve **15.**
- Valve **15** is fed hydraulically by pilot pressure (35 bar)
- Depending on the intensity of the voltage received, the valve supplies a pressure which acts on the torque regulating valve **18,** which is piloted.
- Thus the pump outlet pressure will enter the large and small chambers of the servo-control cylinder 16.
- The outlet flow of the pumps will decrease so as to consume hydraulic power equal to that which is available.

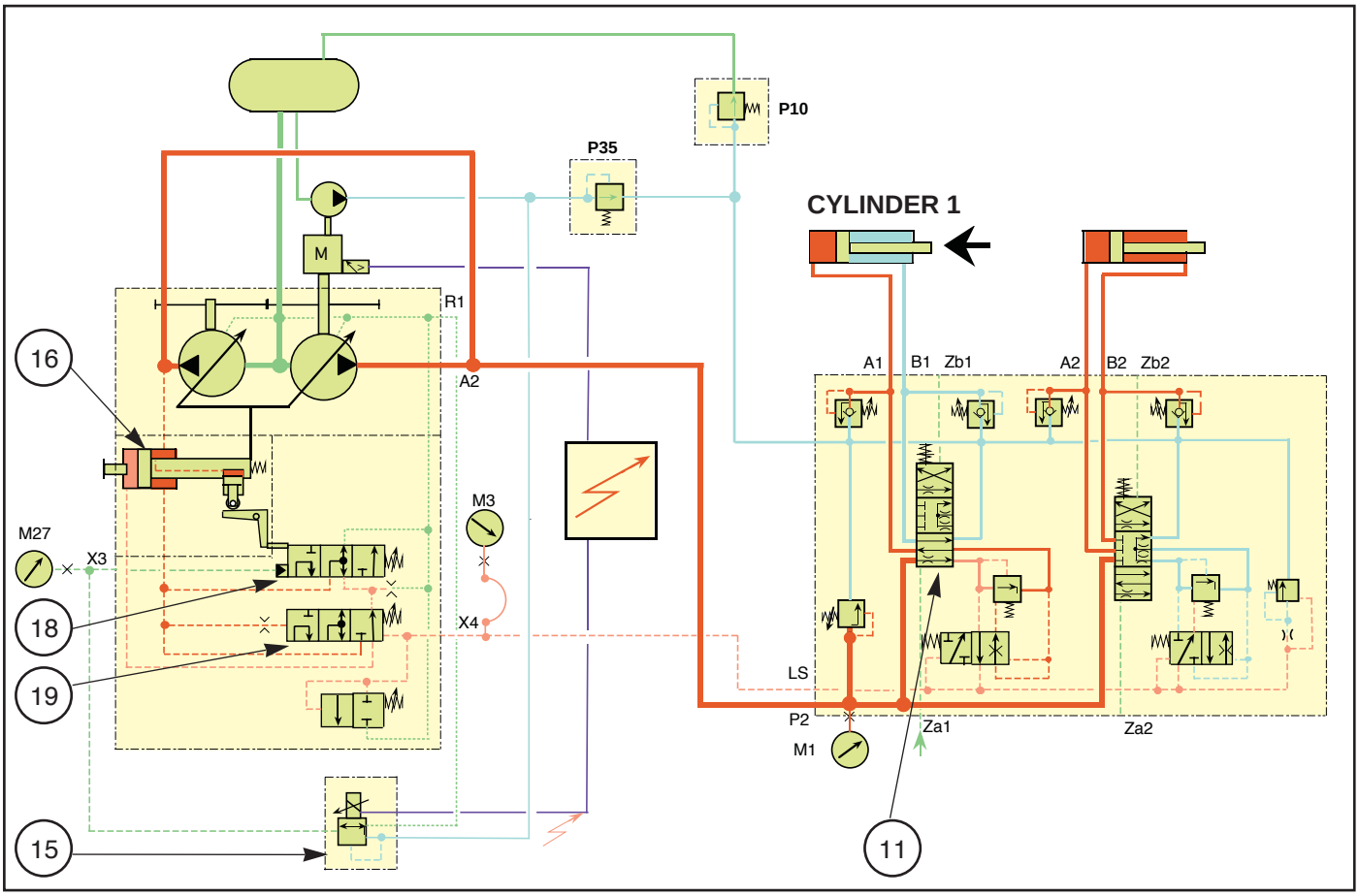
NOTA

- The arm of torque regulation lever **17** compensates the electro-hydraulic response time.

LOAD-SENSING, TORQUE REGULATOR, FLOW CANCELLING AND INDEPENDENCE OF MOVEMENTS SYSTEMS

SPEED SENSING SYSTEM (TORQUE REGULATION)

PHASE 7



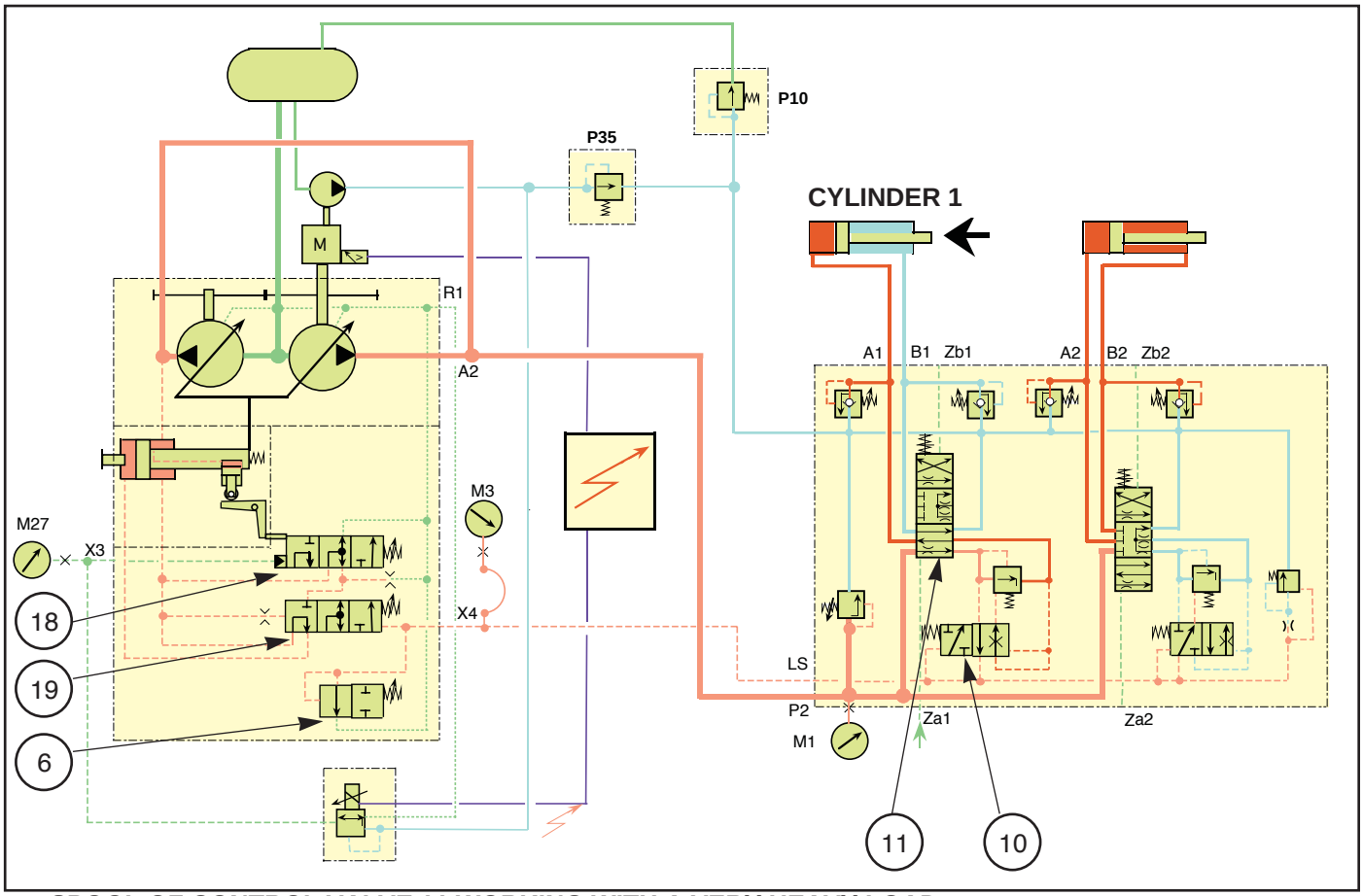
SPOOL OF CONTROL VALVE 11 WORKING WITH A HEAVY LOAD (all the hydraulic power is being consumed)

- Since the flow has decreased, for the same opening of the spool of control valve **11**, the pressure drop is less than **20** to **22** bar.
- As a result the L-S valve comes back to the rest position.
- Now the engine speed is at the authorised level.
- The voltage at the proportional valve **15** decreases, also the pressure delivered by that valve.
- When the hydraulic and mechanical forces on the torque regulation valve 18 are equal, the valve is in a state of balance.
- This enables part of the large chamber of servo-control **16** to be sent to the tank so as to have a pressure in that chamber which is in relation to the section of the chambers.
- In this case, the hydraulic and mechanical forces in servo-control are equal.
- In this situation, the pumps deliver a flow in relation to the pressure in the large chamber of cylinder

LOAD-SENSING, TORQUE REGULATOR, FLOW CANCELLING AND INDEPENDENCE OF MOVEMENTS SYSTEMS

FLOW CUT-OFF AND PRESSURE MAINTENANCE SYSTEM

PHASE 8



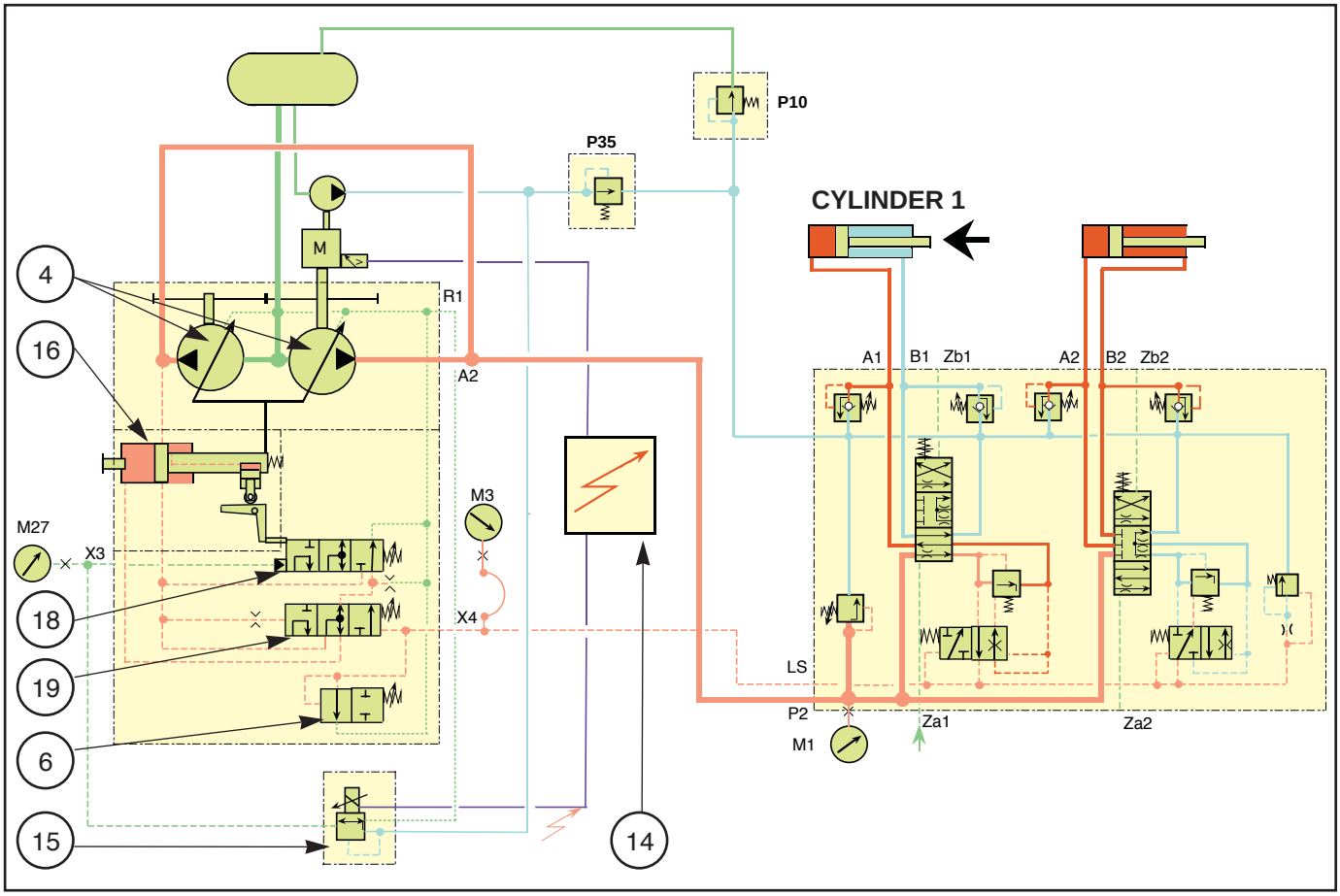
SPOOL OF CONTROL VALVE 11 WORKING WITH A VERY HEAVY LOAD

- If now the resistance met by cylinder **1** gives a presure equal to the pressure setting of the flow cut-off valve, that valve will open.
- Since the pressure cannot increase any more, the load becomes static.
- All the flow that we are requiring from the pumps has a tendency to pass through the pressure selector **10** and the flow cut-off valve **6.**
- The flow through the pressure selector **10** produces a pressure drop greater thanh **20** to **22** bar, which means that the L-S valve is piloted.
- This puts the two chambers of the servo-control **16** at the same pressure.
- The flow starts to be cancelled

LOAD-SENSING, TORQUE REGULATOR, FLOW CANCELLING AND INDEPENDENCE OF MOVEMENTS SYSTEMS

FLOW CUT-OFF AND PRESSURE MAINTENANCE SYSTEM

PHASE 9

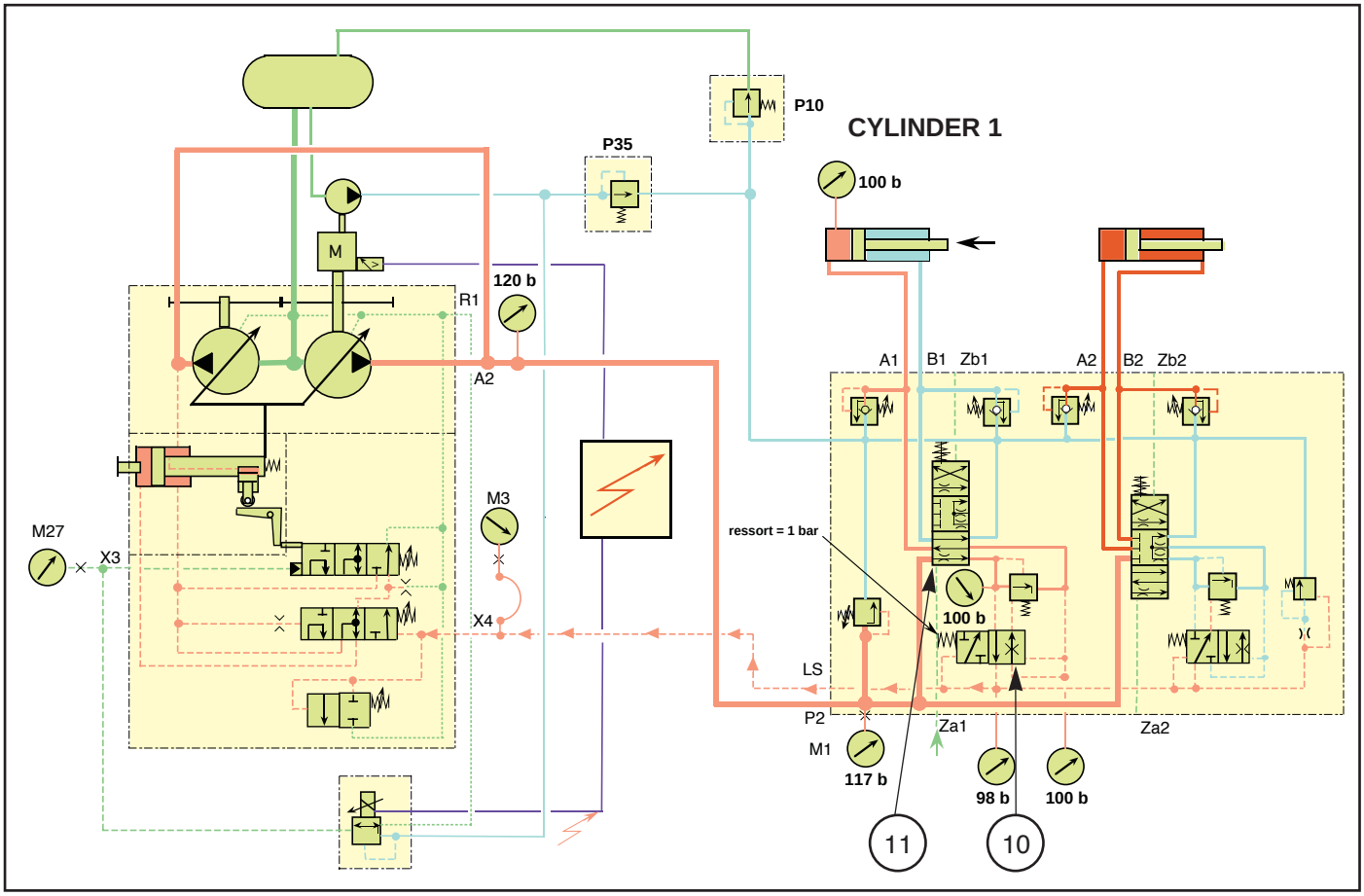


SPOOL OF CONTROL VALVE 11 WORKING WITH A VERY HEAVY LOAD

- The hydraulic power being consumed is low, because the flow supplied by the pumps **4** is equal to the working leaks plus the leak through the flow cut-off valve **6,** which keep the pressure at the authorised maximum level.
- The engine speed increases
- The electronic sensor **3** informs the electronic control housing **14** which transmits a lower voltage to the electro-hydraulic proportional valve **15** so that that valve delivers a lower pilot pressure.
- At that moment, the force of the torque regulation spring **18** is greater and the valve comes back to the rest position.
- If the flow cuts off too much, the pressure falls, unbalancing L-S valve **19,** which puts itself back into balance so as to get equal forces in the servo-control **16** so as to get a constant flow

LOAD-SENSING, TORQUE REGULATOR, FLOW CANCELLING AND INDEPENDENCE OF MOVEMENTS SYSTEMS

WORKING PRINCIPLES OF INDEPENDANCE OF MOVEMENTS
PHASE 10



Technical details for understanding the independence of movements

- Pressure difference between the pumps outlet and the spool of control valve **11** = 3 bar
- Pressure difference between inlet and outlet of spool **11** = 17 bar
- Pressure difference between inlet and outlet of pressure selector **10** = 2 bar
- Equivalence between the mechanical force of the pressure selector spring **10** and the hydraulic pressure = 1 bar

- We have seen that when the pressure drop in the system is equal to 22 bar, the L-S valve is in balance and we have a constant flow delivered by the variable displacement pump bodies.
- With the pressure values shown on the diagram above, we see that pressure selector **10** remains piloted because

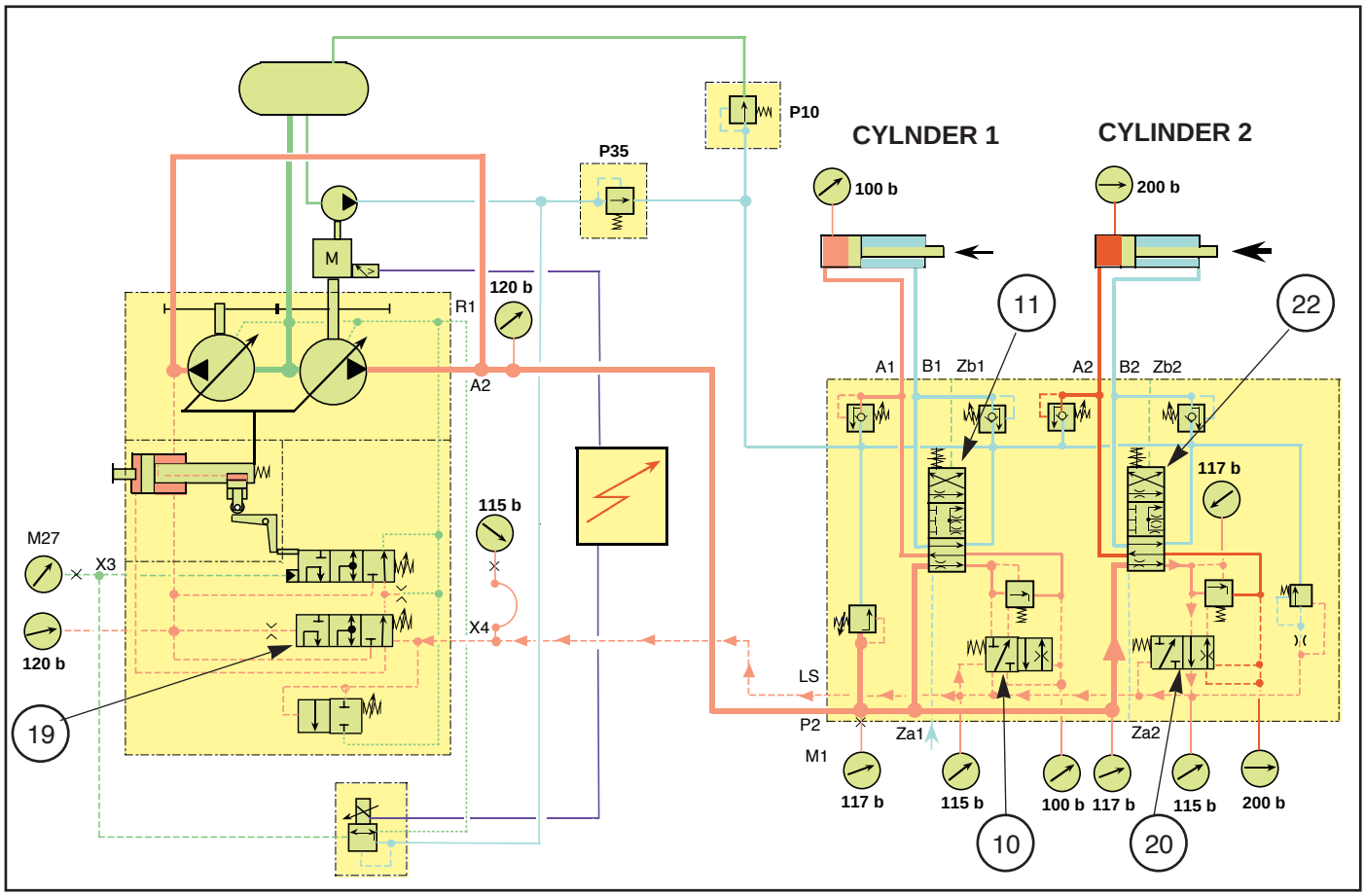
Pressure at end without spring = 100 bar
Pressure at end with spring = **98** bar + the force of the spring equal to **1** bar = 99 bar

- As a result, the pressure information after the progressivity grooves of the control valve spool is sent by the pressure selector **10** to the L-S valve

LOAD-SENSING, TORQUE REGULATOR, FLOW CANCELLING AND INDEPENDENCE OF MOVEMENTS SYSTEMS

WORKING PRINCIPLES OF INDEPENDANCE OF MOVEMENTS

PHASE 11



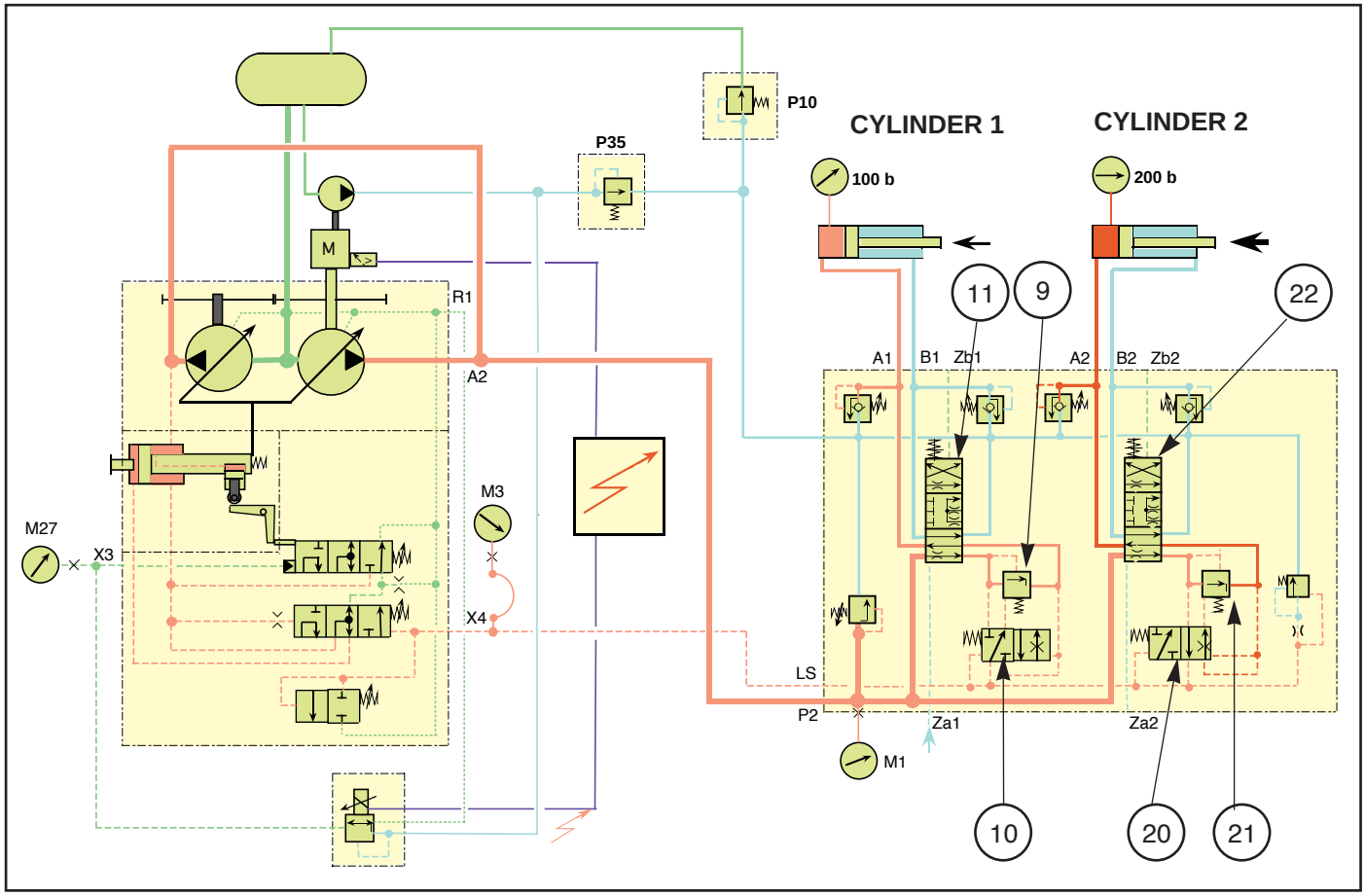
SPOOLS OF CONTROL VALVES 11 AND 22 AT WORK, WITH 22 LOADED MORE HEAVILY

- We consider that the flow requirement is lower than that which the variable displacement pumps can supply
- In this case, each component receives the flow that the operator requires.
- When the spool of control valve **22** is moved, the pressure in the large chamber of cylinder **2** pilots the pressure selector **20,** at the end without spring.
- With the pressure values indicated on the above diagram, we see that the pressure at the outlet of the variable flow pumps goes via spool **22** and selector **20** into pressure selector **10** at the spring end.
- This selector comes back to the rest position, because at the spring end we have **115** bar and at the other end **100** bar.
- At the L-S valve **19:**
  at the end without spring we have a pressure of **120** bar and the other end **115** bar + the **force of the spring**.
- The L-S valve comes back to rest position and requires the variable flow pumps to increase their flow

LOAD-SENSING, TORQUE REGULATOR, FLOW CANCELLING AND INDEPENDENCE OF MOVEMENTS SYSTEMS

WORKING PRINCIPLES OF INDEPENDANCE OF MOVEMENTS

PHASE 12



SPOOLS OF CONTROL VALVES 11 AND 22 AT WORK, WITH 22 LOADED MORE HEAVILY

- Pressure selector **10** is at rest position.
- The L-S pressure from the cylinder **2** partially closes, via this selector, the pressure compensator.
- this enables us to avoid all the flow from the pumps going to cylinder **1,** which is loaded less heavily.
- When pressure compensator **9** is closed the feed circuit can increase in pressure and as a result open pressure compensator **21** to feed cylinder **2,** which is loaded more heavily.
- The pressure difference is consumed by the compensator **9.**
- Now if the flow requirement is higher than that which can be supplied by the pumps, with this system, in spite of the various resistances encountered, each component will receive a flow which will be proportional to the demand

12/1488 PILOT SYSTEM

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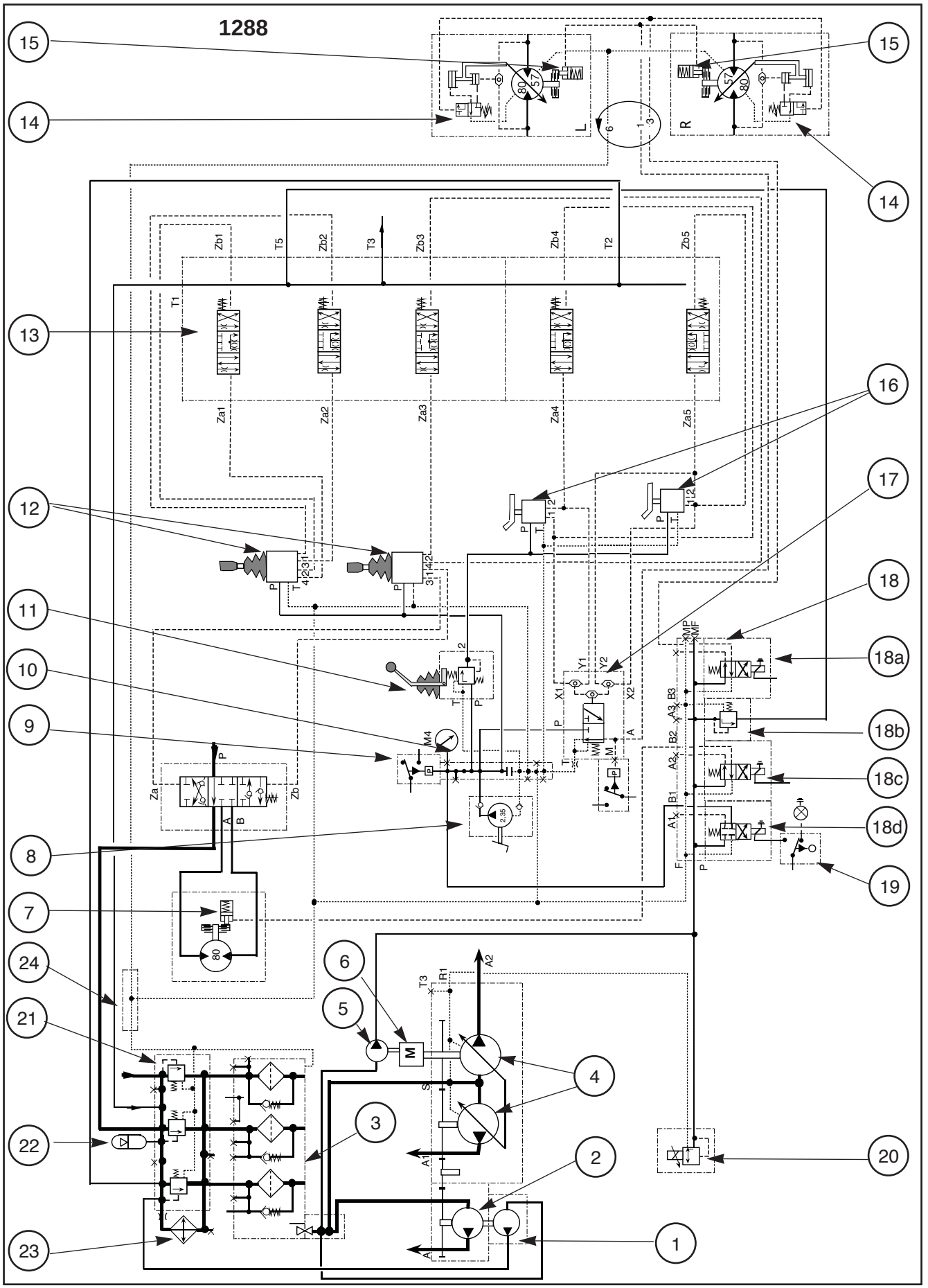


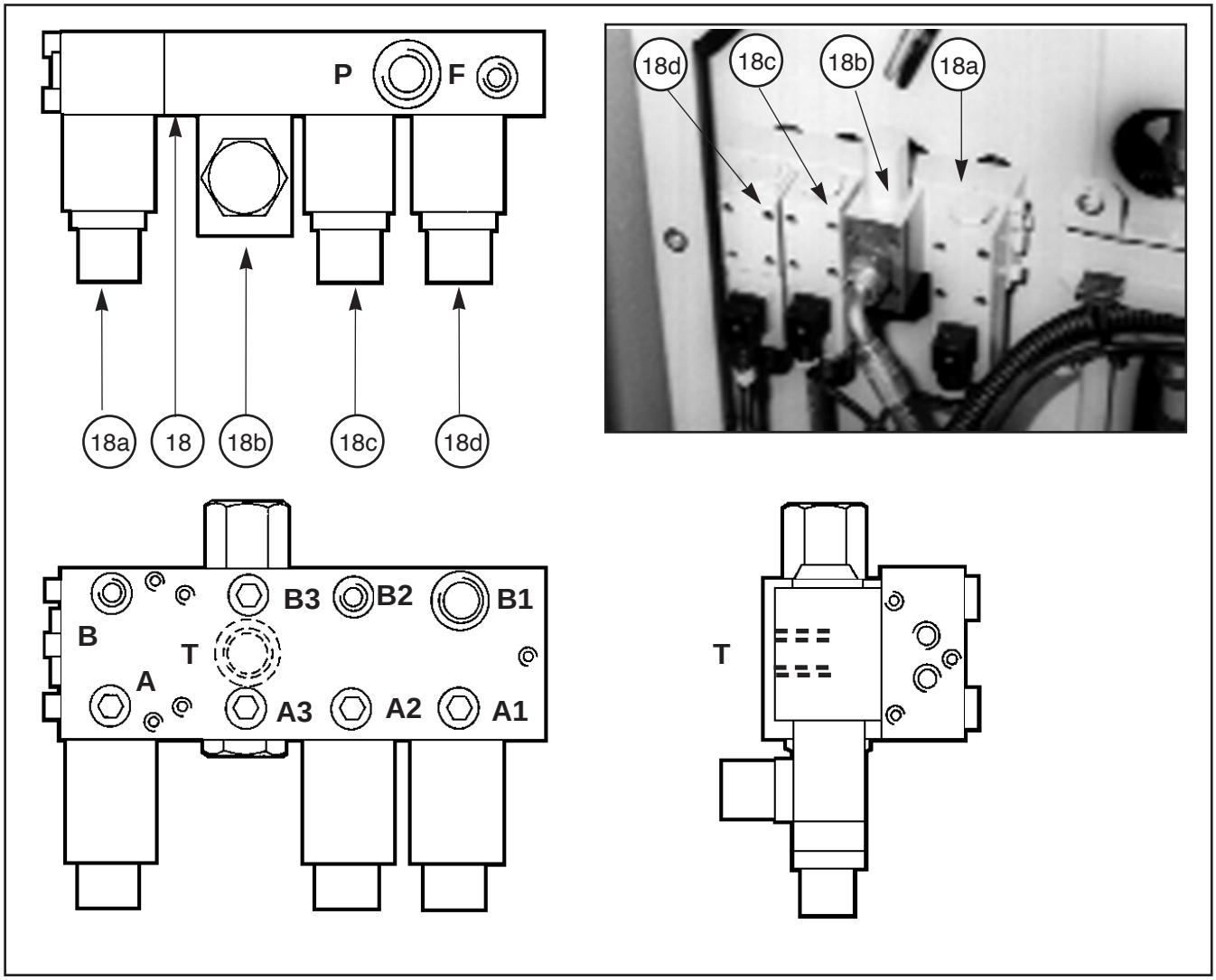
12/1488 PILOT SYSTEM

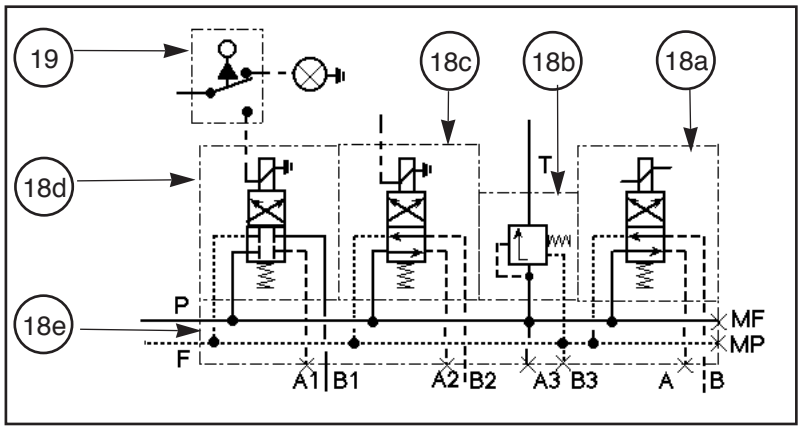
Description of hydraulic pilot schematic

1 - Force-feed (anti-cavitation) pump (for the **1488** acomplementary forced-feed pump attached before the asservissement pump feeds by the **T4** orifice the attachmenst/travel control valve)
2 - Swing pump
3 - Hydraulic tank
4 - Variable displacement pumps
5 - Pilot pump
6 - Engine
7 - Swing brake
8 - Emergency pump
9 - Mini pilot pressure switch
10 - Feed and return manifold
11 - Manual travel control block
12 - Control valves
13 - Travel / attachments control valve
14 - Two-speed excavator travel motor displacement change selector
15 - Hydraulic travel motor brake
16 - Control pedals
17 - Hydraulic travel motors automatic brake release valve
18 - Electrovalve block, comprised of:
18 a - Two-speed excavator hydraulic travel motors displacement change electrovalve (optional)
18 b - Pressure limiter (35 bar)
18 c - Swing brake release electrovalve
18 d - Sliding safety lever cut-out electrovalve
19 - Sliding safety lever safety switch
20 - Proportional valve
21 - Counter pressure valves **3P10** (10bar)
22 - Accumulatorr
23 - Cooler
24 - Leak return manifold

12/1488 PILOT SYSTEM

ELECTROVALVE BLOCK





12/1488 PILOT SYSTEM

ELECTROVALVE BLOCK

It is located on the control valves partition, walkway side, near the hydraulic tank

Description

It consists of :

18 - Base
18a - Hydraulic travel motor displacement change electro-control valve (Standard on 1488, optional on 1288)
18b - Pressure limiter(P35)
18c - Swing breake electrovalve
18d - Arm rest electrovalve

Functions of the various components : (to be read with the pilot circuit schematic on the preceding page)
Electrovalve 18a, (**1288 two-speed option, standard on 1488**) :

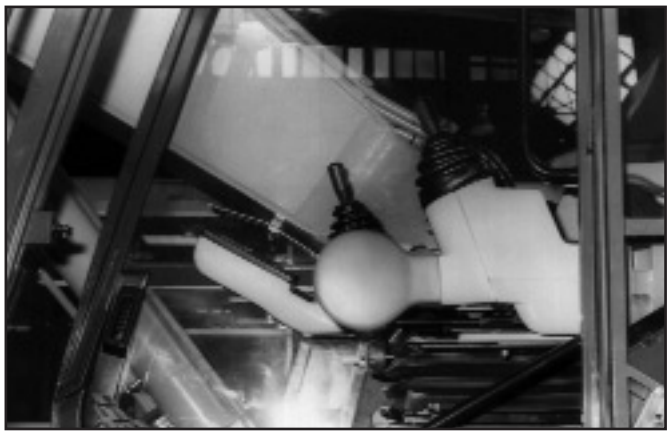
- When it is at rest, the hydraulic travel motors displacement change selectors **14** are returned to the tank. The excavator is in low speed.
- When it is energized by the electronic control housing (See chapter **1** : Introduction), it allows the displacement change selectors to be piloted. The excavator is in high speed.

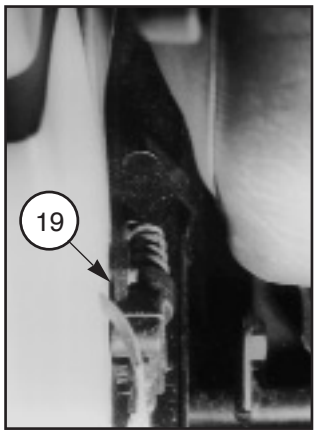
Pressure limiter 18b :

- It limits the pressure in all the pilot circuits to **35** bar. The return from the pressure limiter goes into the force-feed circuit via orifice **T5** of the attachments / travel control valve block.

Electrovalve 18d :

- When the left arm-rest is pulled back, pressure switch **19** energizes this electrovalve. The armrest safety warning light on the instrument panel goes out. Feed passes to manifold **10**. If the pressure is correct pressure switch **9** is closed. The minimum pressure pilot warning light on the instrument panel goes out. Feed passes to the travel brake release selector **17**, control levers **12** and manual travel control block **11**. As soon as this control block lever is tilted, feed passes to the control pedals **16**.
- When the left arm-rest is pushed forward, pressure switch **19** de-energises this electrovalve and the armrest safety warning light on the instrument panel comes on. Manifold **10** is no longer fed. No movement can occur in the receiving components. This makes for safety when the operator gets in or out of the cab.





Electrovalve 18 c :

- When this is at rest, it returns brake chamber **7** to the hydraulic tank. The upper structure is braked.
- When it is energized by the electronic control housing (See chapter **8J** : Swing function), it allows theupper structure brake to be released by the pilot pressure.

Identification of orifices:

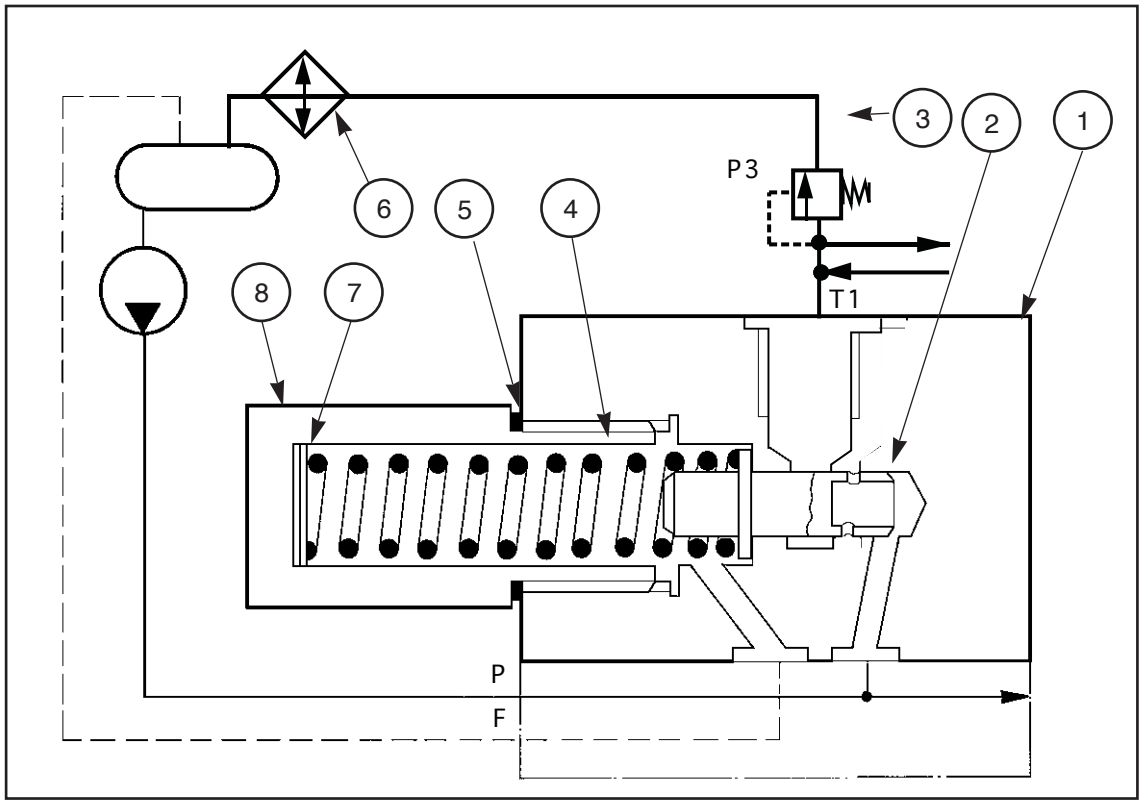
P - Arrival from pilot pump
F - Return to tank
T - **35** bar limiter return to **T5**
B1 - Outlet feed to manifold
B2 - Outlet feed to swing
B3 - Outlet feed to displacement changeselectors (travel motors)

12/1488 PILOT SYSTEM

35 bar pressure limiter

it is attached to the electrovalve base

Function :



It limits the pressure in the pilot circuits

Description :

1 - Body
2 - Spool
3 - Travel / attachments control valve
4 - Pre-stressed spring
5 - Seal
6 - P10 pressure limiter
7 - Adjustment shims
8 - Cap

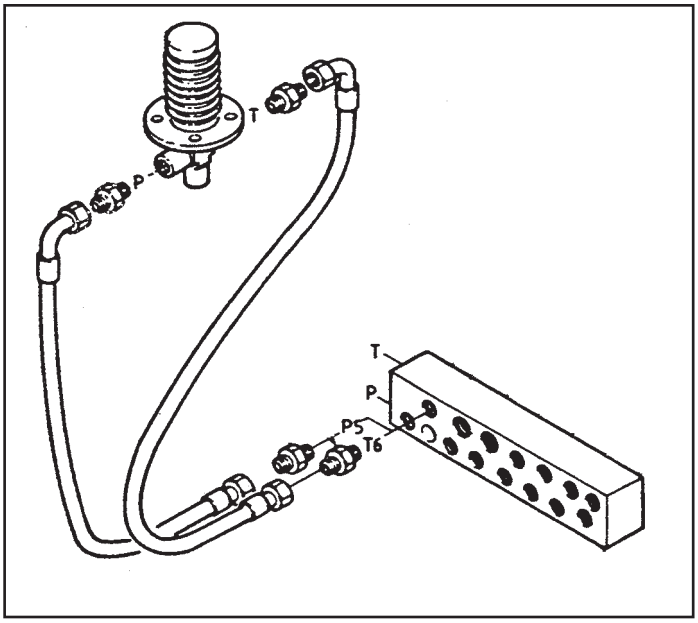
Identification of orifices :

P - Inlet from gear pump into the electrovalve base
F - Working leaks return to tank
T - Return to attachments / travel control valve

Working principles :

Oil coming from the gear pump arrives at **P** on the base and enters the pressure limiter.
When the hydraulic force exerted on the front of piston **2** is greater than the force of spring **3**, then piston **2** moves back, allowing oil to pass into **T**.
The pressure setting can be changed by using shims **7** behind the spring.

12/1488 PILOT SYSTEM



EMERGENCY PUMP

It is located on the floor of the cab

Functions :

- It enables the use of the control blocks: control levers , manual travel control block and control pedals
  in case of a failure of the engine or in the feed circuit.
- It enables the hydraulic circuits to be decompressed when doing service operations requiring the disassembly of piping or components.

Working method:

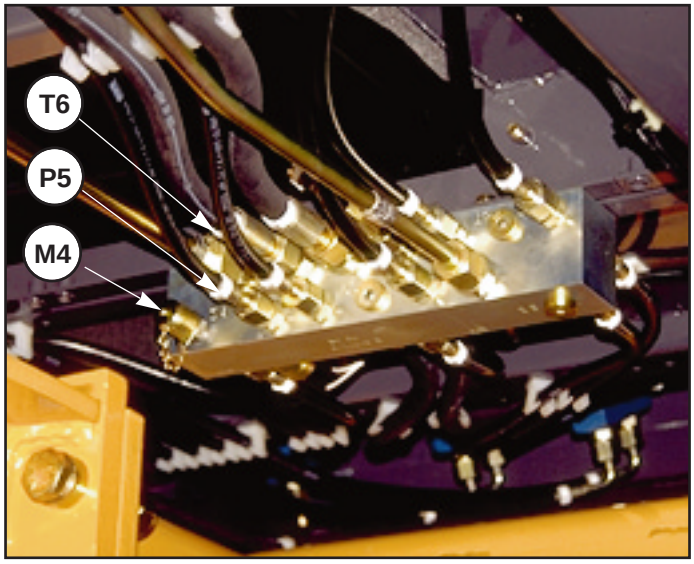
Just work the pump with one's foot while maintaining the control concerned in the desired position
The pump takes oil from the return circuit via orifice **T6** and pumps it out, through orifice **P5**, into the feed circuits of the various control block.
It has two one-way valves, one for the suction, the other for the outlet

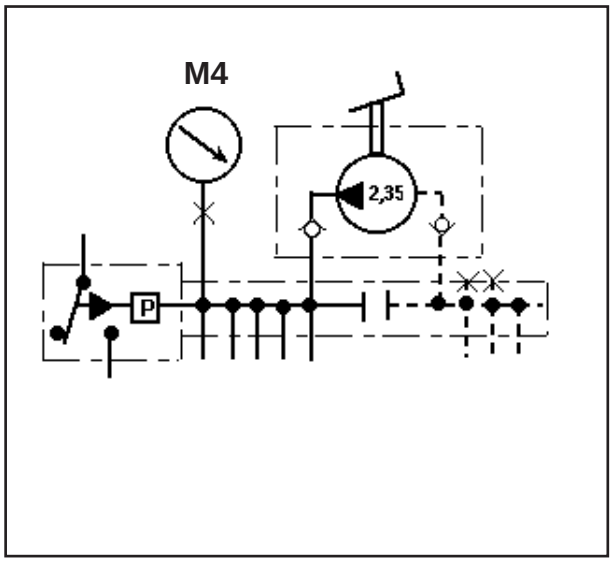
MANIFOLD

It is bolted under the floor of the cab

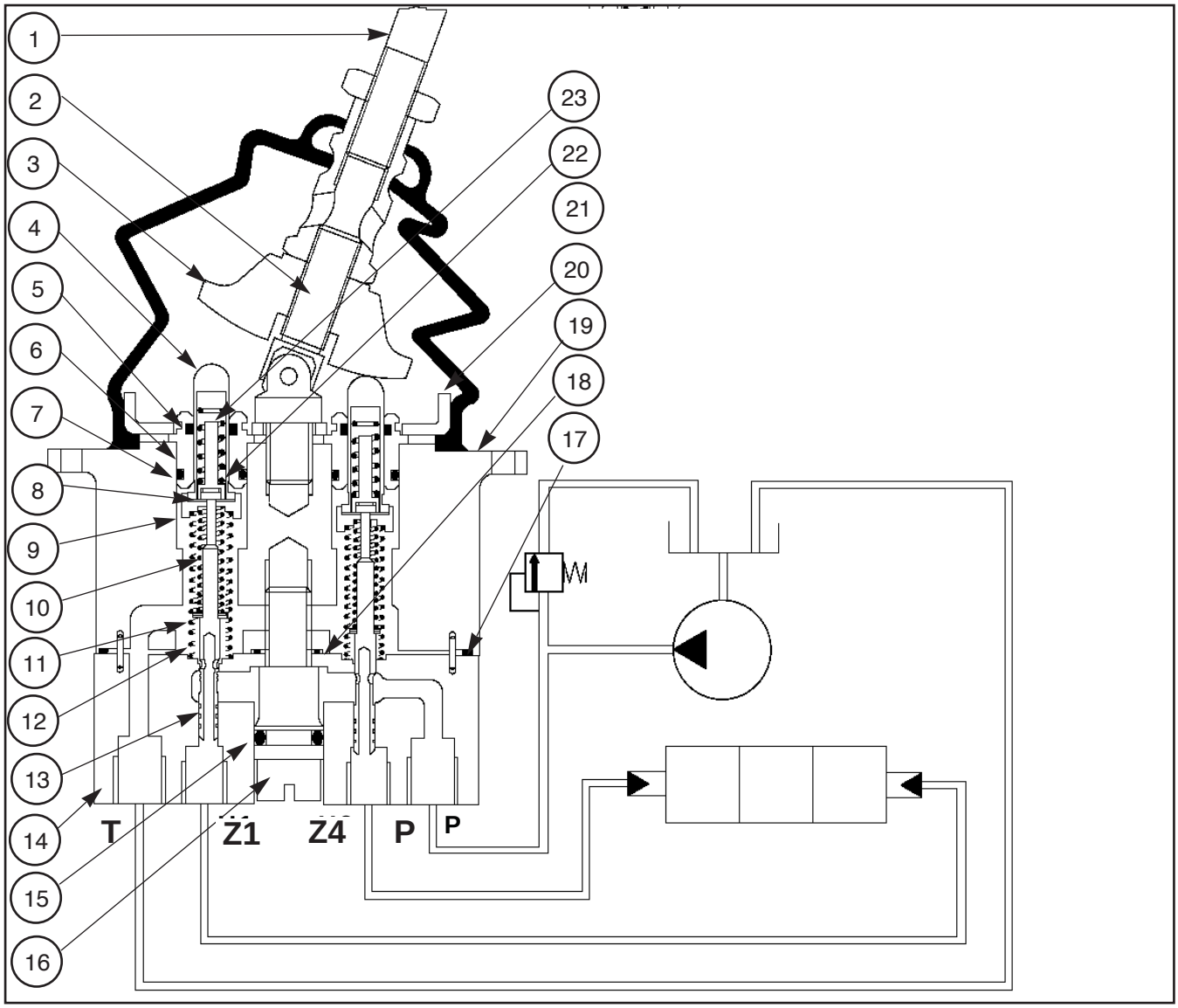
Function :

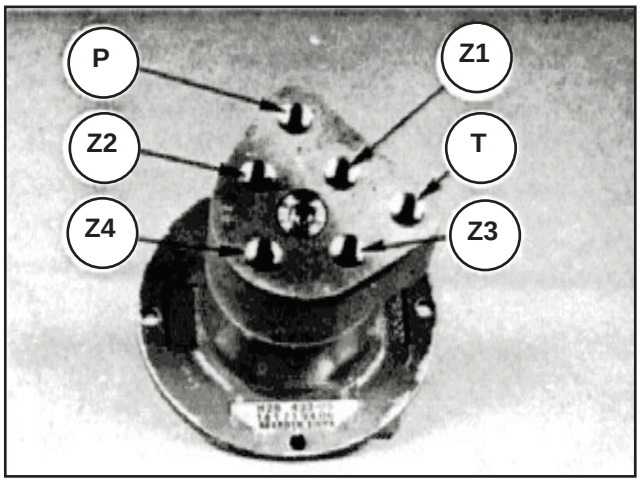
It is a drilled block which can group the feed circuits and the return circuits from the various feed blocks.
Pressure check point **M4** and the minimum pilot pressure captor are located on this manifold.





12/1488 PILOT SYSTEM





12/1488 PILOT SYSTEM

THE CONTROL LEVERS

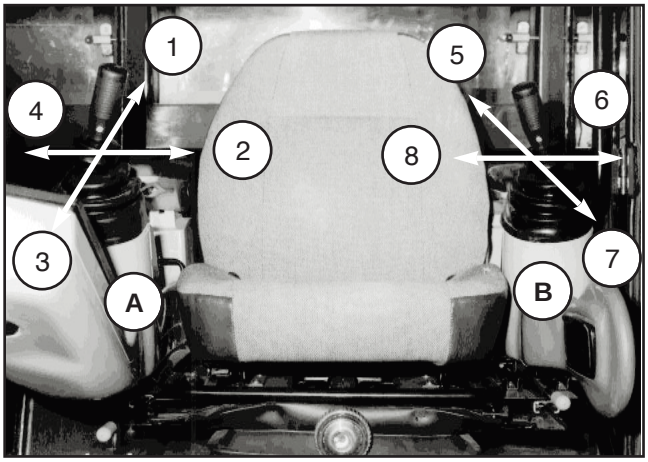
They are located in the seat arm-rests

Function :

They enable the various control valve elements to be remote-controlled, using hydraulic assistance.
For the attachments, each control lever can control four different movements, two of which can be controlled at the same time if necessary.They pilot the following functions:

Right control lever A

1 - Raise boom
2 - Close bucket
3 - Lower boom
4 - Open bucket



Left control lever B

5 - Retract dipper
6 - Left swing
7 - Extend dipper
8- Right swing

Description

1	-	Control lever	**9**	-	Collar	**17**	-	Seal
2	-	Universal joint	**10**	-	Pre-stressed spring	**18**	-	Seal
3	-	Cam	**11**	-	Shim	**19**	-	Lower body
4	-	Push-rod	**12**	-	Return spring	**20**	-	Retaining plate
5	-	Seal	**13**	-	Spool	**21**	-	Bellows
6	-	Spring guide	**14**	-	Lower body	**22**	-	Collar
7	-	Seal	**15**	-	Seal	**23**	-	Stop
8	-	Half-collars	**16**	-	Screw	**24**	-	Pre-stressed spring

Identification of orifices

P - Feed from manifold
T - Return to manifold

Left-hand control lever

Z1 - Upper structure swing
Z2 - Retract dipper
Z3 - Upper structure swing
Z4 - Extend dipper

Right-hand control lever

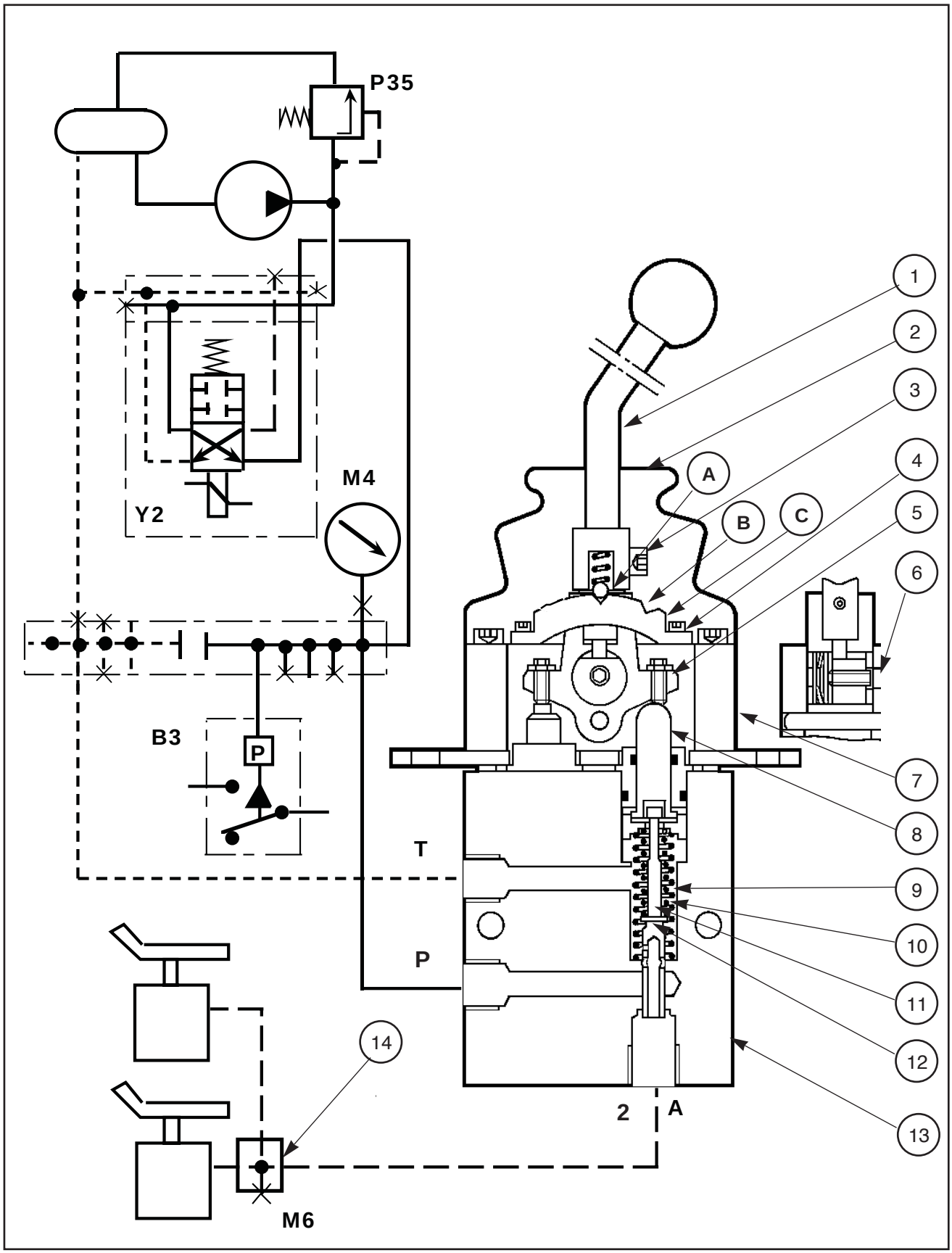
Z1 - Close bucket
Z2 - Lower boom
Z3 - Open bucket
Z4 - Raise boom

Working principles :

From the **35** bar feed circuit (**P**), the control lever delivers a pilot pressure proportional to the tilting of the lever. It is a pressure reducer.
This pressure acts on the spool of the control valve which one wants to actuate. The spool moves in ccordance with the pressure which it receives.If a function is actuated in one direction, the control circuit of the opposite direction must be directed to the leak return so as to allow the free movement of the control valve spool.
This is also done by the control valves, via orifice **T**.
On the drawing opposite : The **35** bar feed circuit pressure arrives at P and we feed one side of the chosen function at **Z4** under a pressure which is in relation to the tilt we apply to lever 1.
The other side of the function comes back to **Z1** to return to the tank, passing through spool **13**.

12/1488 PILOT SYSTEM

Manual travel control block (INCHING)



12/1488 PILOT SYSTEM

Manual travel control block

It is located on the right-hand side of the operator's seat.

Function :

Depending on the amount its lever is moved, it enables the control pedals to be fed with a reduced pressure so as to obtain a lower travel speed even with the travel pedals completely pressed down.

Examples:

- Slow travel movement
- Getting off or onto transport trailers

Description :

1 - Lever
2 - Bellows
3 - Indexing block
4 - Notched cam
5 - Cam
6 - Lever stiffness adjustment screw
7 - Upper body
8 - Pushrod
9 - Return spring
10 - Regulator spring
11 - Spool
12 - Shims

Identification of orifices :

P - Pilot circuit pressure inlet (35 bar) after sliding safety lever electrovalve
T - Return to the tank
2 - Outlet to the entry port for the two foot pedals

Working method :

When at rest, control lever **1** is held in position by indexing system **3**. Return spring **9** holds pushrod **8** and spool **11** in the rest (neutral) position. There is no communication from **P** to **2**, but from **2** to **T**.

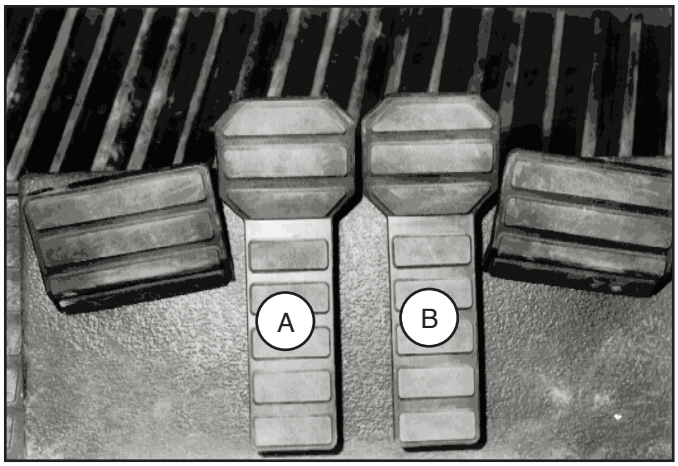
When the lever is tilted, through the action of cam **5** it moves pushrod **8** and spool **11** as an assembly, compressing spring **9**.

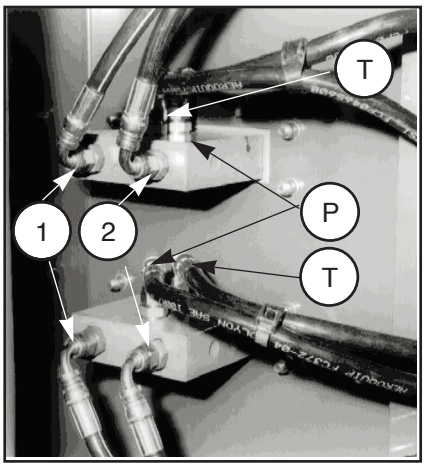
This allows **P** to communicate with **2** via the drilling in spool **11** and to create a pressure at the entry port of the pedal controls.

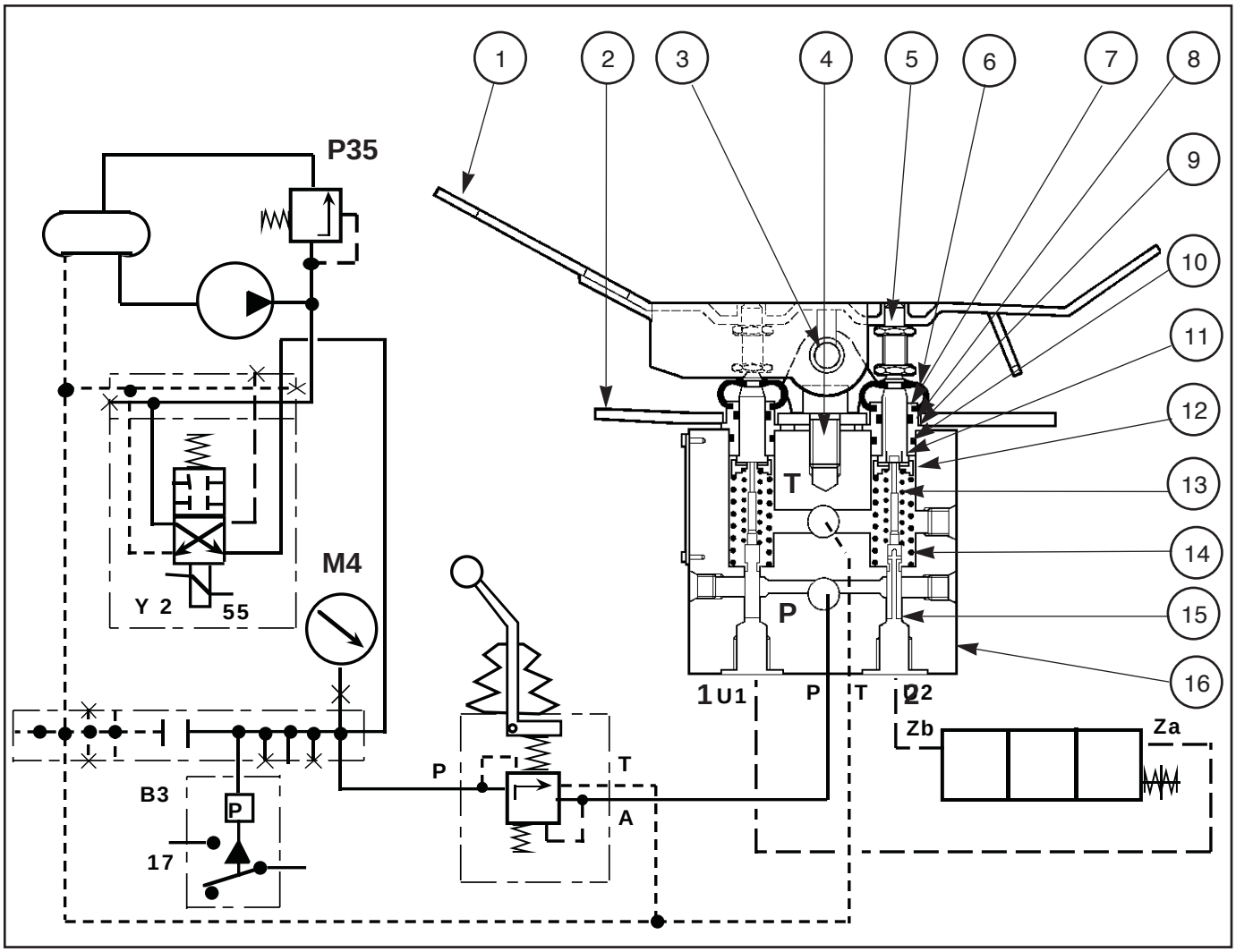
This pressure will be proportional to the tilting of the lever.

12/1488 PILOT SYSTEM

The pedal controls







12/1488 PILOT SYSTEM

The pedal controls

They are located on the floor of the cab

Function :

They enable the travel control valves to be controlled using power-assistance. Two more pedal controls can be placed on either side of the travel control pedals to control optional attachments. (See chapter 8 K)
On this page we will study the working principles of the travel pedal controls which include the special manual control block in their feed circuit.
Option control pedals are fed directly from the manifold (the same as for hand control levers).

The left-hand control pedal **A** controls the left-hand travel control valve element
The right-hand control pedal **B** controls the right-hand travel control valve element
To identify the right-hand or left-hand hydraulic motors, the travel motors must be behind the cab.

Pressing on the front of the pedals feeds the forward drive and on the back feeds the reverse drive.

Description :

1 - Control pedal
2 - Retention plate
3 - Pivot
4 - Screw
5 - Adjusting screw
6 - Protector
7 - Pushrod
8 - Seal
9 - Pushrod guide
10 - Seal
11 - Half-collar
12 - Collar
13 - Pre-stressed spring
14 - Return spring
15 - Piston
16 - Body

Identification of orifices :

P - Arrival of pressure coming from manual travel control block
T - Return to tank, passing via the manifold
1 - Forward drive travel pilot
2 - Reverse drive travel pilot

Working principle :

The control pedals are fed, passing via the manual travel control block, in parallel with the attachments and travel hand control levers.

- Neutral position :

When the pedal is in the neutral position, oil from the pilot circuit arriving at **P** is blocked by spools **15**.
The control valve spool pilot circuits **1** and **2** communicate with the tank via the central spool passages **15**.

- **Feed position** (forward or reverse, depending on the desired direction).
One of the spools **15** is pushed down, which puts passage **P** in communication with one or other of the receiving circuits **1** or **2**, via the central passage of spool **15**.
Coming from circuit **P** (under maximum **35** bar pressure), spool **15** delivers a pilot pressure which is proportional to the amount the pedal has been moved (it is a pressure reducer).
This pressure acts on the spool of the control valve concerned. That spool moves more or less depending on the pressure it receives.
For the spool to be able to move, the opposite pilot circuit must be directed to the leak return.
This is done via the other spool **15**, which has stayed in the neutral position.

When the pedal is moved to its maximum position, a maximum pressure of **24** to **26** bar is in the control valve spool pilot circuit.
In fact, at this pressure, the pilot circuit pressure acts on the lower section of the spool.
This force compresses spring **13** and as a result the communication with circuit **P** is cut off, and the pilot circuit pressure is kept between **24** and **26** bar.

12/1488 PILOT SYSTEM

12/1488 ATTACHEMENT OPTIONS

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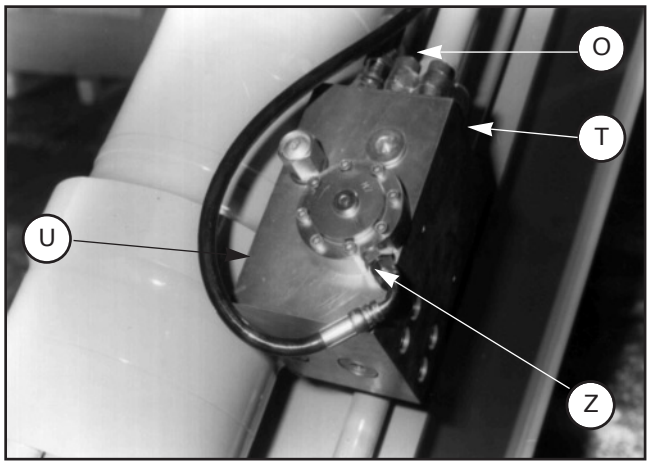
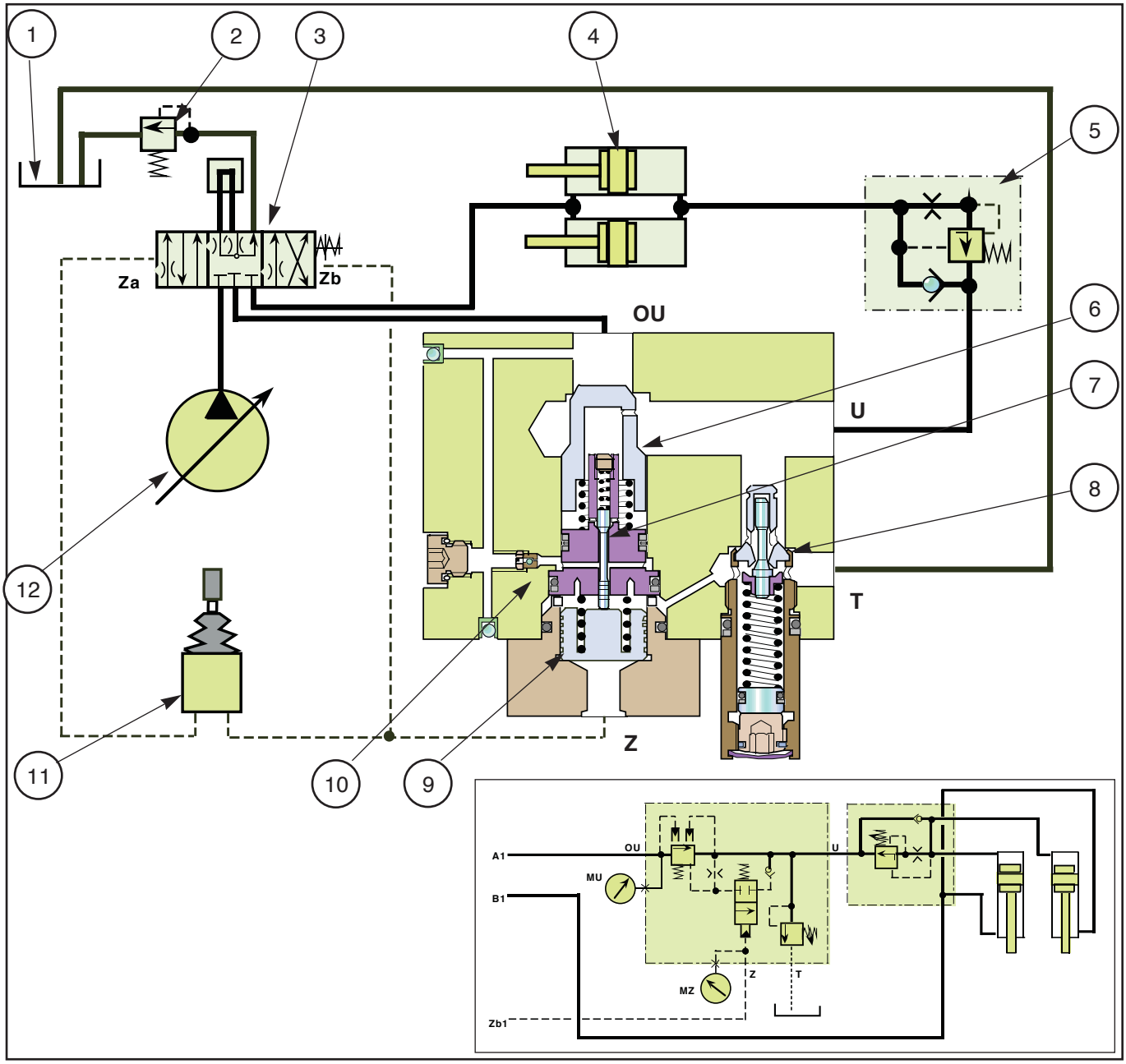
12/1488 ATTACHEMENT OPTIONS

LOAD-HOLDING VALVES (on boom and dipper cylinders)





12/1488 ATTACHEMENT OPTIONS

LOAD-HOLDING VALVES (on boom and dipper cylinders)

PURPOSE
To avoid functional leaks at the control valve spools when they are at rest, so that loads remain stable.

LOCATION ON MACHINE:

BOOM:
Attached by flange to the cylinder feed block.

DIPPER:
Attached by flange to the cylinder tube small chamber feed side.

DESCRIPTION:

1	-	Hydraulic tank	**7**	-	Spindle check valve
2	-	Counter-pressure valve (P10)	**8**	-	Safety valve (400 bar)
3	-	Control valve section	**9**	-	Pushrod
4	-	Boom cylinders	**10**	-	Non-return valve
5	-	Flow limiter	**11**	-	Hand control lever
6	-	Piloted check valve	**12**	-	Variable flow pump body

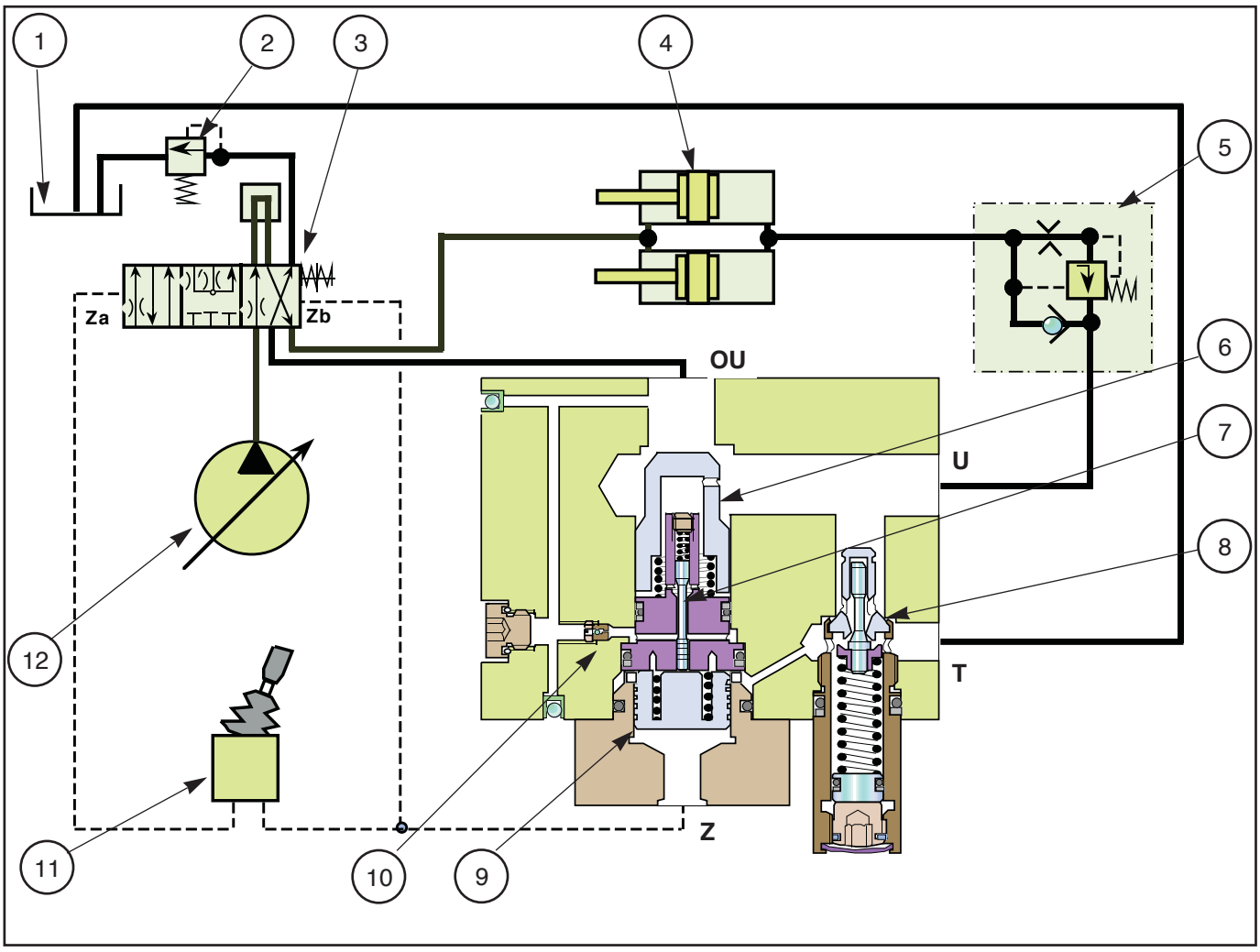
IDENTIFICATION OF PORTS IN THE BLOCK:

OU	:	Feed to cylinder from control valve
U	:	Cylinder feed (Boom cylinder big chamber, dipper cylinder small chamber)
Z	:	Pilot pressure from control valve for control of piloted check valve. (Pilot circuit pressure for the function opposite to the one where the load-holding block is installed).
T	:	Return to hydraulic tank. (Safety valve opens).

OPERATING PRINCIPLE:
PHASE 1. CONTROL VALVE SPOOL AT REST POSITION:
Hand control lever **11** and control valve spool **3** are at rest position. Feed and return lines to cylinders are blocked. Piloted check valve **6** is held against its seat by the action of its spring. The pressure created by the load on the cylinders passes through the calibrated orifice in piloted check valve **6** and arrives behind it to give a stronger contact between the valve and its seat. The load cannot descend because the cylinder big chambers are isolated from spool **3**. The maximum pressure in the cylinder big chambers **4** is controlled by the safety valve **8**.

ATTACHMENT OPTIONS

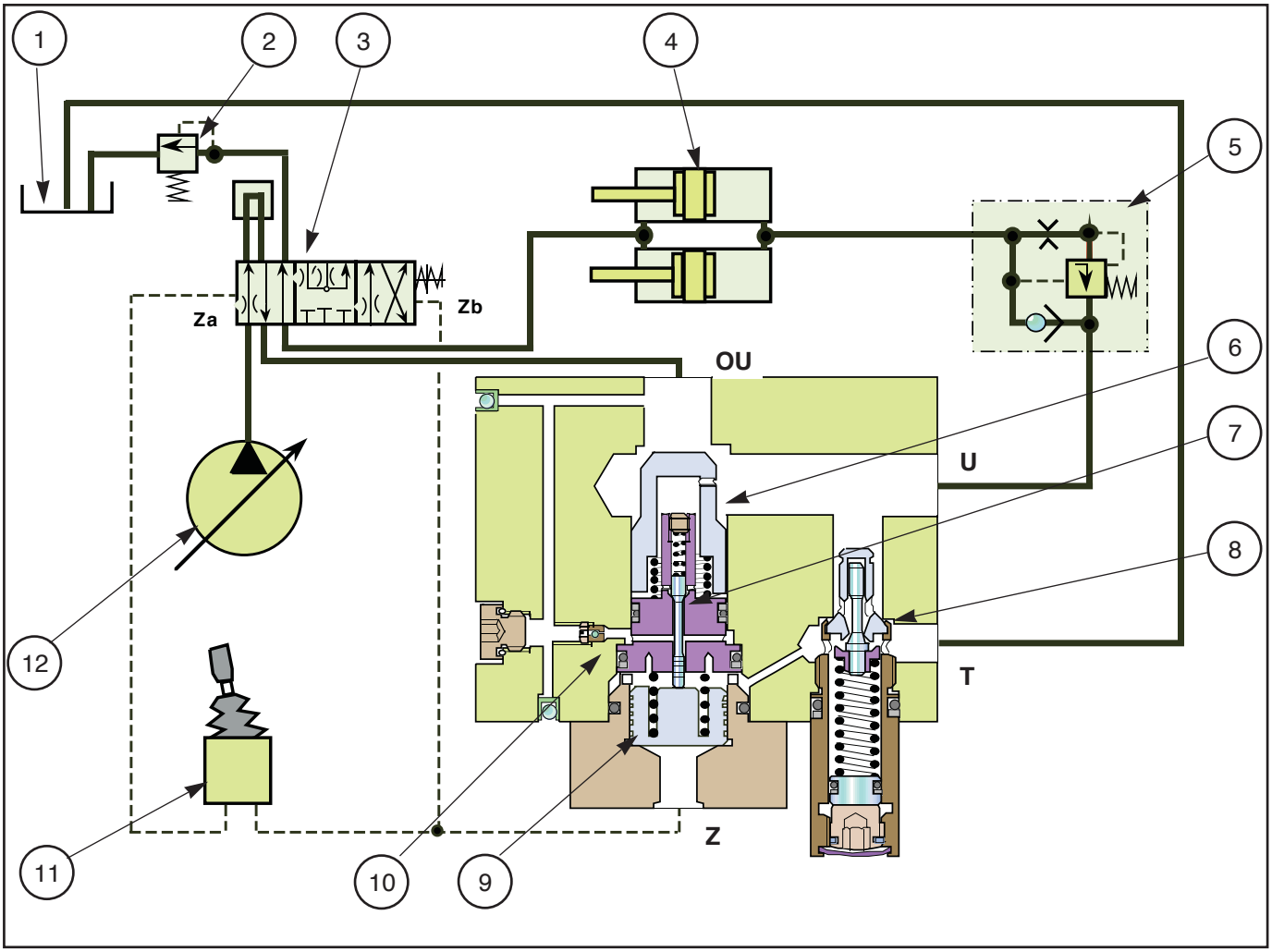
LOAD-HOLDING VALVES (on boom and dipper cylinders)
OPERATING PRINCIPLE (continued)



PHASE 2.
BOOM LOWERING:
If hand control lever **11** is moved in the lowering direction, the control valve pilot pressure also acts on pushrod **9**, which moves and lifts spindle check valve **7** from its seat. The rear chamber of piloted check valve **6** is connected to the return via non-return valve **10**.
Spool **3** is now piloted. Oil moves through the “crossed arrows” passages**.** Oil from pump body **12** passes via spool **3** and feeds the cylinder small chambers **4**.
The return from the big chambers passes through flow limiter **5**, piloted check valve **6** which opens (due to the pressure acting on its annular section), spool **3**, counter-pressure valve **2** and hydraulic tank **1**.

12/1488 ATTACHEMENT OPTIONS

LOAD-HOLDING VALVES (on boom and dipper cylinders)
OPERATING PRINCIPLE (continued)

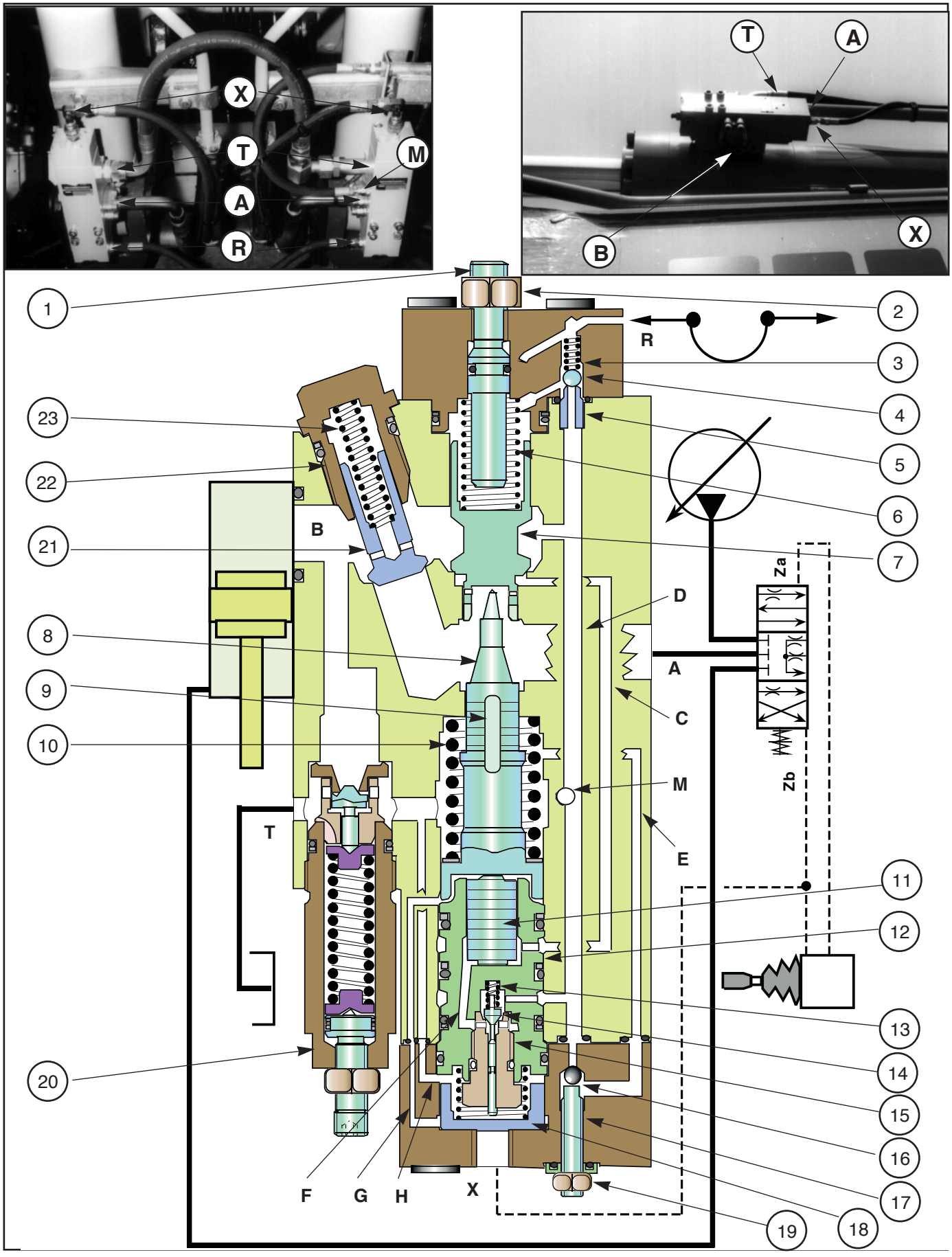


PHASE 3.
BOOM RAISING:
When hand control lever **11** is moved in the boom raising direction, spool **3** is piloted. At **Za** the feed moves through the “parallel arrows” passages.
The flow from variable flow pump **12** passes via spool **3**, pilot check valve **6** and flow limiter **5** in the “free movement” direction, then feeds cylinders **4**. The small chamber return flow comes back into spool **3**, passes via counter-pressure valve **2** and returns to the hydraulic tank **1**. Non-return valve **10** is held against its seat by the feed pressure.

The operating principle is the same when the load-holding block is installed on the dipper cylinder except when it is installed on the small chamber of the cylinder (lengthened dipper).

12/1488 ATTACHEMENT OPTIONS

SAFETY VALVES (on boom and dipper cylinders)



12/1488 ATTACHEMENT OPTIONS

SAFETY VALVES (on boom and dipper cylinders)

LOCATION ON MACHINE:

BOOM:
Attached by flange to each cylinder big chamber feed port
DIPPER:
Attached by flange to the cylinder small chamber feed port

PURPOSE:
- They ensure safety and load-holding in case of rupture of a hose or pipe feeding the cylinder chamber to which they are connected.
- They control the return flow and therefore the lowering speed of the load, even if the function control lever is kept in the lowering position
. In that case, if the control lever is brought back to stop position, the load stops moving.
- They include a tap which enables the cylinder chambers to be emptied into the hydraulic tank in case of a failure in the pilot circuit.

DESCRIPTION

1 - Non-return valve **7** stop (Do not tighten. Must be completely unscrewed)
2 - Locknut
3 - Parachute valve spring
4 - Parachute valve
5 - Parachute valve seat
6 - Piloted valve spring
7 - Piloted valve
8 - Control spoo
9 - Escape groove
10 - Control spool return spring
11 - Pushrod guide
12 - Pushrod
13 - Shuttle valve spring
14 - Shuttle valve
15 - Shuttle valve seat
16 - Tap
17 - Tap control screw
18 - Piston
19 - Tap locking nut
20 - Safety valve
21 - Non-return valve
22 - Non-return valve guide
23 - Non-return valve return spring

PORT IDENTIFICATION

A - Port to control valve
B - Cylinder chamber port (boom cylinder big chamber, dipper cylinder small chamber)
M - Pressure gauge tapping
R - Connection by hose, with the other safety valve, on the boom
T - Return to hydraulic tank
X - Pilot line

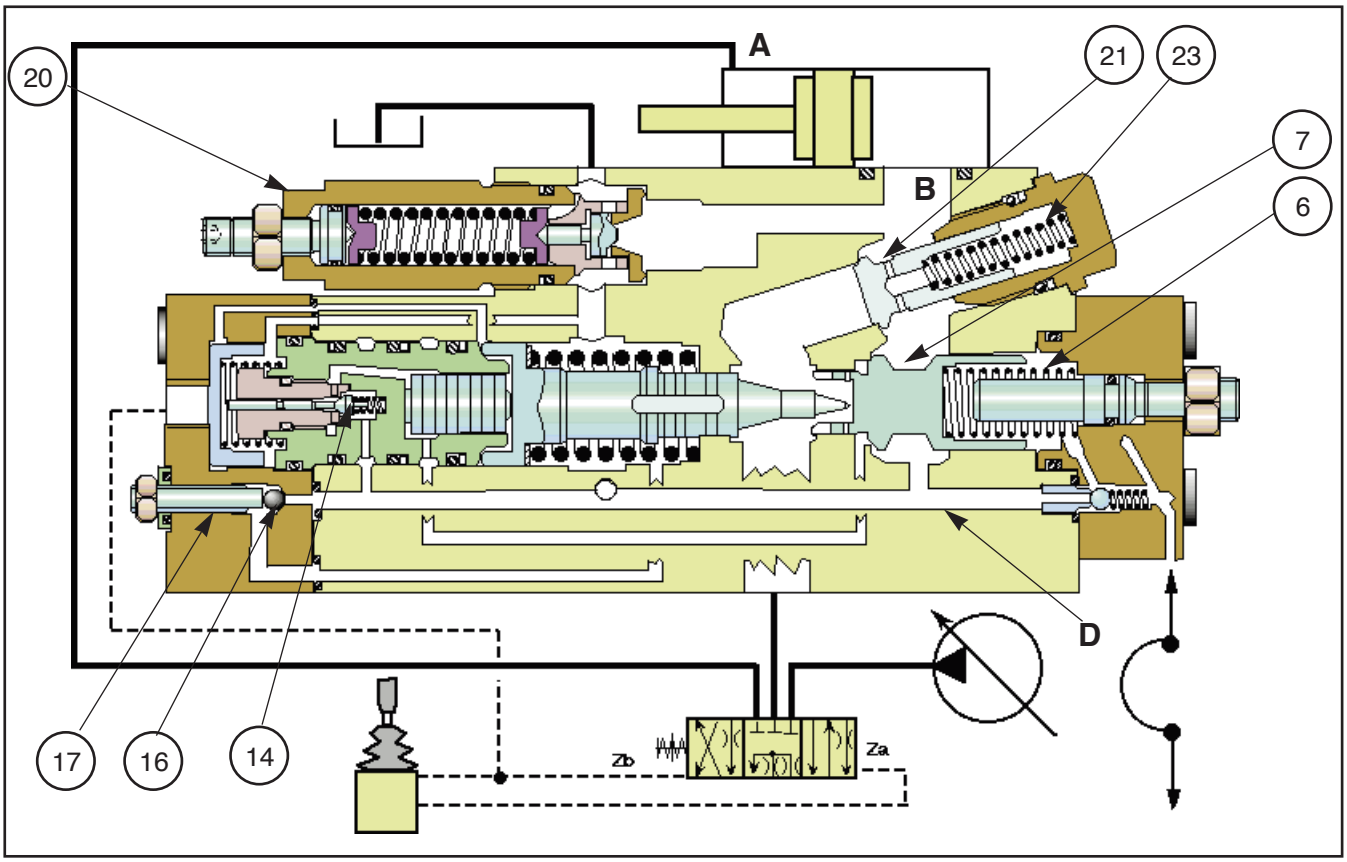
INTERNAL PASSAGES

C - Connection between pushrod and piloted valve annular section
D - Connection between pressure in **B** and balance valve
E - Connection between tap and return to hydraulic tank
F - Connection to hydraulic tank
G - Connection between piston pilot line and spool
H - Connection between piston pilot line and tank

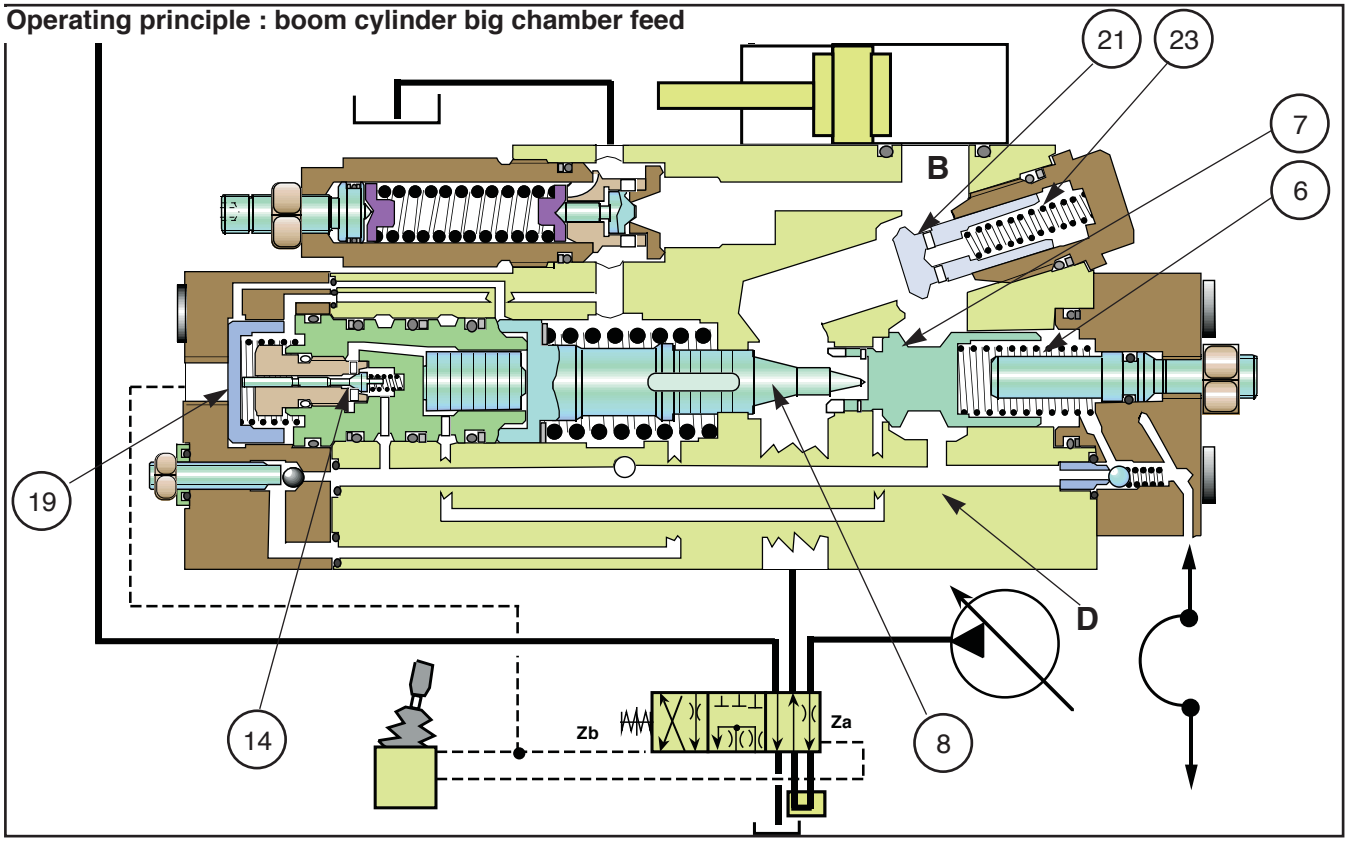
12/1488 ATTACHEMENT OPTIONS

SAFETY VALVES (on boom cylinders)

Operating principle : control valve spool in neutral position



Operating principle : boom cylinder big chamber feed



12/1488 ATTACHEMENT OPTIONS

SAFETY VALVES (on boom cylinders)

OPERATION

Control valve spool in rest position

As soon as no feed passes to cylinder at **A**, the return springs **6** and **23** push valves **7** and **21** back on their seats. The pressure at **B**, produced by the weight of the attachments plus the load, enters the rear chambers of these two valves and also balance valve **14**, passing through passage **D**. This causes the valves to be strongly pressed against their seats, thus isolating the cylinder chamber from the control valve spool. In this position, the maximum pressure in the cylinder big chamber is controlled by valve **20**.

In case of failure of circuits (feed, return or pilot), it is possible to control the lowering of the load manually, by using screw **17** to open tap **17**.

Cylinder big chamber feed control valve spool

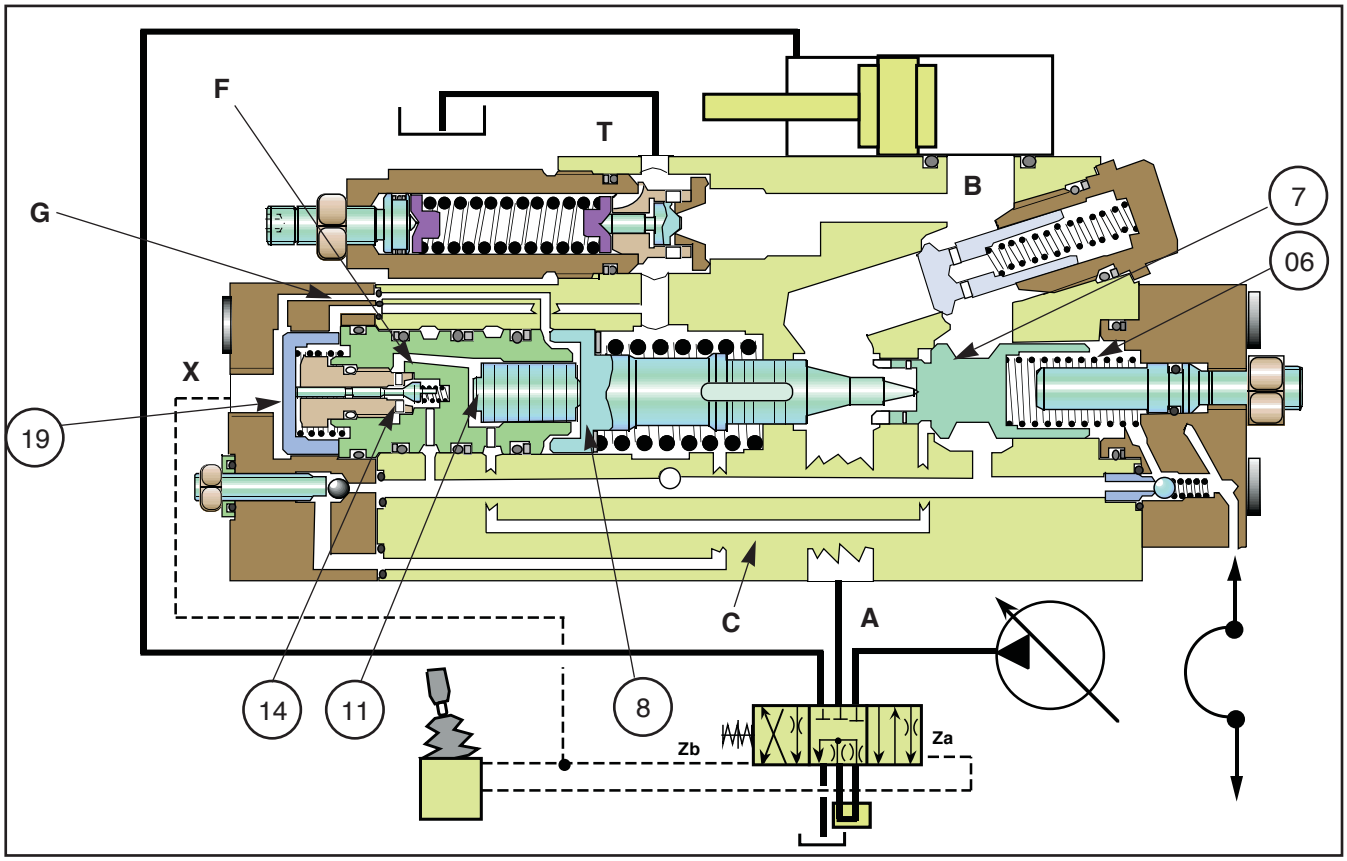
The control valve spool is piloted at **Za**. As soon as the pressure applied on the front of non-return valve **21** is sufficient to overcome the forces applied on its rear, it opens valve **21** and enables feed to pass to cylinder at **B**. This pressure arrives in the chamber behind valve **7** and on balance valve **14**, passing through passage **D**. This keeps the valves strongly pushed against their seats.

The front chamber of pilot piston **19** is directed to leak return by piloting the control valve spool at **Zb**. There is no information to control the assembly consisting of control spool **8** / piloted valve **7**.

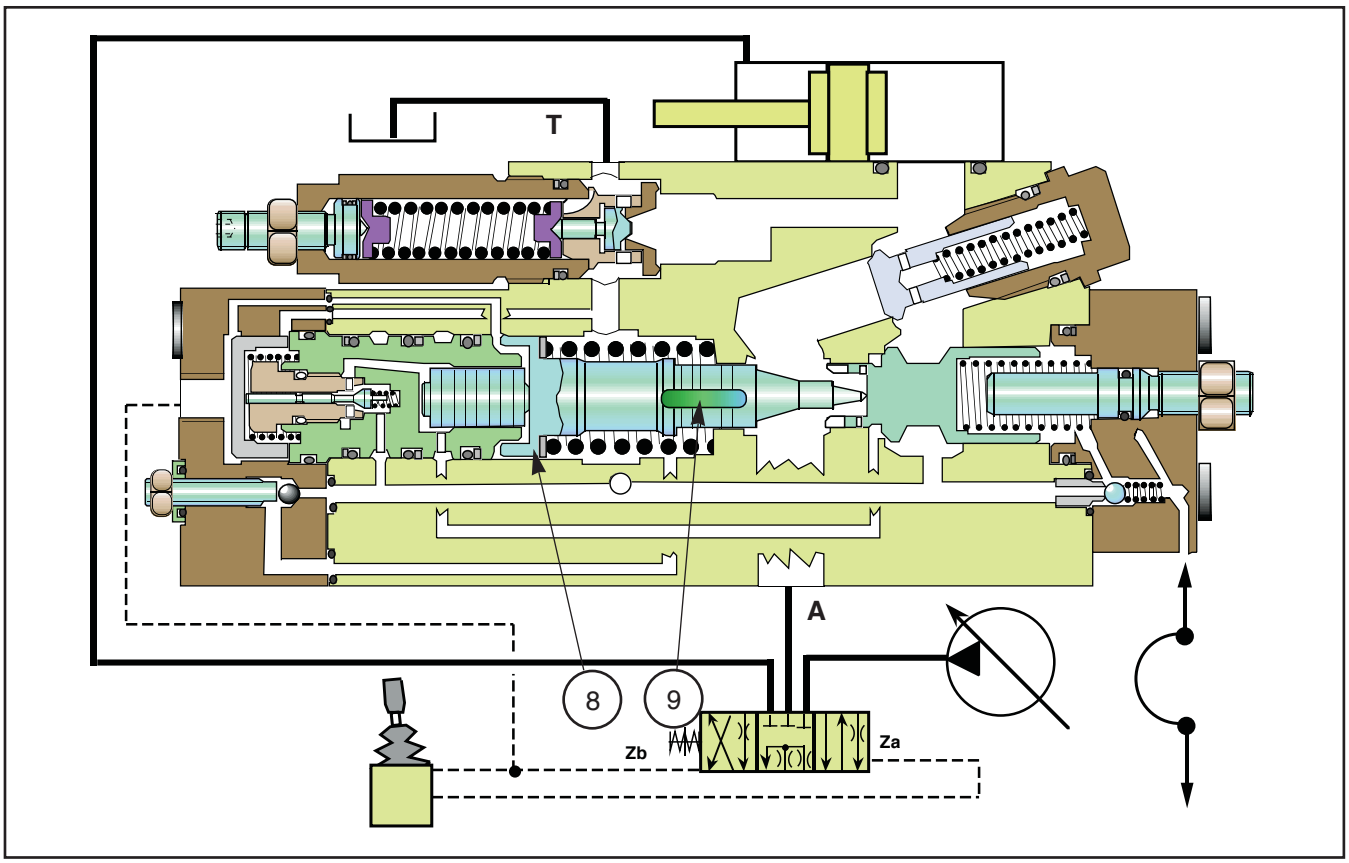
12/1488 ATTACHEMENT OPTIONS

SAFETY VALVES (on boom cylinders)

Operating principle : feed to boom cylinder small chamber (Phase 1)



Operating principle : feed to boom cylinder small chamber (Phase 2)



ATTACHMENT OPTIONS

SAFETY VALVES (on boom cylinders)

OPERATION

Boom lowering
Phase : 1
The pilot pressure from the control valve spool acts at **X** on piston **19** and via passage **G** on spool **8**. As it moves, piston **19** comes in contact with the stem of balance valve **14** which opens. This enables the pressure from the cylinder chamber to be applied to pushrod **11** via passage **F**, and on the annular section of piloted valve **7**, via passage **C**. At this moment, the forces applied on each side of the piloted valve are equal and cancel each other out. the only force remaining to be overcome is that of return spring **6**.

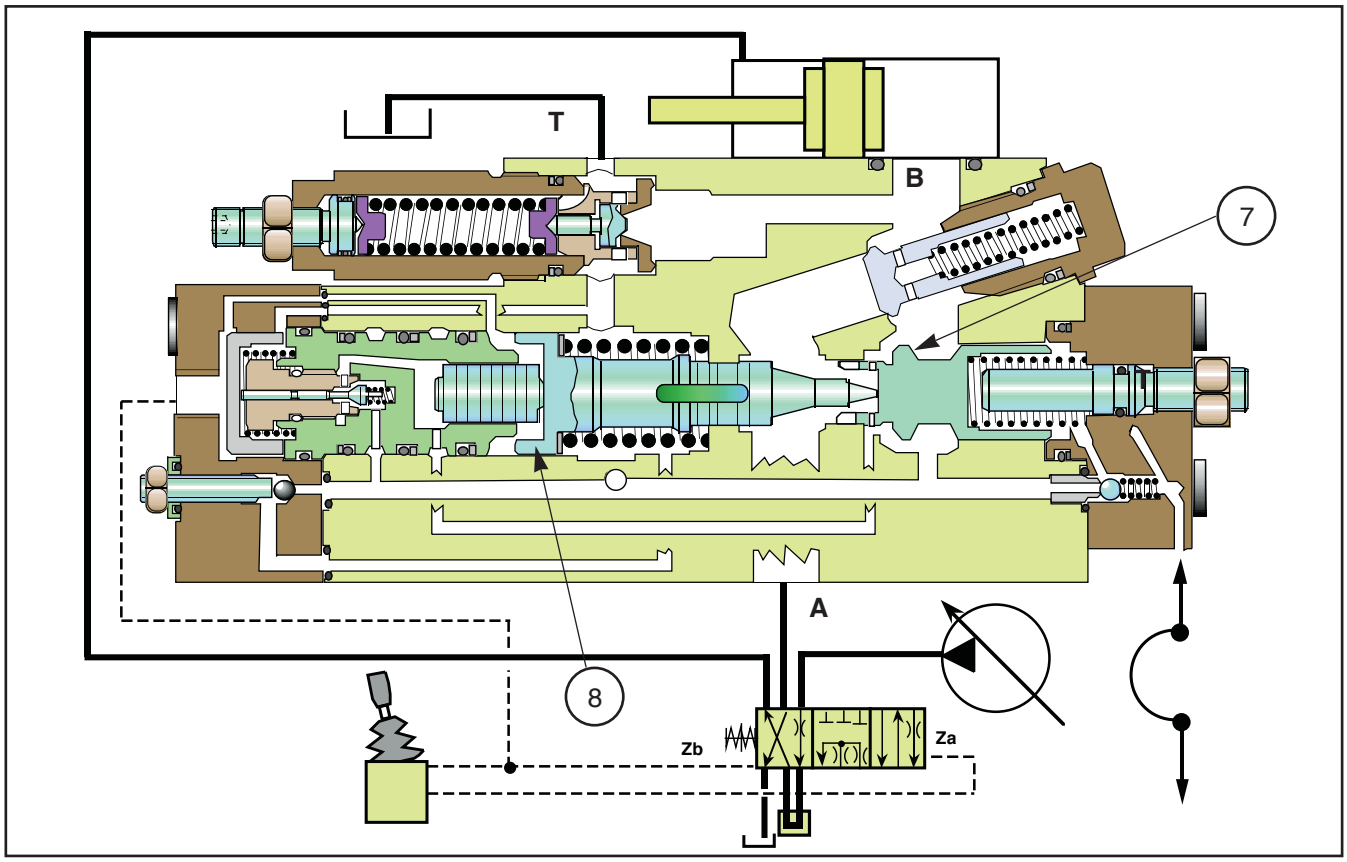
Phase : 2

Control spool **8** moves and allows the rectangular escape groove **9** to put **A** into contact with **T**, thus decompressing that passage.
At the same time, the control valve spool progressivity groove is opened.

12/1488 ATTACHEMENT OPTIONS

SAFETY VALVES (on boom cylinders)

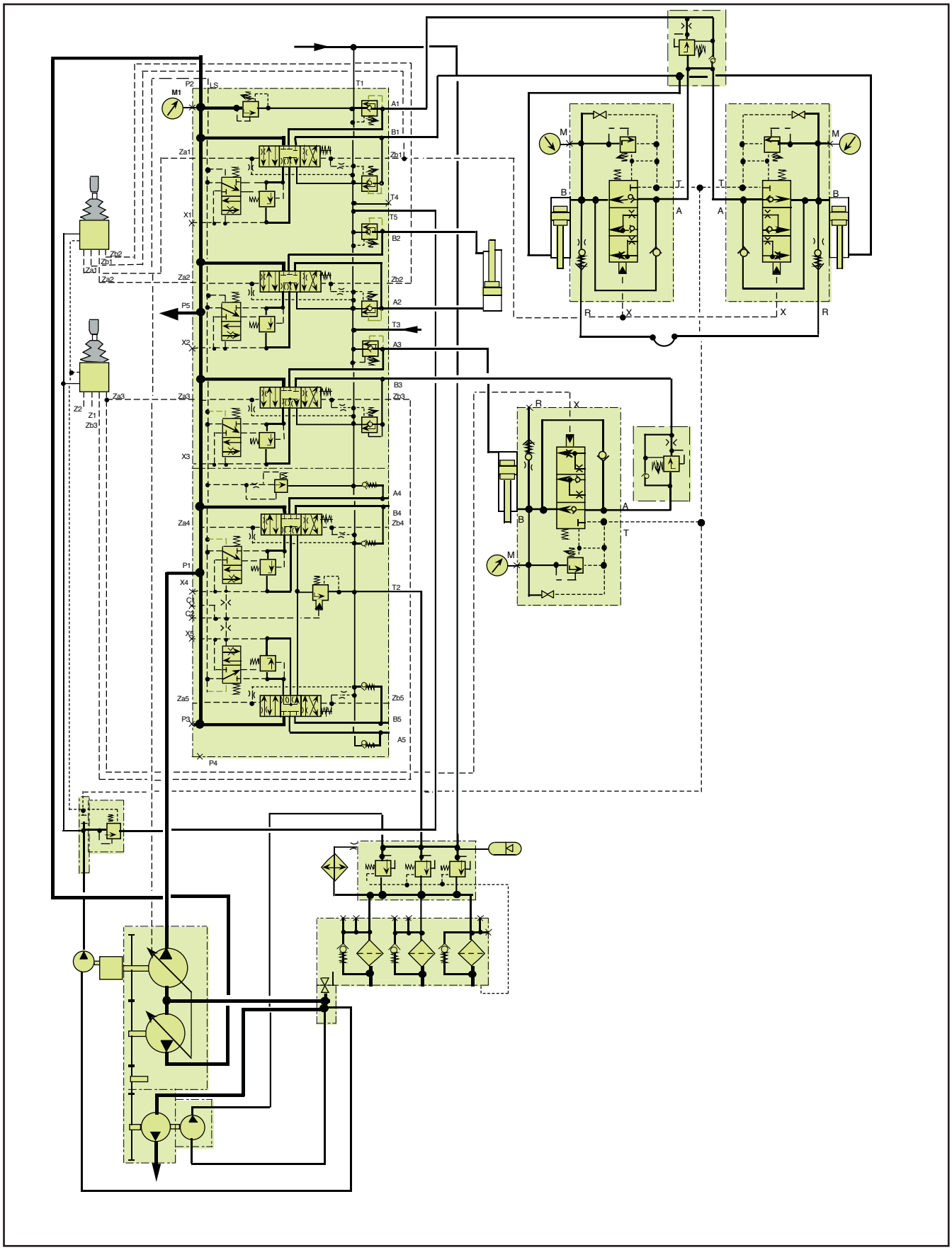
Operating principle : feed to boom cylinder small chamber (Phase 3)



OPERATION
Phase : 3
Piloted check valve **7** begins to open, allowing communication from cylinder chamber **B** to **A**.
The control valve spool supply progressivity groove opens and feeds the other cylinder chamber.

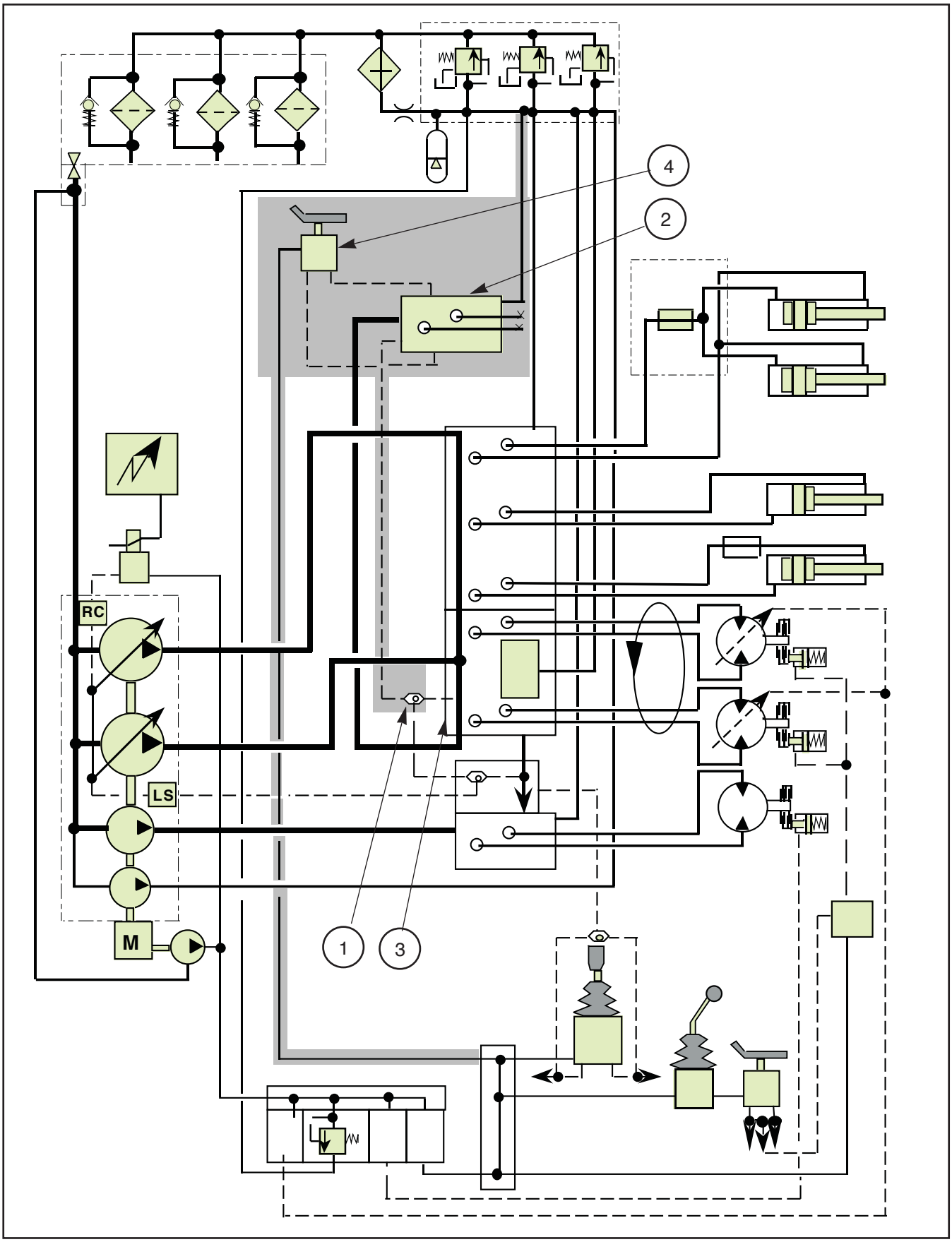
12/1488 ATTACHEMENT OPTIONS

Attachment operating diagram with safety valves on boom and dipper cylinders



12/1488 ATTACHEMENT OPTIONS

HYDRAULIC SIMPLIFIED CIRCUIT WITH OPTION CONTROL VALVE



ATTACHMENT OPTIONS

OPTION CONTROL VALVES

Option control valves must be installed when certain hydraulic applications so require, such as rotation of a clamshell, fitting a hydraulic breaker, etc.

In this chapter we deal with the most frequently required options.

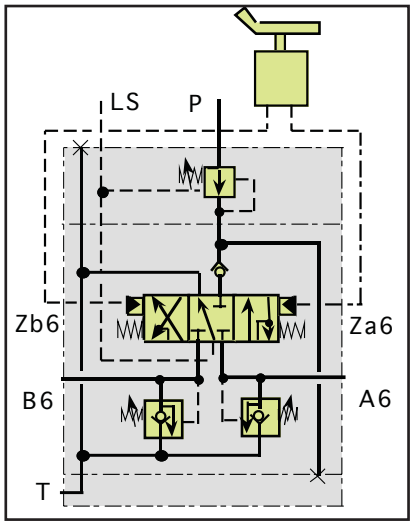
Basic principle
In all cases options are fed in parallel with the attachments and travel function by the variable flow pump, and therefore the attachment block relief valve protects the feed circuit.
As a result of this, in order to obtain a satisfactory regulation of the pump, a shuttle ball valve is installed on the “LOAD-SENSING” information circuits between option control valve **2** and the attachment/travel control valve **3**.
The shuttle ball selects the highest out of the pressures: attachment/travel information or options.

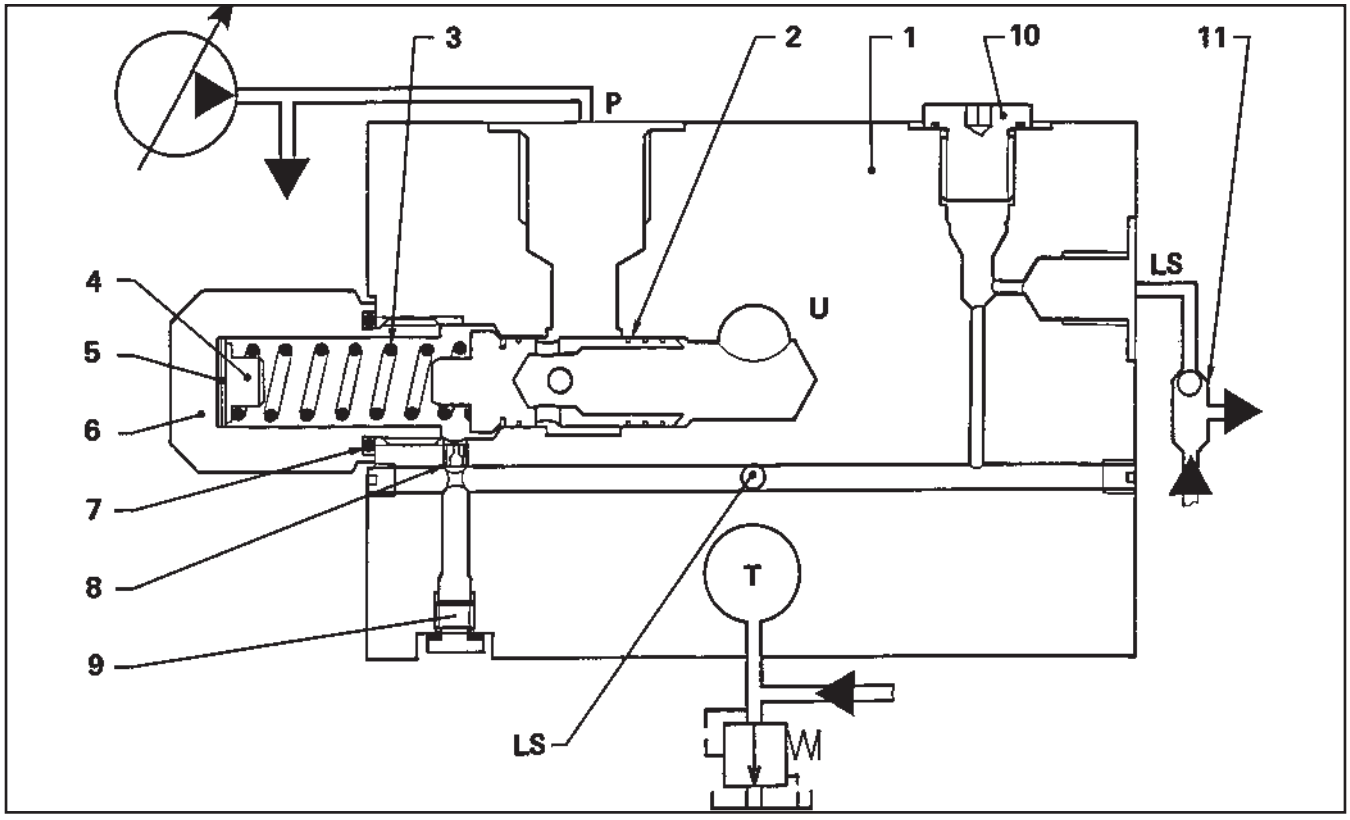
- Low flow control valve
- High flow control valve
- Hydraulic hammer control valve

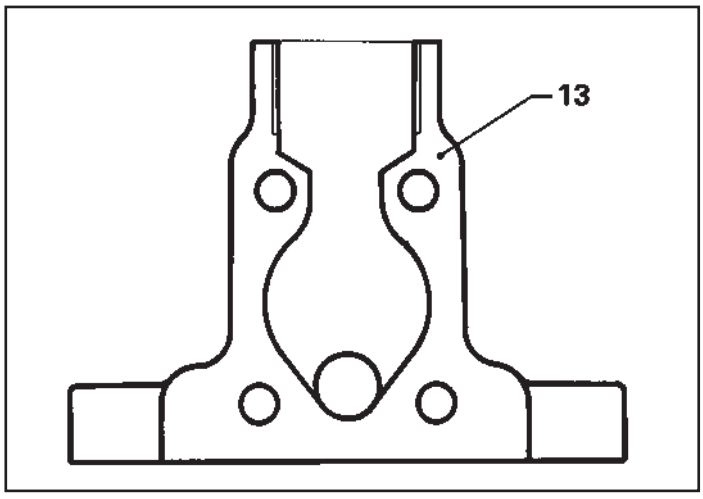
} for spécifications see page 8A 9 & 8B 4

12/1488 ATTACHEMENT OPTIONS

"LOW FLOW" OPTION CONTROL VALVE BLOCK.







12/1488 ATTACHEMENT OPTIONS

"LOW FLOW" OPTION CONTROL VALVE BLOCK.

Purpose:
Feeds a hydraulic option, for example: clamshell rotation, offset boom, etc., requiring a flow not exceeding 30 litres.

Description:

It consists of 1 control valve section.

1 - Inlet plate.
2 - Control valve section.
3 - Outlet plate.

Identification of ports:

P : Flow inlet from variable flow pump
LS : "LOAD-SENSING" information circuit from option function.
Za6 : Option piloted in one direction
Zb6 : Option piloted in the opposite direction.
A6 : Feed to option in one direction.
B6 : Feed to option in the opposite direction.
T : Return to hydraulic tank, passing through P10.
T1 : Plugged

INLET PLATE:

Purpose:
It centralizes the feed and LS information ports from the option circuit.
The flow limiter valve which limits option feed flow is located in this inlet plate.

Description:

1 - Block
2 - Balance spool
3 - Spring
4 - Spring guide
5 - Adjusting shims
6 - Cap
7 - O-ring
8 - Calibrated orifice
9 - Plug with seal
10 - Plug with O-ring
11 - Pressure selector between options LS and attachments/travel

Operating principle:

The oil arrives from the variable flow pump bodies at **P** and passes via balance spool **2,** moving to the receptors at **U**. The flow limiter spool **3** limits the maximum flow to the control block to **30 litres** (pre-adjusted by shims **5**).

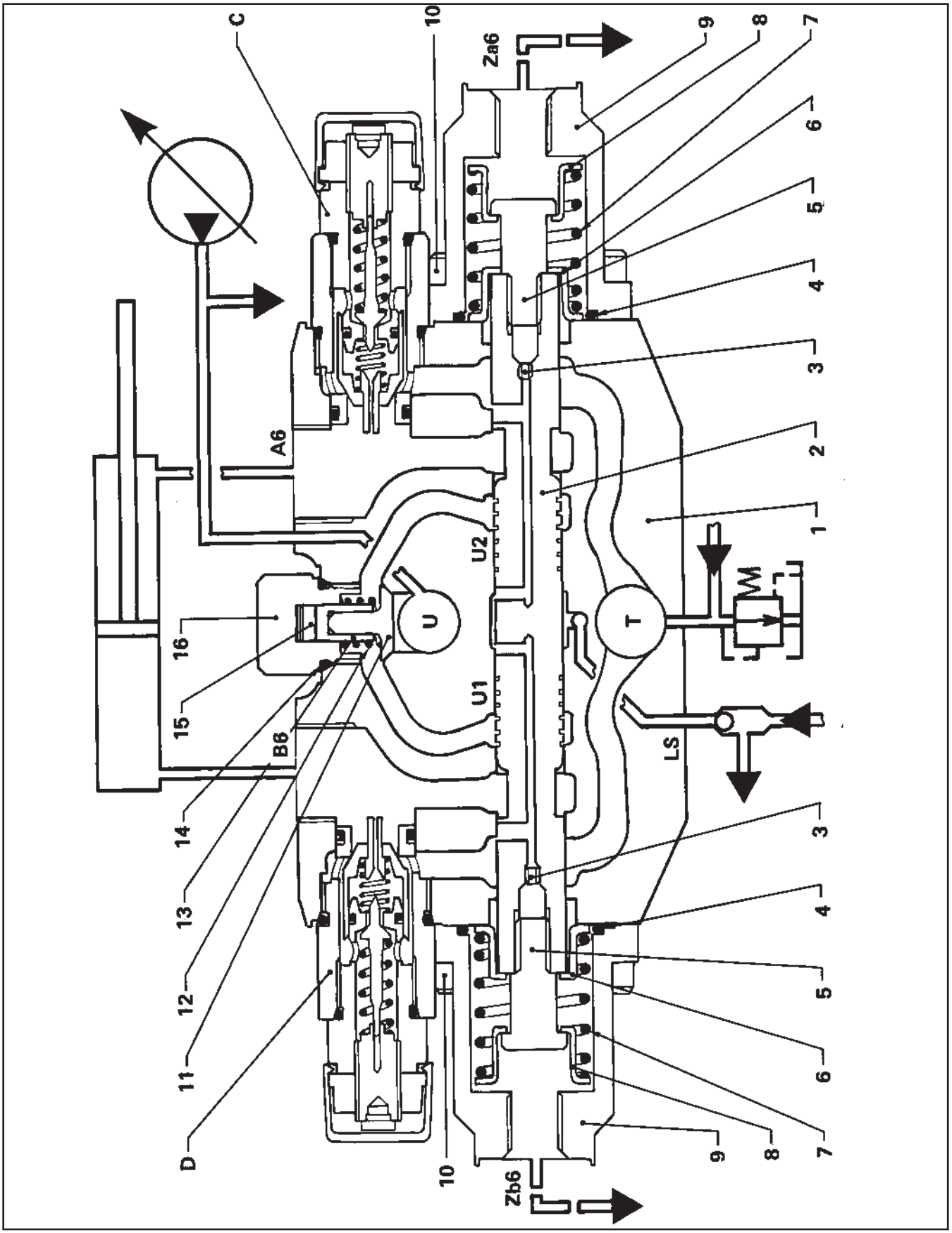
Note:
Depending on the type of option selected, the stroke of the non-return check valve and the grooves in the control valve section spool are limited. This produces a reaction at the L-S valve which instructs the pump body to deliver only one flow, to suit the selected optionCalibrated plug **8** brakes the action of balance spool **2**.

OUTLET PLATE 13:

This plate connects together the flows from the option return and the relief valves return to tank, passing through block P10.

12/1488 ATTACHEMENT OPTIONS

"LOW FLOW" OPTIONS CONTROL VALVE BLOCK.
CONTROL VALVE SECTION:



12/1488 ATTACHEMENT OPTIONS

"LOW FLOW" OPTION CONTROL VALVE BLOCK.

CONTROL VALVE SECTION:
It consists of a closed centre 3 parallel type control valve.

Purpose:
it allows a **30 litres/min** feed and return for a hydraulic option and it controls the maximum pressure in the option's circuits.

Description:

1	-	Block	**9**	-	Cap
2	-	Spool	**10**	-	Screw
3	-	Plug	**11**	-	Check valve
4	-	O-ring	**12**	-	Spring
5	-	End-piece	**13**	-	Liner
6	-	Cup	**14**	-	O-ring
7	-	Spring	**15**	-	Shims
8	-	Cup	**16**	-	Plug

For the composition of C and D safety valves, see page 8G.20.00

Identification of ports:

Za6 - piloted in one direction
Zb6 - piloted in the opposite direction
A6 - Feed in one direction
B6 - Feed in the opposite direction
U - Inlet from feed circuit after flow limitation by the inlet plate flow limiter
LS - "LOAD-SENSING" information circuit from the option, which passes through the inlet plate to inform the pump LS valve.
I - The return circuit, brought together with the flow from the safety valves, passes through block P10 to provide forced-feed to the option.

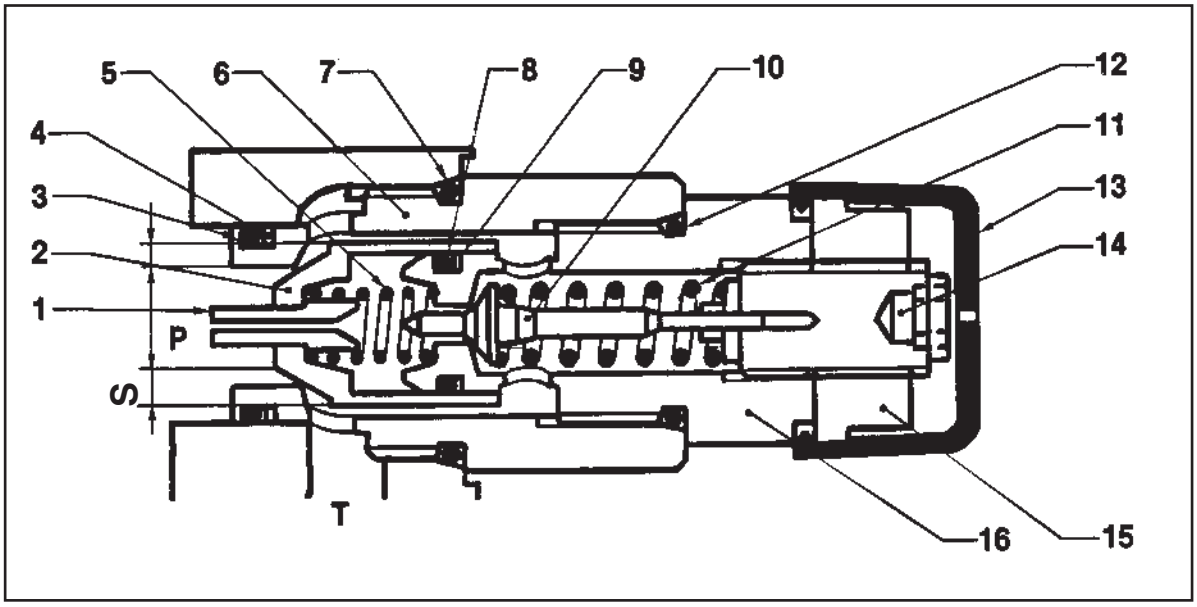
Operating principle:
1) Rest position
The piloting ports are returned to the hydraulic tank via the foot control valve. Spool **2** is not piloted. It is held in the rest position by the springs. **7**. Flow from the pump comes to **U**, non-return valve **11** opens and the flow is blocked in **U1** and **U2** by the spool.
The **LS** circuit communicates with return **T** via the central passages in spools **2.** It then passes into the P10 block before returning to the hydraulic tank.
Pressure in circuits **A6** and **B6** is controlled by safety valves **C** and **D**.

2) Feed position in one direction (for example, piloting of ZA6).
Pressure in one of the caps **9** on the **ZA6** side moves spool **2** by compressing springs **7**. The oil which was waiting in **U2** passes into **A6** via the spool groove and feeds the option.
- By the movement of the spool, the **LS** circuit is also shut off from the return circuit and the pressure at **A6** is sent to inform the LS valve.
The return goes through **B6**, passing through **T** and the P10 block to arrive at the hydraulic tank.

The operating principle is the same for piloting in the opposite direction at **Zb6**.

12/1488 ATTACHEMENT OPTIONS

"LOW FLOW" OPTIONS CONTROL VALVE BLOCK. SAFETY VALVES



12/1488 ATTACHEMENT OPTIONS

“LOW FLOW” OPTION CONTROL VALVE BLOCK.
CONTROL VALVE SECTION (Continued):

C and D safety valves:

Purpose:
They protect the circuits between the control valve spool, when it is at rest, and the receiving unit. Also between the pump and the receiving units when the spool is moved.
The main check valves provide forced feed to each function.

Description:
They are in the form of a unit which includes:

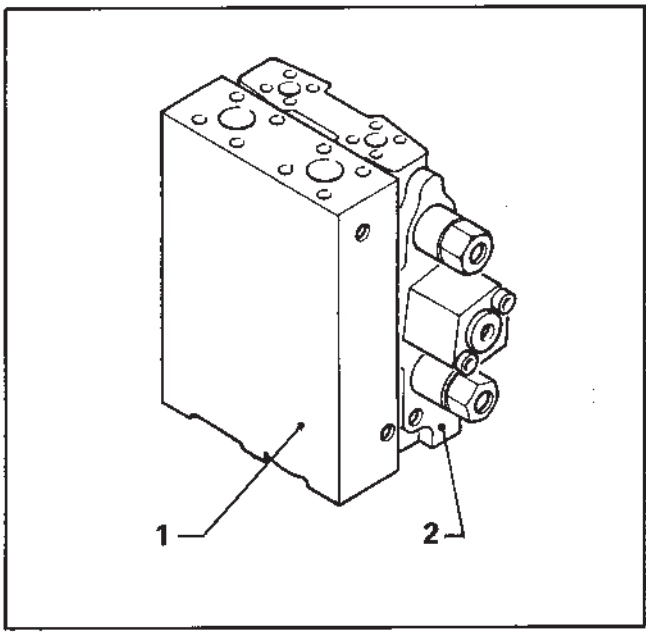
1 - Spring guide
2 - Main check valve
3 - O-ring
4 - Back-up ring
5 - Spring
6 - Body
7 - Seal
8 - O-ring
9 - Back-up ring
10 - Secondary check valve
11 - Spring
12 - O-ring
13 - Protector
14 - Adjusting screw
15 - Lock-nut
16 - Secondary check valve seat

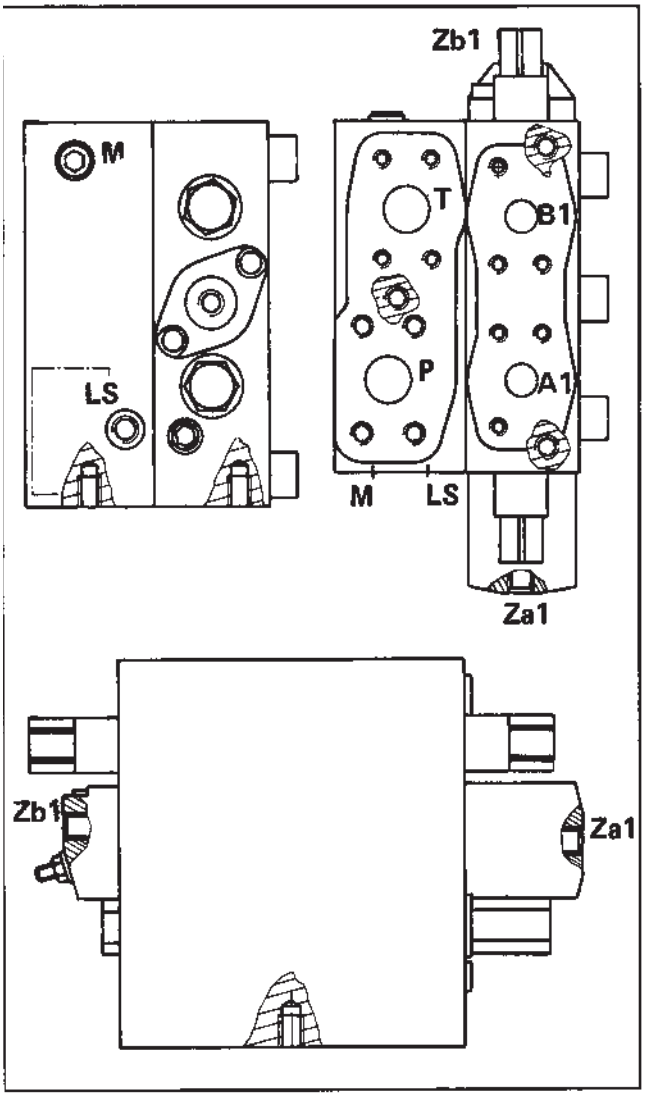
Operation:
This is an indirect action valve. Pressure at **P** acts on check valve **10**, passing through the central orifice of spring guide **1**. When the pressure exceeds the set value of spring **11**, check valve **10** opens and gives access to the hydraulic tank at **T**. this causes a fall in pressure in the main check valve spring chamber **2**. The force acting on the rear of the check valve falls.
Main check valve **2** moves back and connects flow **P** to **T**.

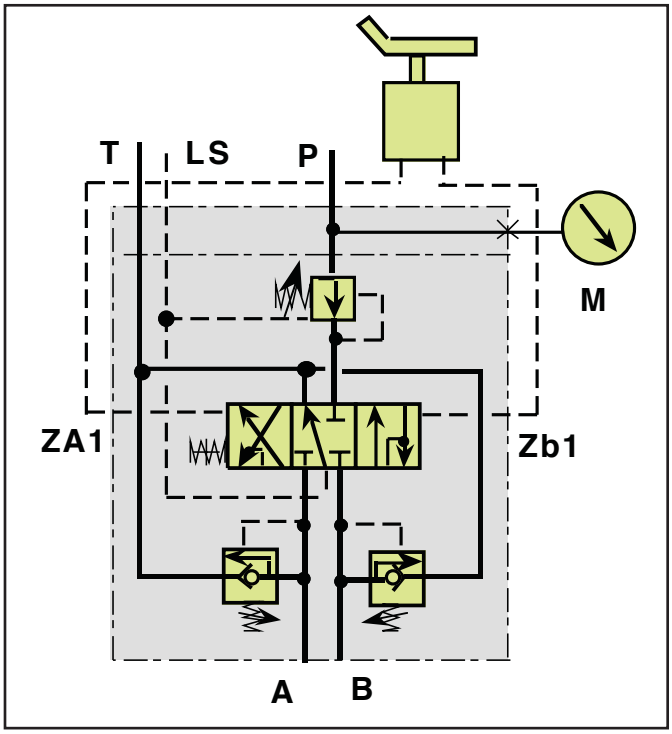
FORCED FEED CIRCUIT:
When the circuit between the receiving unit and the control valve spool is at (???3) a lower pressure than that of the P10 counter-pressure valves, the forced-feed circuit pressure acts on the annular section **S** of main check valve **2**, creating a force which compresses spring **5**. Main check valve **2** opens and connects the receiving unit circuit to the forced-feed circuit. This avoids cavitation.

12/1488 ATTACHEMENT OPTIONS

“HIGH FLOW” OPTIONS CONTROL VALVE BLOCK.







12/1488 ATTACHEMENT OPTIONS

"HIGH FLOW" OPTION CONTROL VALVE BLOCK.

Purpose :
It provides the supply to and the return from an optional hydraulic tool and limits maximum pressure in the tool's circuits.

Description:
- **1** - Inlet plate
- **2** - Control valve section.

Identification of orifices
- **P** - Inlet flow from variable flow pump bodies.
- **T** - Return to tank passing through P10 block (10 bars).
- **M** - Pressure gauge tapping (plugged)
- **A1** - Feed to option in one direction
- **B1** - Feed to option in the opposite direction
- **LS** - LOAD-SENSING information from the option function
- **Za** - Piloting the option function in one direction
- **Zb** - Piloting the option function in the opposite direction

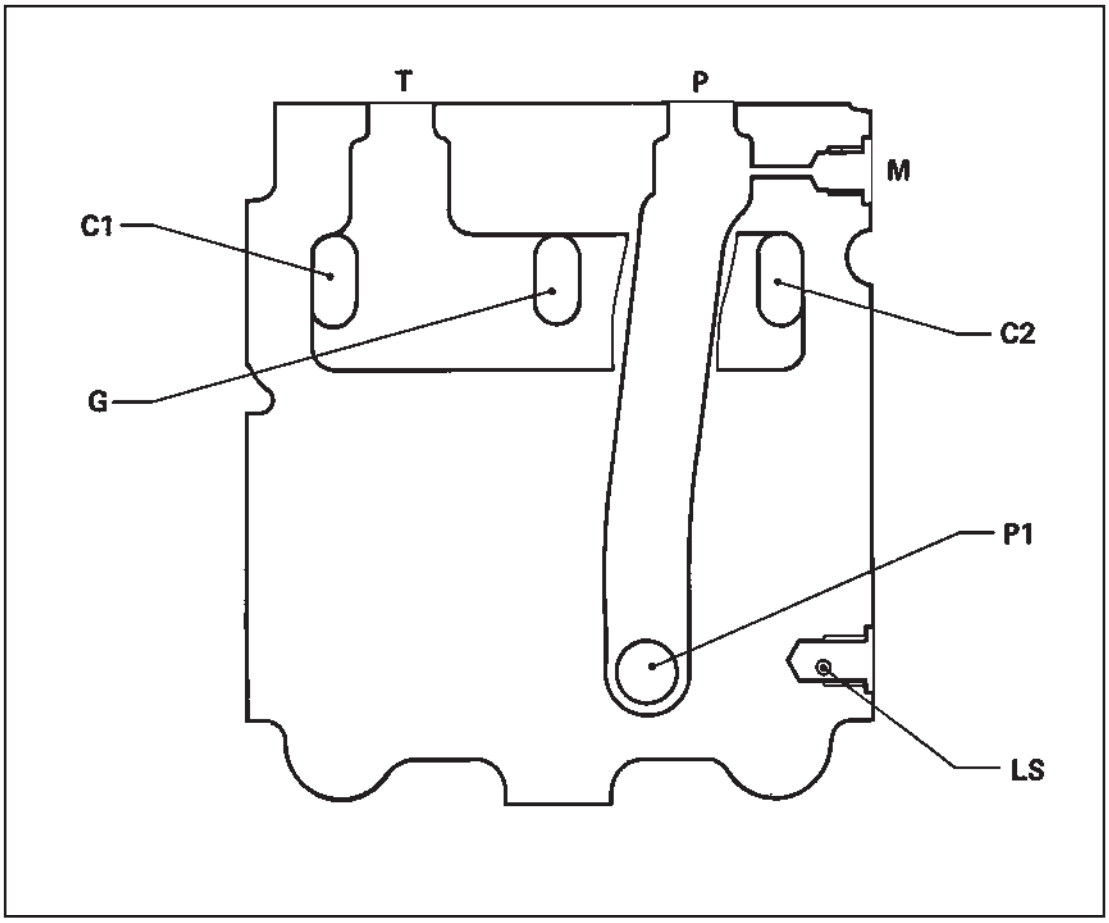
Special features on the choice of option feed:

1) Feed to receiving unit via part B1 (piloting at **Zb1**)
Feed at a flow of from **50** to **170** litres is obtained, adjustable by the shuttle spool.

2) Feed via orifice A1 (piloting at **Za1**)
Feed at a flow of **130** litres is obtained, limited by the spool grooves.
This can be reduced by means of the adjusting screw, located on the spool cap (**Zb1** side).
This screw limits the spool stroke.

12/1488 ATTACHEMENT OPTIONS

“HIGH FLOW” OPTIONS CONTROL VALVE BLOCK.
THE INLET PLATE:



12/1488 ATTACHEMENT OPTIONS

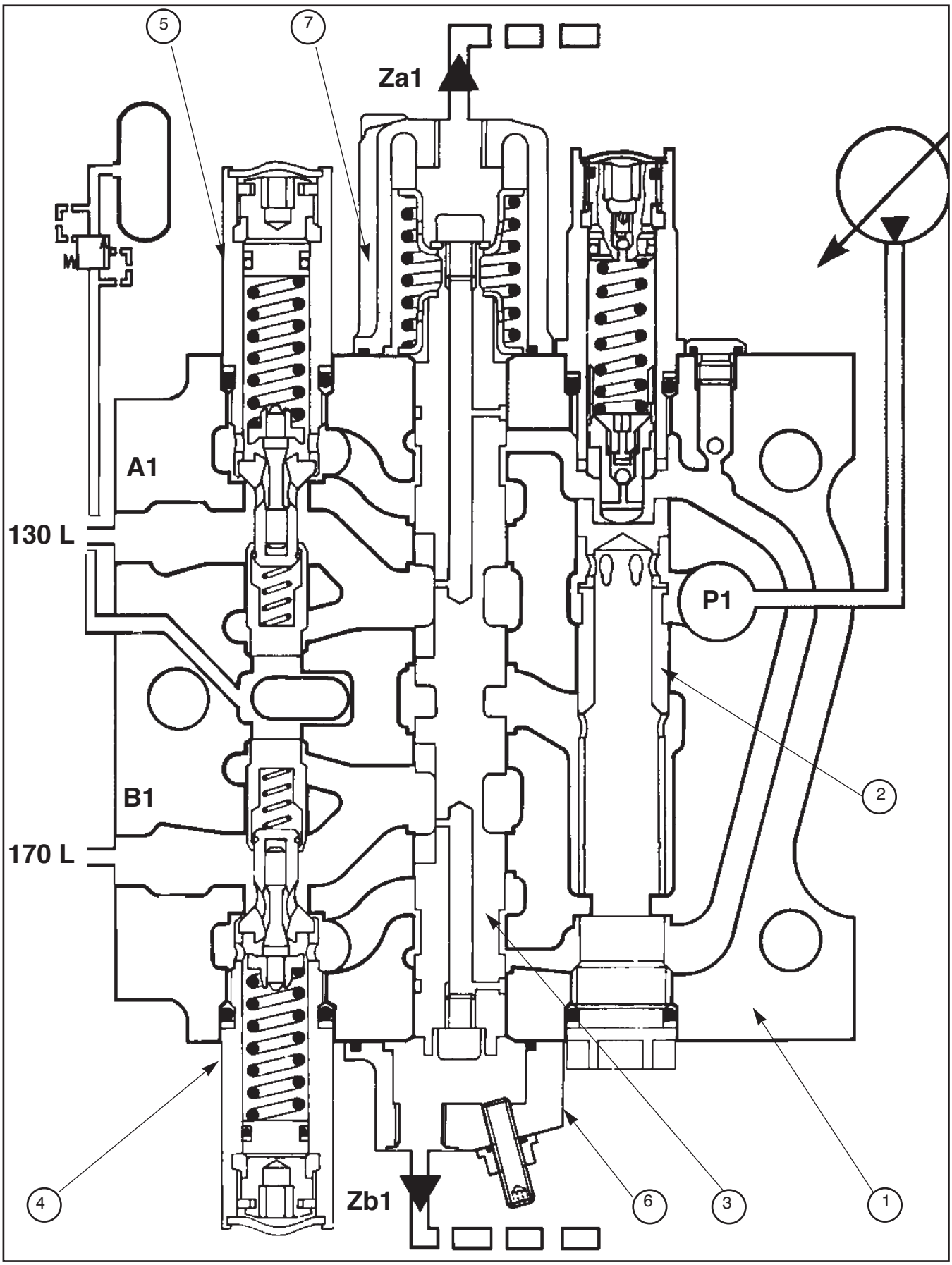
“HIGH FLOW” OPTION CONTROL VALVE BLOCK.
THE INLET PLATE:

Purpose:
It receives the flow from the variable flow pump bodies coming from the inlet plate of the attachment/travel control valve, which goes to feed the option control valve.
It provides a passage for the return via the **P10** block.
It enables the LS information to go to the pump LS valve.
It enables a pressure gauge to be fitted.

Port identification:

P	-	Inlet flow from variable flow pump.
P1	-	Outlet to the option control valve.
M	-	Pressure gauge tapping.
C1-C2	-	Safety valves relief flow manifold.
G	-	Forced-feed manifold.
T1	-	Return to hydraulic tank via **P10** (10 bars).
LS	-	pressure information from option function.

12/1488 ATTACHEMENT OPTIONS



12/1488 ATTACHEMENT OPTIONS

"HIGH FLOW" OPTION CONTROL VALVE BLOCK.

THE CONTROL VALVE

It is distributor with closed centre, parallel type.

Function:

Depending on the position of the control spool, it provides supply to and return from the function concerned. It limits the amount of flow supplying the optional tool, either by means of the balance valve spool or by means of the adjustable mechanical stop on the spool small cap.

It provides protection for the feed circuits between the distributor and the receiver, when the distributor spool is at rest.

Description:

1 - Body
2 - Flow balance spool
3 - Control spool
4 - Circuit relief valve, **B1** side
5 - Circuit relief valve, **A1** side
6 - Rear cap with adjustment screw to limit the travel of the spool **3** when it is controlled in **Za1**.
7 - Front cap with spool return spring

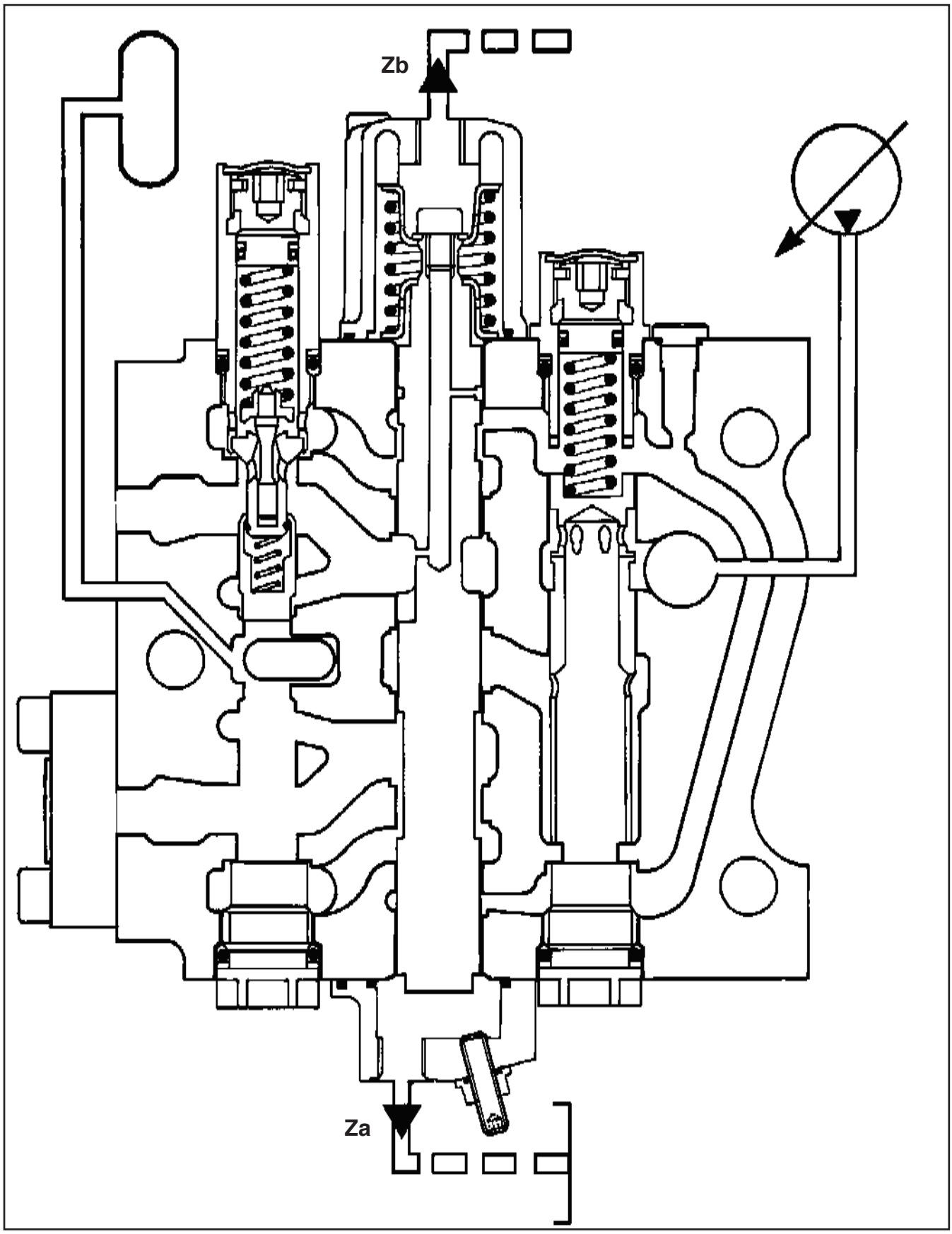
Operation

- When the distributor is piloted at **Zb1**, option feed, by orifice **B1**, the variable flow pump's output is limited by the balance spool **2** (from **50 to 170 L.** depending on the latter's adjustment).
- When the distributor is piloted at **Za1**, option feed by orifice **A1**, the variable flow pump's output is limited by the progressivity grooves in the spool **3** to a maximum value of **130** litres.This value can be reduced by actuating the adjustment screw on the cap 6.

N.B.: The progressivity grooves on the distributor spool are not symetrical.

12/1488 ATTACHEMENT OPTIONS

THE OPTION VALVE BANK - “HYDRAULIC HAMMER”



12/1488 ATTACHEMENT OPTIONS

THE OPTION VALVE BANK - “HYDRAULIC HAMMER”

The hydraulic hammer option only requires one supply, as the hammer return circuit leads directly to the tank.

- Therefore, the distributor only comprises supplies in one direction.

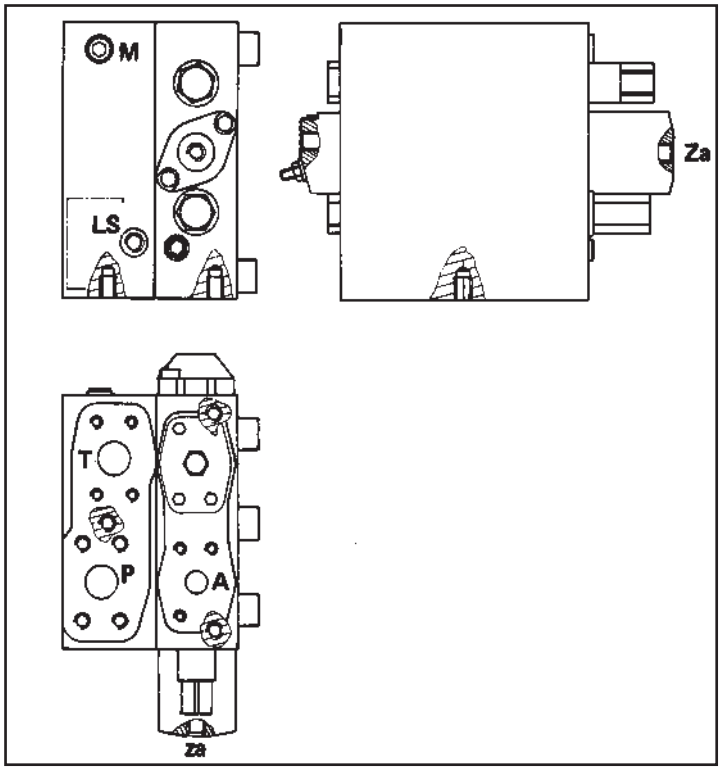
The design of this control valve is based on a “hight flow” distributor, but the distribution spool is only machined in one single feed direction.

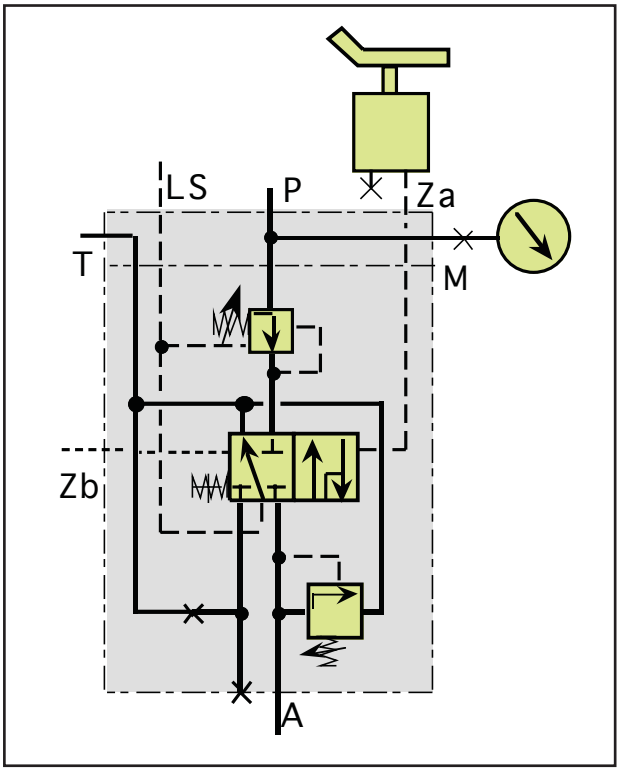
There is only one circuit relief valve without any forced feed function, and the balance spool does not possess any non-return valve.

Operation
Depending on the type of hammer used, the balance’s spool must be adjusted for the output recommended by the hammer’s supplier.

The balance is adjustable from **50** litres to **180** litres.

N.B.:
Assembly of this option makes it necessary to replace the clogging indicator fitted to the tank filters. (from 5 bars to 2 bars).





12/1488 ATTACHEMENT OPTIONS

12/1488 ATTACHMENT FUNCTION

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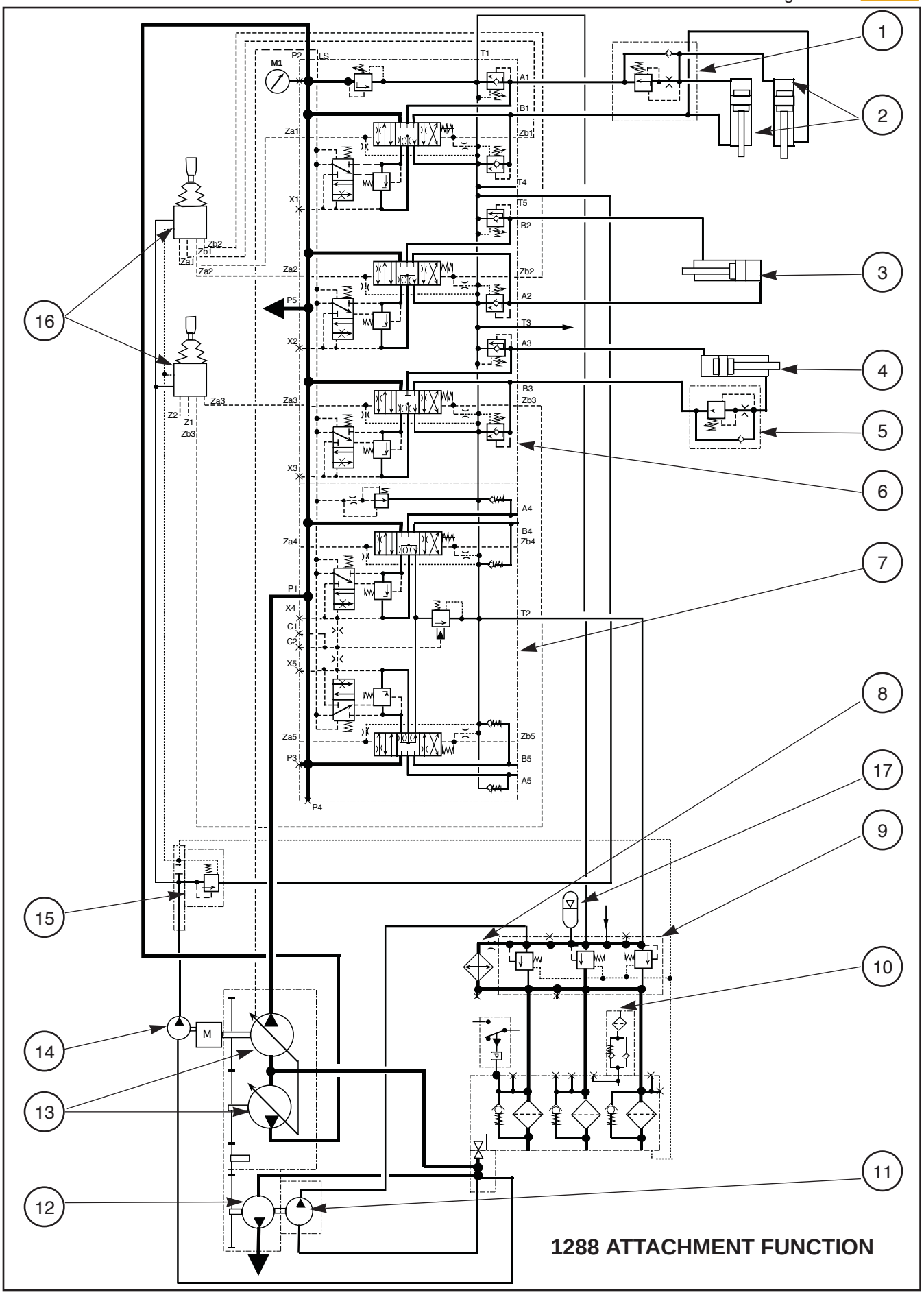


12/1488 ATTACHMENT FUNCTION

ATTACHMENT FUNCTION HYDRAULIC DIAGRAM

Description

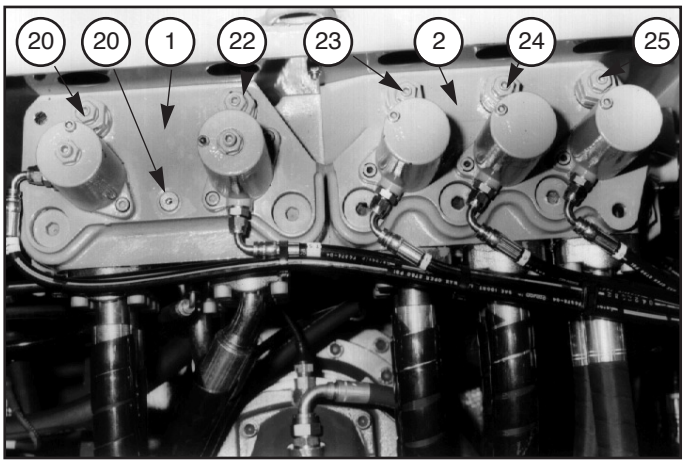
1 - Boom cylinders flow limiter(two)
2 - Boom cylinders
3 - Bucket cylinder
4 - Dipper cylinder
5 - Dipper cylinder flow limiter
6 - Attachment control valve block
7 - Travel control valve block
8 - Oil cooler
9 - **P10** pressure limiter
10 - Hydraulic tank and filters
11 - Force-feed pump
12 - Swing pump
13 - Attachment and travel pumps
14 - Pilot circuit pump
15 - **P35** pressure limiter
16 - Control levers
17 - Accumulator

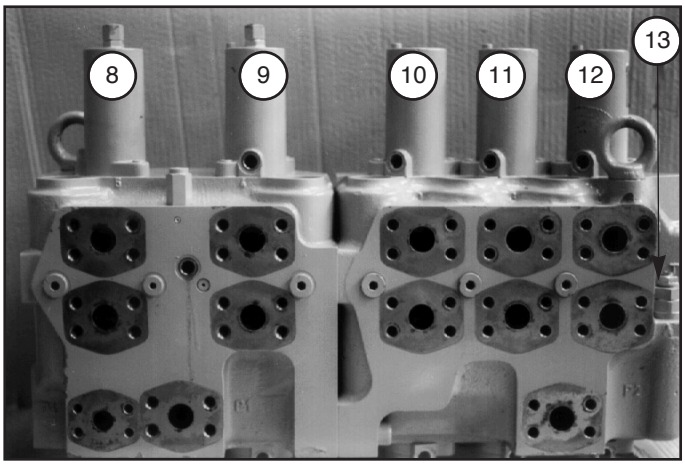
This chapter deals with components 6,2,3,4,1,5,17,9 in that order. The others (except 7) have been explained in previous chapters.

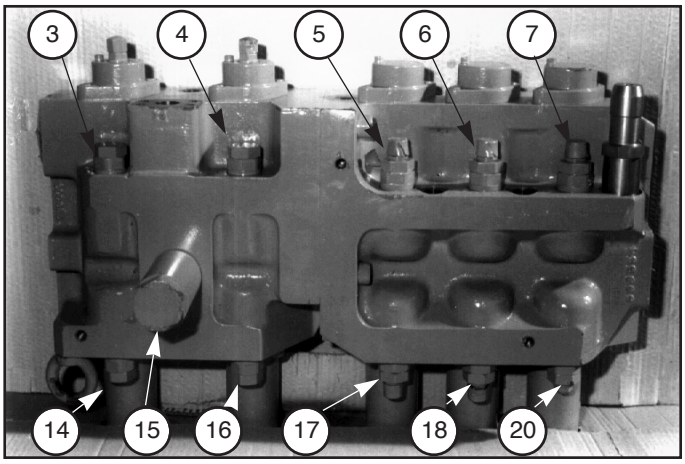
12/1488 ATTACHMENT FUNCTION

THE ATTACHMENT/TRAVEL CONTROL VALVE BLOCK

- It is attached to the control valve partition.
- It consists of two one-piece control valves, joined a together by bolts.
- The first block is composed of three elements for feed to the boom, dipper and bucket cylinders.
- The second block has two elements for feed to the hydraulic travel motors.
- All these control valve elements are fed in parallel by two bodies of the variable displacement pump.
- They are all of the parallel type, with the centre and outlets closed when at rest.
- The spools are piloted at low pressure.



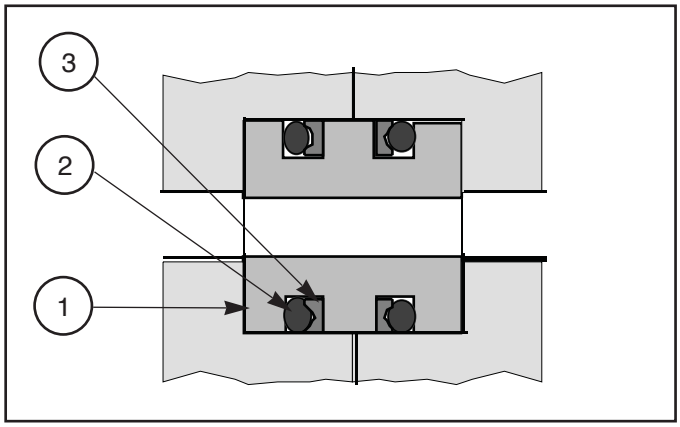




Description:

1 - Travel control valve
2 - Attachment control valve
3 - RH travel force-feed valve
4 - LH travel force-feed valve
5 - Dipper cylinder big chamber safety valve
6 - Bucket cylinder big chamber safety valve
7 - Boom cylinders big chamber safety valve
8 - RH travel element
9 - LH travel element
10 - Dipper element
11 - Bucket element
12 - Boom element
13 - Relief valve
14 - RH front travel force-feed valve
15 - Speed limiter
16 - LH front travel force-feed valve
17 - Dipper cylinder small chamber safety valve
18 - Bucket cylinder small chamber safety valve
19 - Boom cylinders small chamber safety valve
20 - RH travel pressure compensator and selector
21 - Flow regulator (decompression of LS information)
22 - LH travel pressure compensator and selector
23 - Dipper pressure compensator and selector
24 - Bucket pressure compensator and selector
25 - Boom pressure compensator and selector

- A spacer fitted with seals and back-up rings is used for sealing purposes between the two LS information circuit control valve blocks.



1 - Spacer
2 - O-ring
3 - Back-up ring

12/1488 ATTACHMENT FUNCTION

ATTACHMENT/TRAVEL CONTROL VALVE BLOCK

Identification of orifices:

T2 - Return to one of the **3P10**
P3 - Low-flow option control valve feed
M1 - Pressure check point
T3 - Outlet to force-feed swing
T5 - Inlet from **P35** valve opening
T4 - Pluged

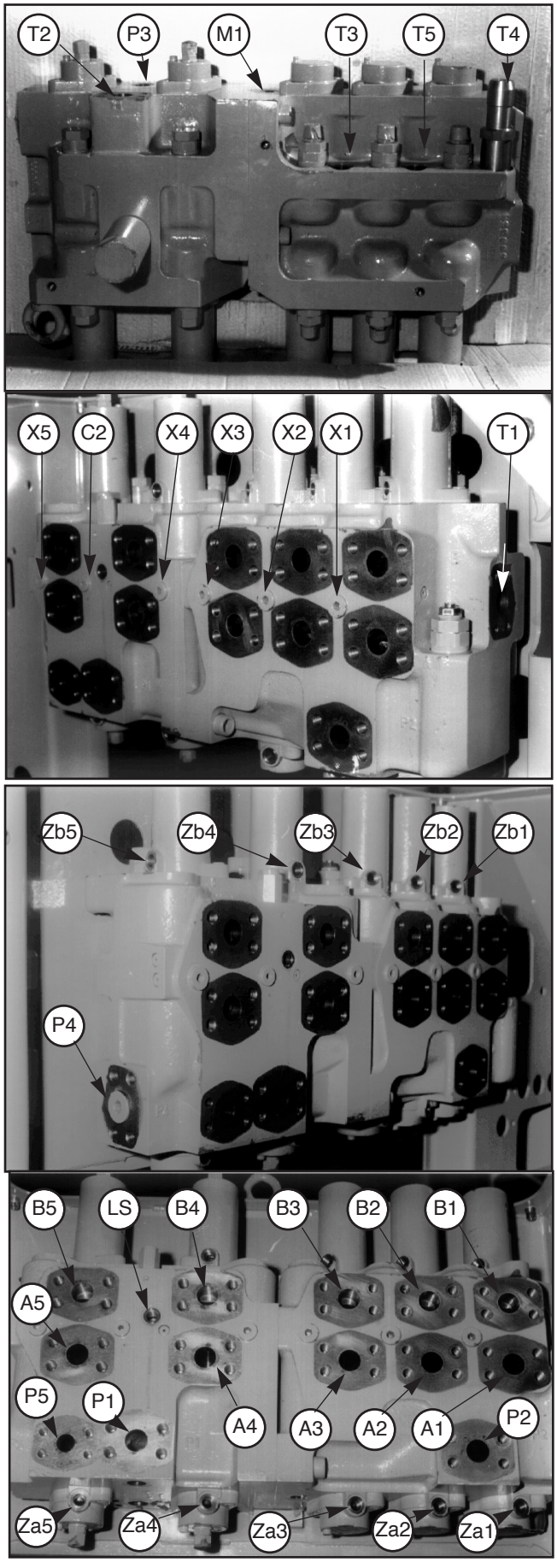
X5 -
C2 -
X4 -
X3 -
X2 -
X1 -
} Plugs

T1 - Return to the 3 P10 's

Zb5 - RH forward drive travel feed pilot
Zb4 - LH forward drive travel feed pilot
Zb3 - Dipper cylinder small chamber feed pilot
Zb2 - Bucket cylinder small chamber feed pilot
Zb1 - Boom cylinders small chamber feed pilot
P4 - High-flow or hydraulic hammer option control valve feed

B5 - Forward drive RH travel motor feed
LS - LS information circuit outlet
B4 - Forward drive LH travel motor feed
B3 - Dipper cylinder small chamber feed
B2 - Bucket cylinder small chamber feed
B1 - Boom cylinders small chamber feed
A5 - Rear drive RH travel motor feed
A4 - Rear drive RH travel motor feed
A3 - Dipper cylinder big chamber feed
A2 - Bucket cylinder big chamber feed
A1 - Boom cylinders big chamber feed
P5 - Partial flow reinjection to swing
P1 - Flow inlet from one body of variable flow pump

P2 - Flow inlet from the other body of variable flow pump
Za5 - RH rear drive travel feed pilot
Za4 - LH rear drive travel feed pilot
Za3 - Dipper cylinder big chamber feed pilot
Za2 - Bucket cylinder big chamber feed pilot
Za1 - Boom cylinders big chamber feed pilot

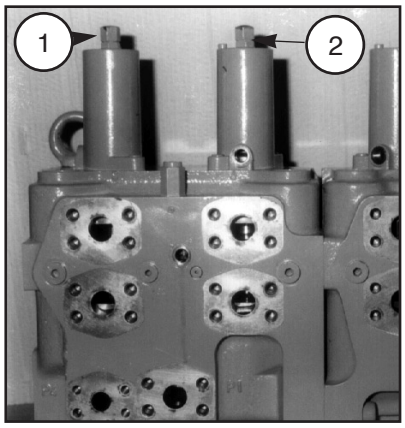


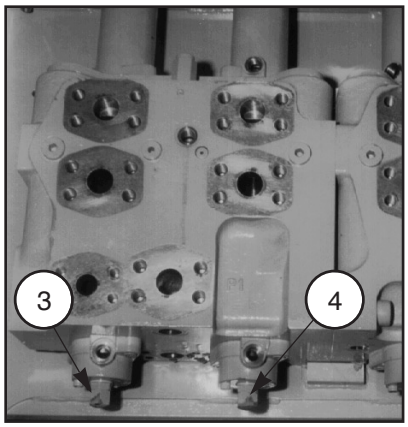
12/1488 ATTACHMENT FUNCTION

ATTACHMENT/TRAVEL CONTROL VALVE BLOCK
TRAVEL CONTROL VALVE

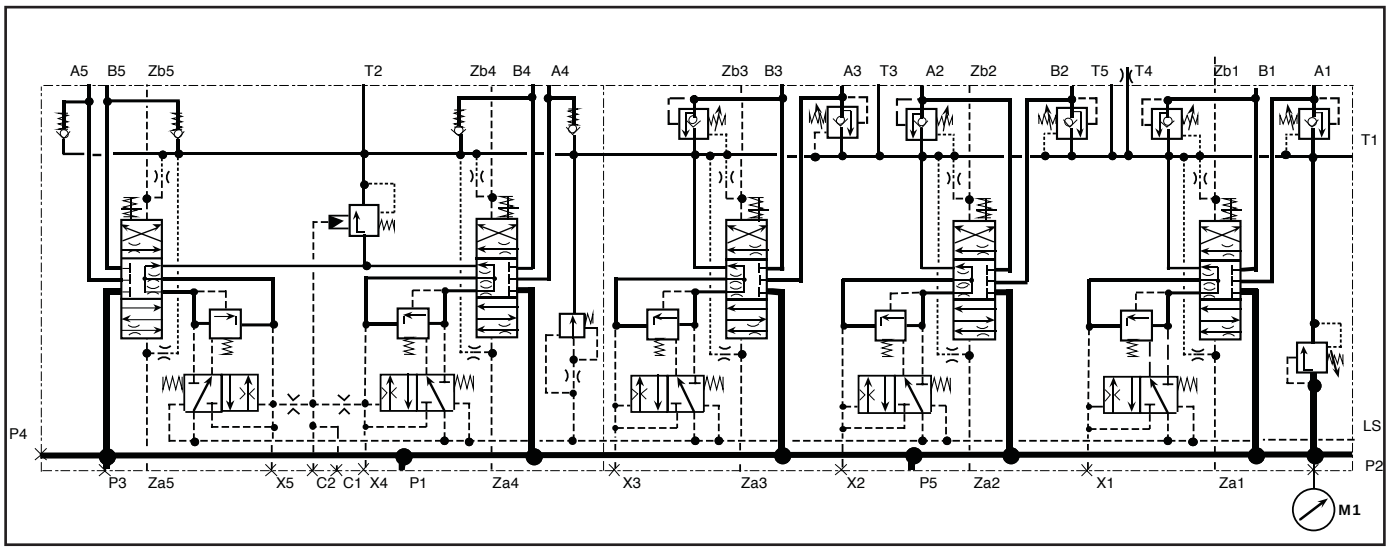
Identification of special adjustments (using screw)

1 - Adjusting the rear drive RH travel flow
2 - Adjusting the rear drive LH travel flow
3 - Adjusting the forward drive RH travel flow
4 - Adjusting the forward drive LH travel flow





Symbolic diagram of control valve



12/1488 ATTACHMENT FUNCTION

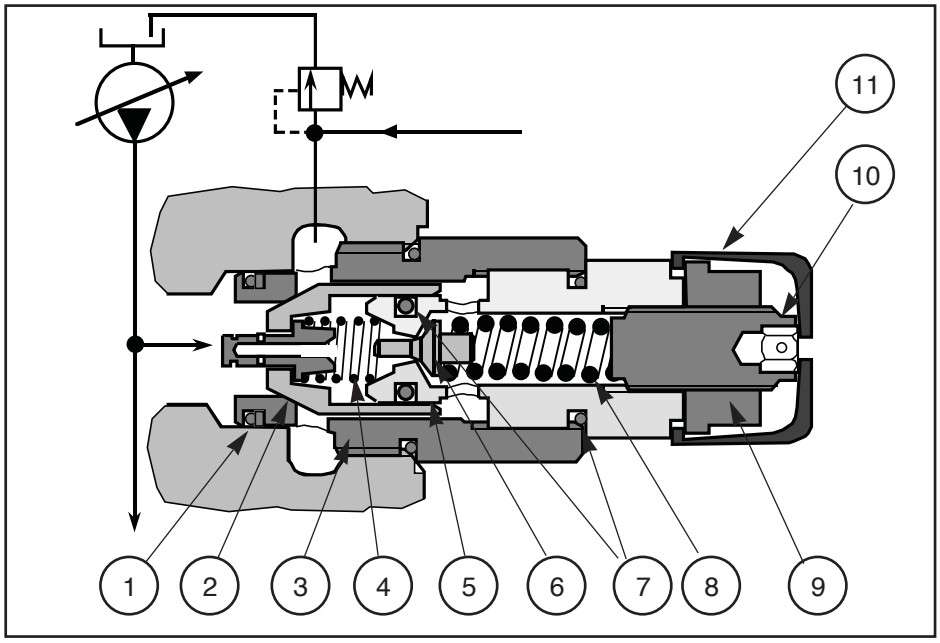
ATTACHMENT/TRAVEL CONTROL VALVE BLOCK

Relief valve

It is an indirect action valve

Purpose:

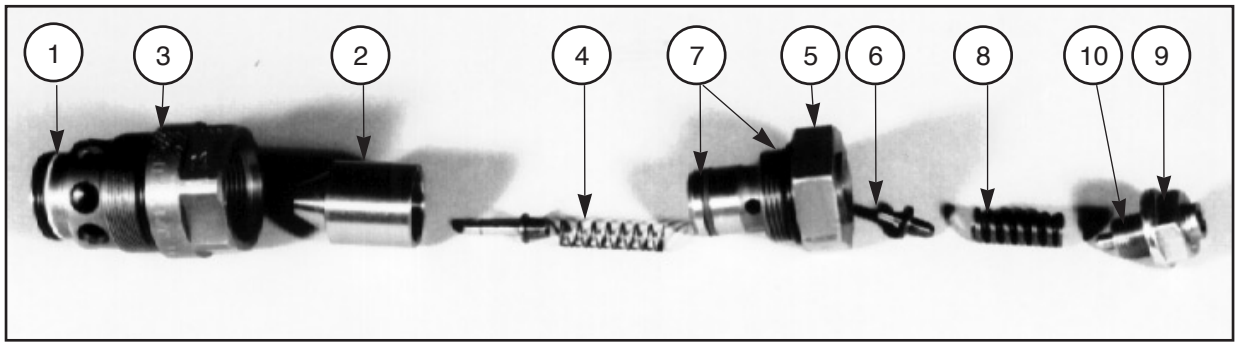
- It protects the circuits between the pumps and the spools of the attachment, travel, and option (if fitted) control valves, at their rest position.
- It limits the maximum pressure on the travel.



Description:

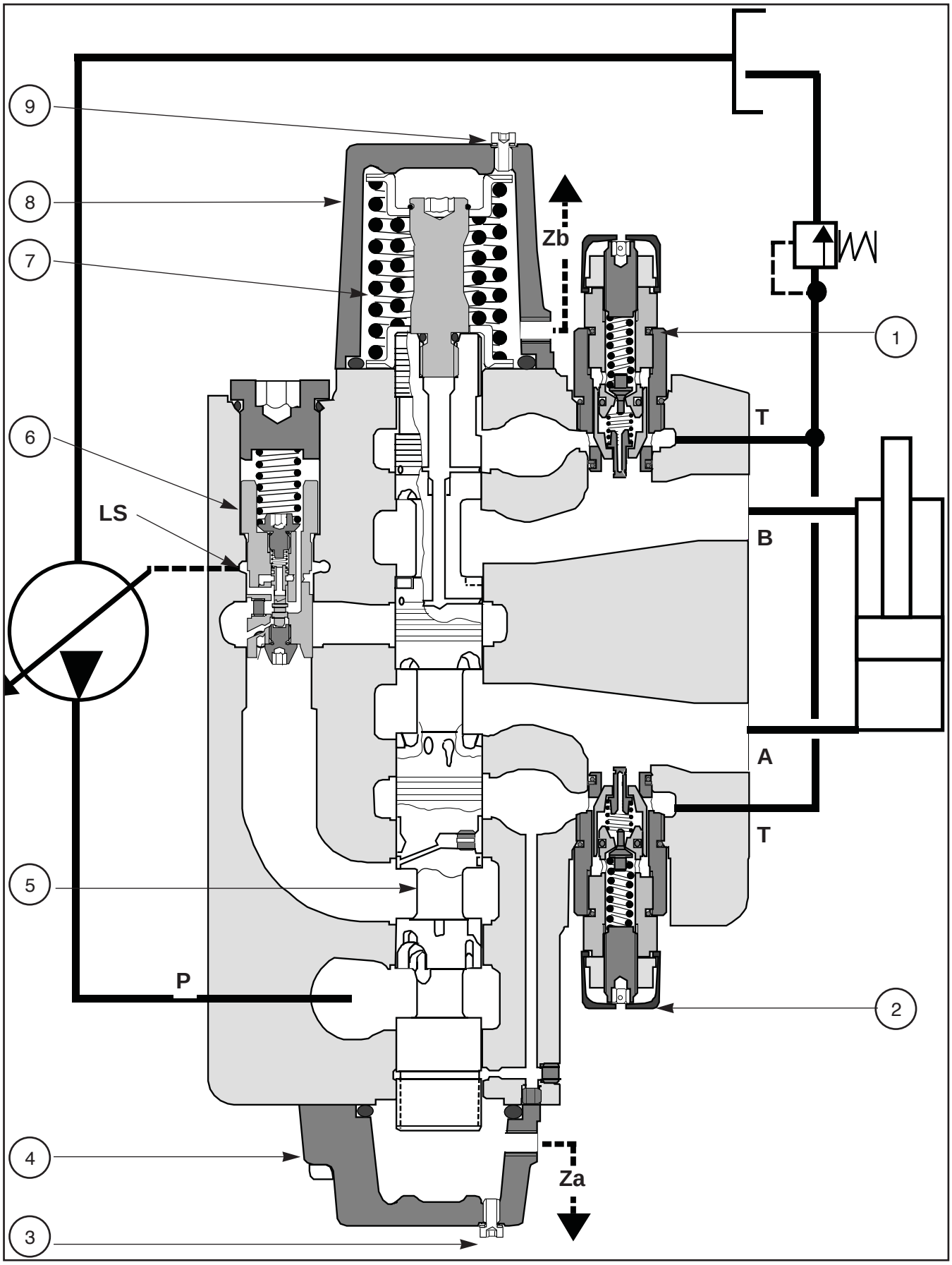
- It is in the form of a cartridge which includes:

1 - Seal and back-up ring
2 - Primary check-valve
3 - Primary check-valve seat
4 - Primary check-valve return spring
5 - Secondary check-valve seat
6 - Secondary check-valve
7 - Seals
8 - Pressure-setting spring
9 - Lock-nut
10 - Pressure-setting nut
11 - Protective cover



12/1488 ATTACHMENT FUNCTION

Control valve element



12/1488 ATTACHMENT FUNCTION

Control valve element

Purpose:

- Depending on the position of the spool, its purpose is to direct the fluid towards the cylinder and to allow its return to the hydraulic tank, or to block the feed and return ports of the cylinder when the spool is in the neutral position.

Description:

1 - Cylinder big chamber safety valve
2 - Cylinder small chamber safety valve
3 - Upper caps bleed screw
4 - Upper cap
5 - Element spool
6 - Pressure compensator and selector
7 - Return spring
8 - Rear cap
9 - Lower caps bleed screw

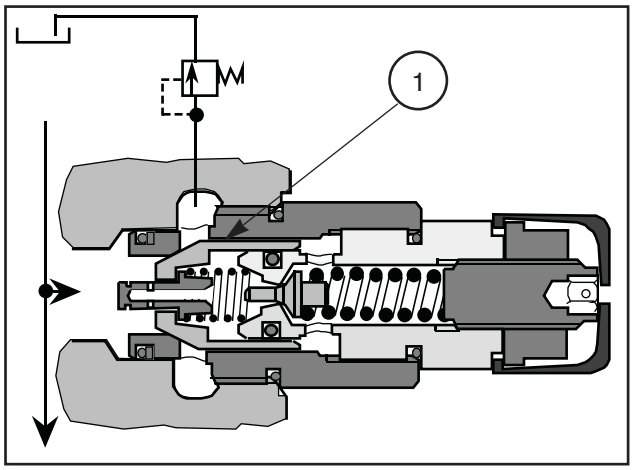
Identification of orifices:

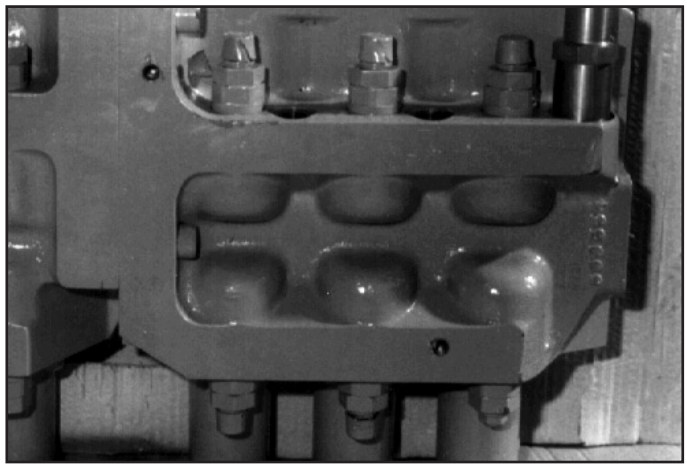
P - Inlet from variable flow pump bodies
T - Return to hydraulic tank passing through a **P10**
A - Feed to cylinder big chamber
B - Feed to cylinder small chamber
Za - Spool piloting (big chamber)
Zb - Spool piloting (small chamber)
LS - Load-Sensing valve information circuit

12/1488 ATTACHMENT FUNCTION

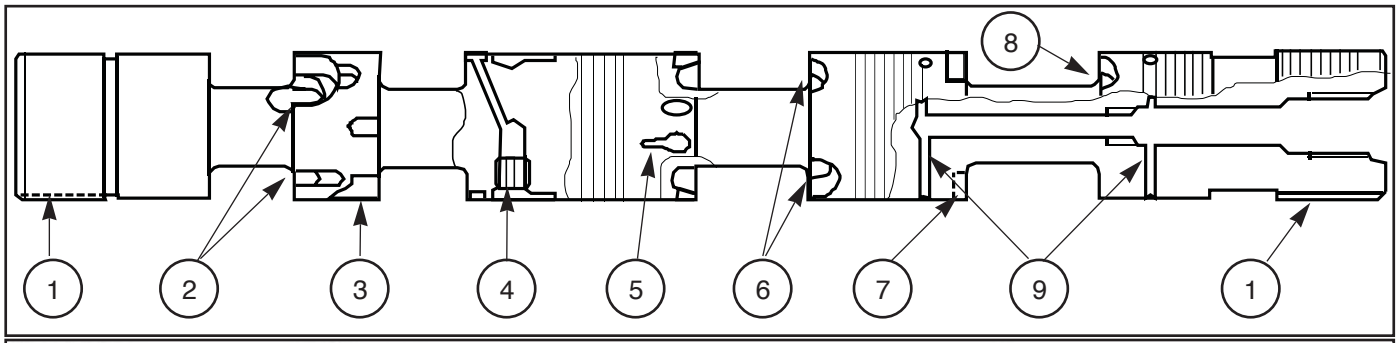
TECHNICAL DETAILS OF THE CONTROL VALVE ELEMENT

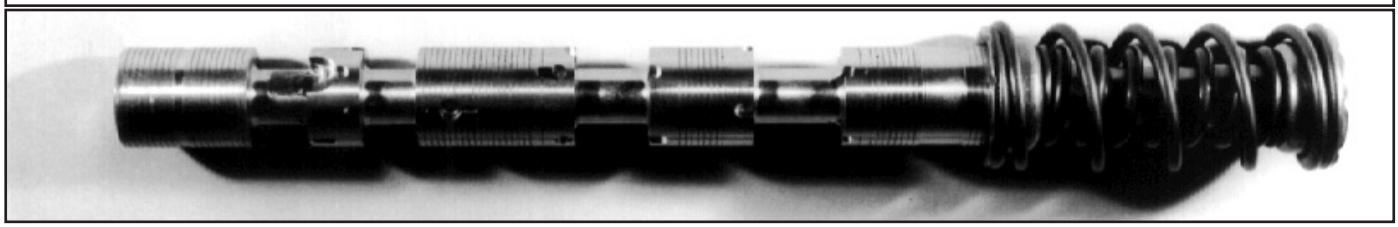
A) Safety valves





B) Control valve spool





12/1488 ATTACHMENT FUNCTION

ATTACHMENT/TRAVEL CONTROL VALVE BLOCK
CONTROL VALVE ELEMENT TECHNICAL DETAILS

A) Safety valves

They are identical to the relief valve and are screwed into each control valve element at each cylinder feed port.

Purpose:

- They protect the circuits between the control valve spool and the receiving component when the spool is placed in the rest position or in case of a shock when the spool is in neutral position.
- The primary check-valve 1 of each valve is used as force-feed valve.

B) The control valve spool

Gradual movement grooves function

2* - Big chamber feed
3* - Small chamber feed

* It is at these grooves that the pressure drop (ratio between flow and passage section) causes the Load-Sensing valve to operate.

5 - Cylinder big chamber return
6 - Cylinder big chamber feed
7 - Cylinder small chamber feed
8 - Cylinder small chamber return

Gradual movement grooves function

1 - Calibrated orifices for warming spool pilot circuits
4 - Inserted calibrated orifice for decompressing the circuit between the spool and the compensator when the spool is at rest.
9 - Calibrated orifices and internal passage for decompression between the pressure compensator and the spool.

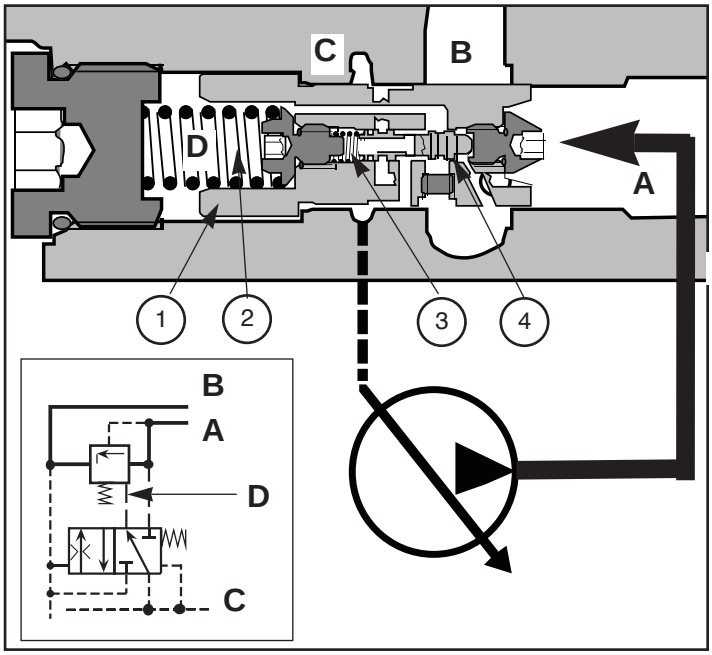
12/1488 ATTACHMENT FUNCTION

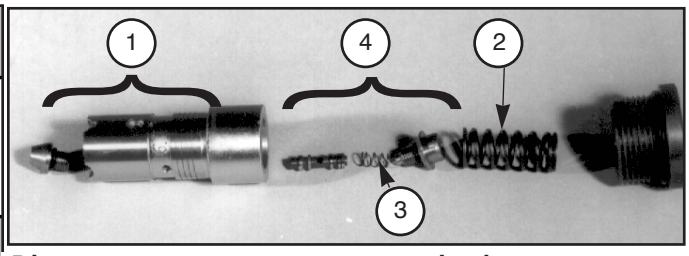
TECHNICAL DETAILS OF THE CONTROL VALVE ELEMENT

C) The pressure compensator and selector

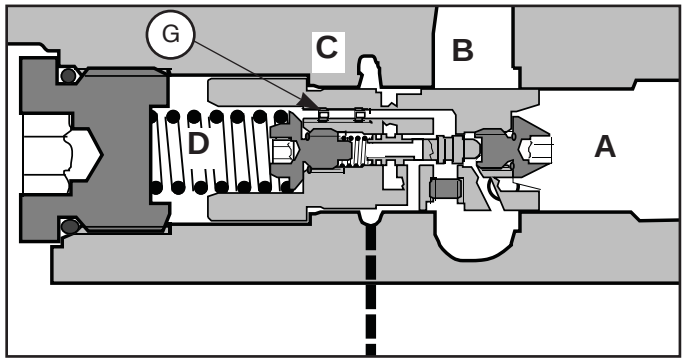
It is an assembly mounted on each control valve element which includes :

1 - Pressure compensator
4 - Pressure selector





Dipper pressure compensator and selector



Pressure compensator 1
Purpose:

- It is the load check valve.
- It provide independant of functions whatever resistances of functions
- It provide proportionnal flow of all functions ever the pump flowis lever of demand

Pressure selecteurr 4
Purpose:

- It selects the highest pressure out of five receiving components (the attachment cylinders and the travel motors) and transmits it to the L.S. valve of the pump (spring side).

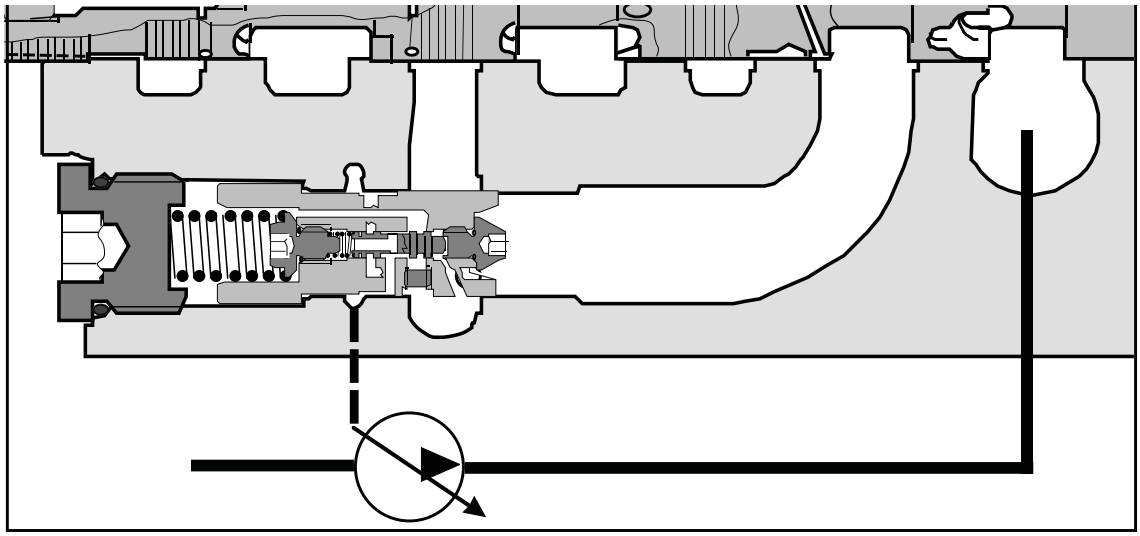
Description:

2 - Pressure compensator spring
3 - Pressure selector spring
A - Inlet from pump flow and compensator pilot (side without spring)
B - Flow outlet to receiving component and pressure selector pilot.
C - L.S. information outlet
D - Pressure compensator pilot (spring side)

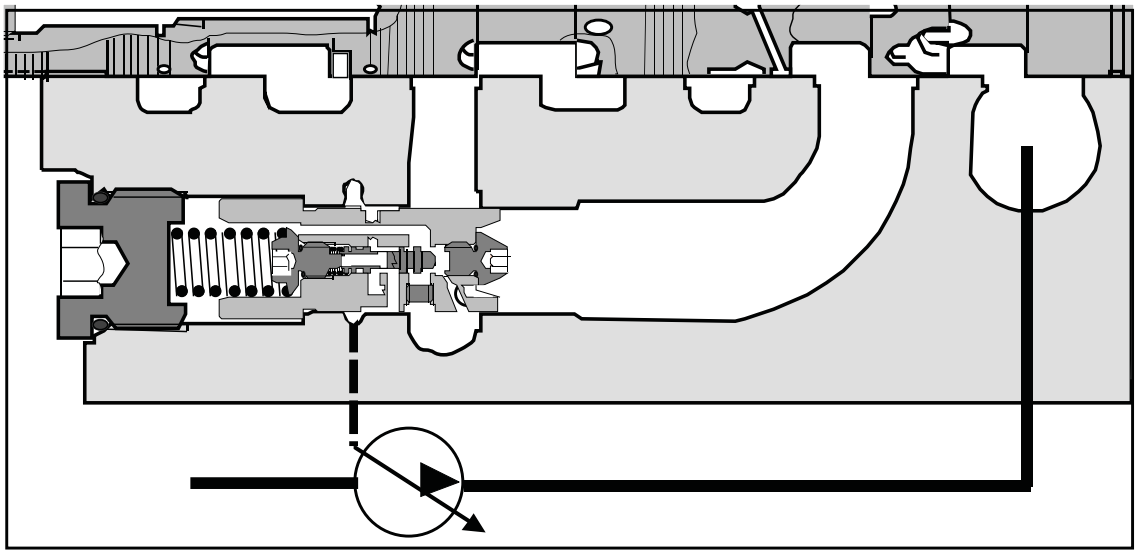
12/1488 ATTACHMENT FUNCTION

The pressure compensator and selector
(FOR FUNCTION : SEE CHAPTER **8D**)

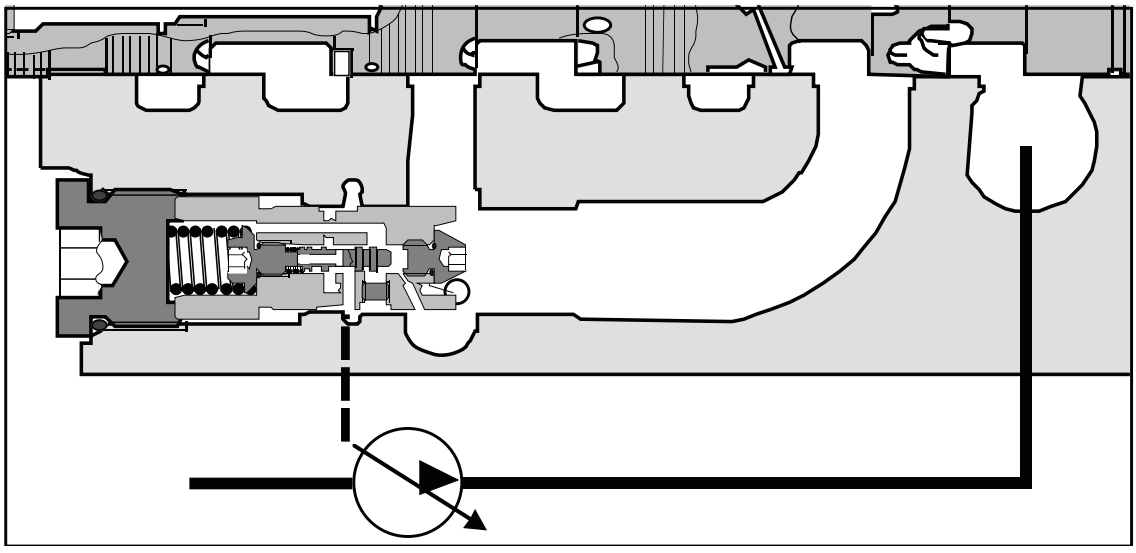
PHASE 1 : neutral position



PHASE 2 : selecteur working position



PHASE 3 : pressure selector working position



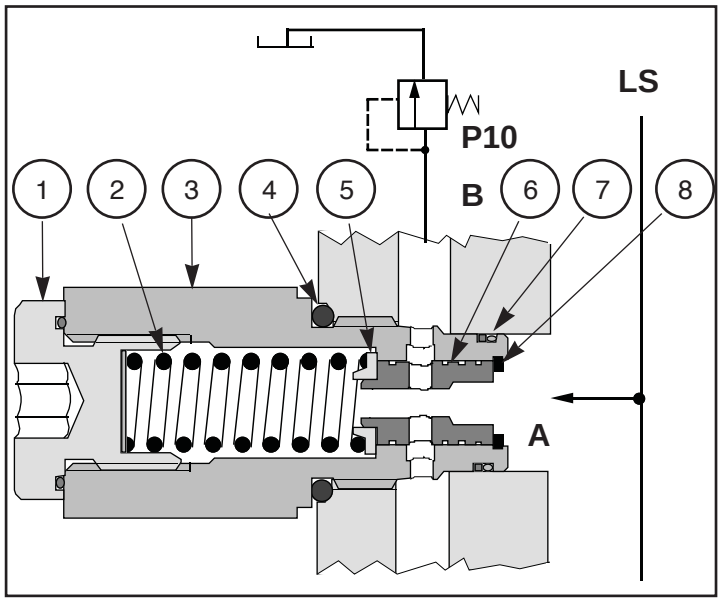
12/1488 ATTACHMENT FUNCTION

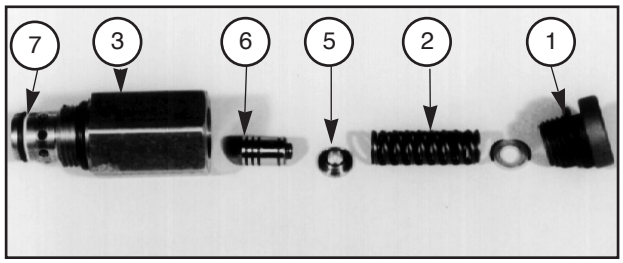
TECHNICAL DETAILS OF THE CONTROL VALVE ELEMENT

Control valve element technical details (continued)

D) L.S. information decompression selector block

- It is screwed into the control valve block between the travel spools (big caps side)





Purpose :

- It enables the L.S. valve information circuit to be decompressed (spring side) as soon as the various controls are no longer activated.

Description

1 - Plug
2 - Pre-set spring
3 - Cartridge
4 - Seal
5 - Spring guide
6 - Spool
7 - Seal and back-up ring
8 - Locking ring

Identification of orifices

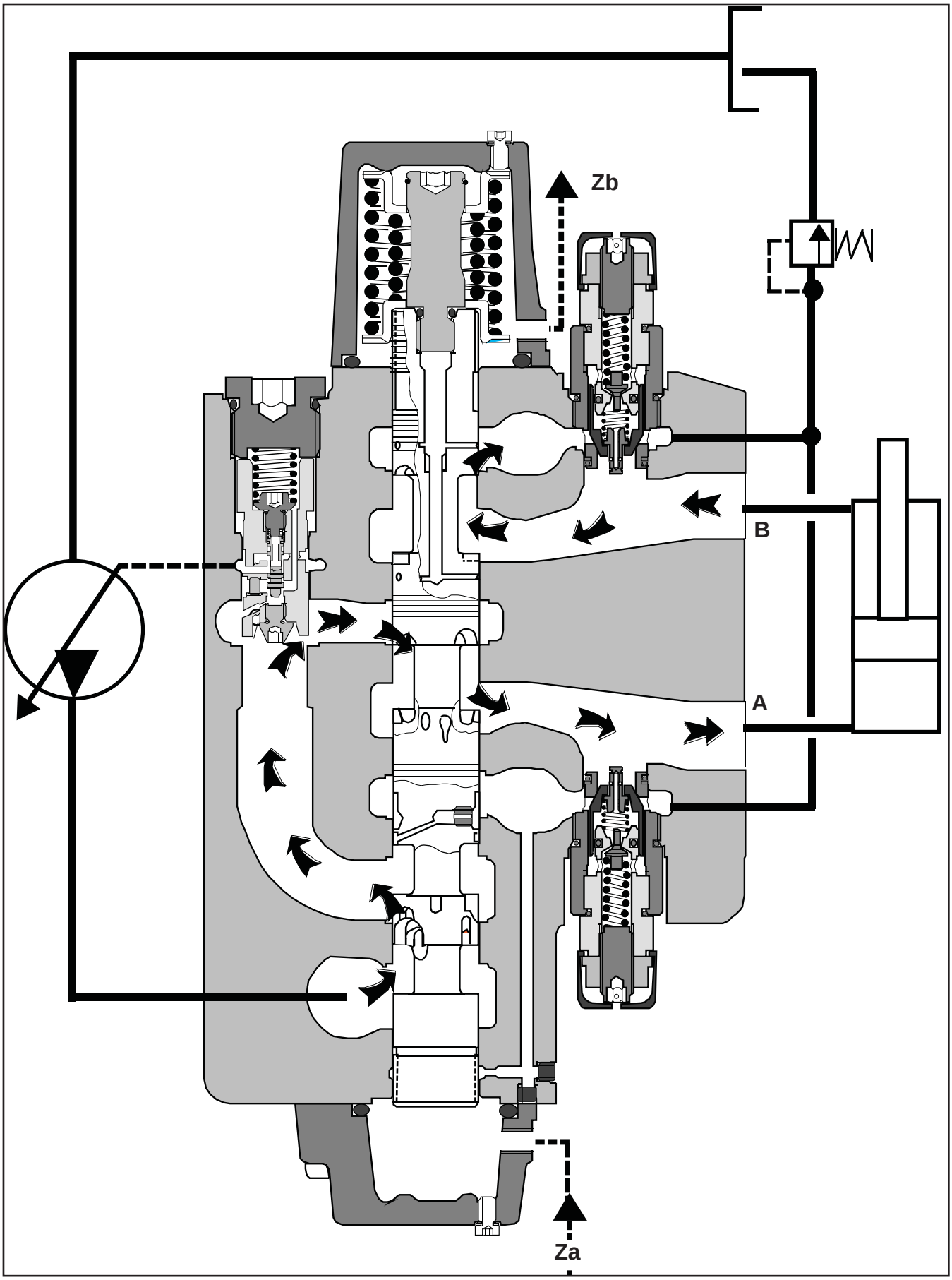
A - L.S. pressure inlet coming from control valve elements
B - Return to the control valve force-feed manifold (P10)

Operation :

- In the rest position the force of spring **2** holds spool **6** against locking ring **8**. This enables **A** to communicate with **B** and to pressurize the **L.S**. information circuit at **P10** pressure.
- As soon as the **L.S.** manifold is connected to the receiving component feed, the flow in **A** causes a pressure drop, which produces a hydraulic force on the front of the spool which is greater than that of spring **2.** The spool moves back and cuts off communication between **A** and **B.**

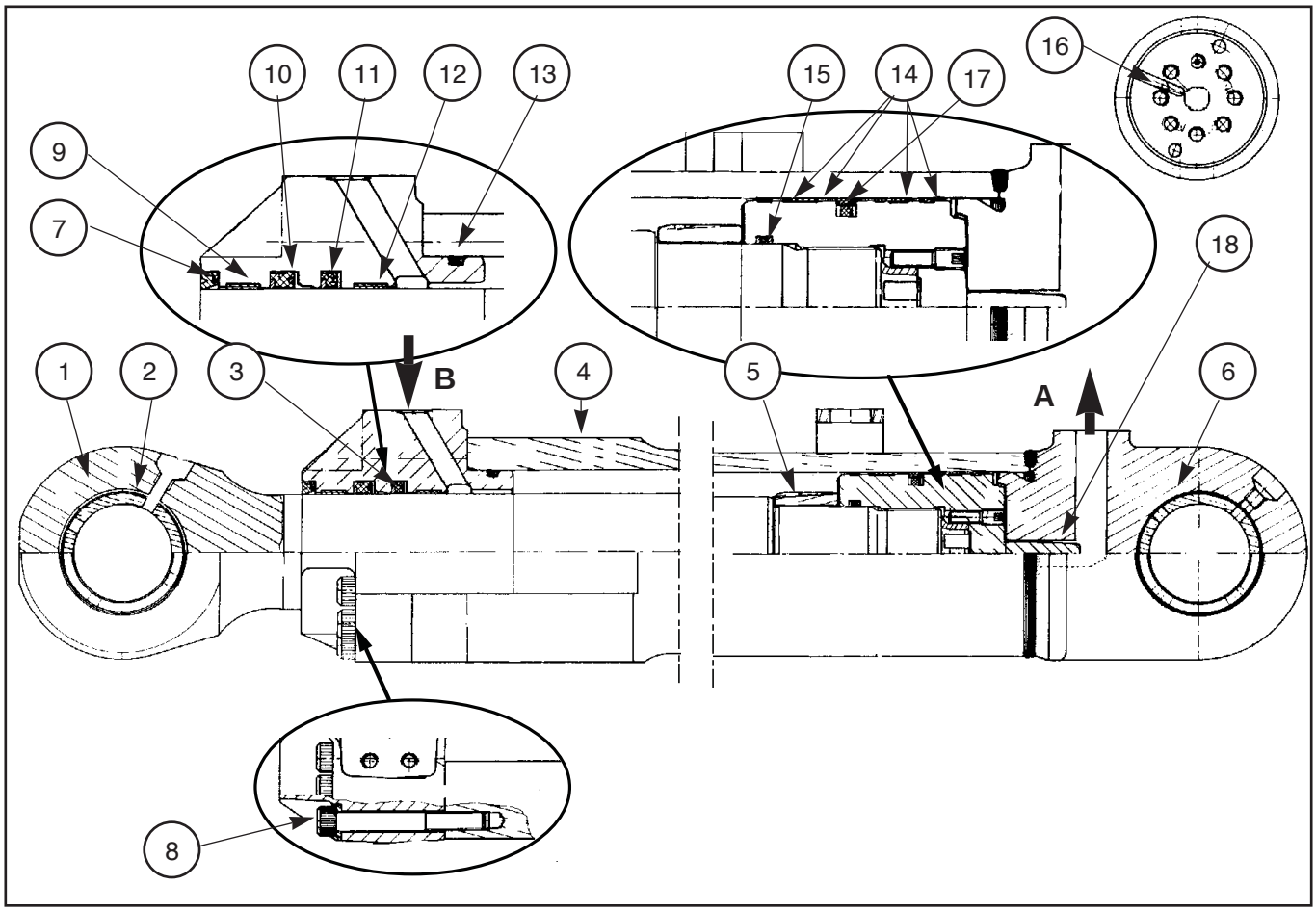
12/1488 ATTACHMENT FUNCTION

Feed circuit for a receiving component through a control valve



12/1488 ATTACHMENT FUNCTION

CYLINDERS



12/1488 ATTACHMENT FUNCTION

CYLINDERS

Purpose

- They produce the movements of the boom, dipper and bucket
- They are fitted with an end-of-stroke dash-pot shock absorber:
  - . Boom and dipper cylinders: on cylinder extend and retract
  - . Bucket cylinder: on cylinder extend

Description

1 - Cyl. rod
2 - Bushing
3 - Gland
4 - Barrel
5 - Piston w/dash-pot
6 - Bushing
7 - Scraper ring
8 - Retaining screws - gland/barrel
9 - Support ring
10 - Single-action seal
11 - Anti-siphon seal
12 - Support ring
13 - Seal
14 - Support ring
15 - Seal
16 - Bronze insert
17 - Double-action seal
18 - Dash-pot

Dash-pot operation at cylinder retract (boom and dipper cylinders)

- Feed to cylinder small chamber via orifice **B**.
- Return flow from big chamber via orifice **A**.
- When the piston is almost at the end of its stroke, the piston dash-pot “tail” (**18**) reduces the section of orifice **A**, thereby decreasing the
  amount of oil which is expelled and thus decreasing the retraction speed of the cylinder.

Dash-pot operation at cylinder extend

- The big chamber is fed via orifice **A**.
- Return flow from small chamber via orifice **B**.
- When the piston reaches the level of orifice **B**, it reduces the section of orifice **B**, thereby decreasing the amount of oil which is expelled and thus decreasing the extension speed of the cylinder.

12/1488 ATTACHMENT FUNCTION

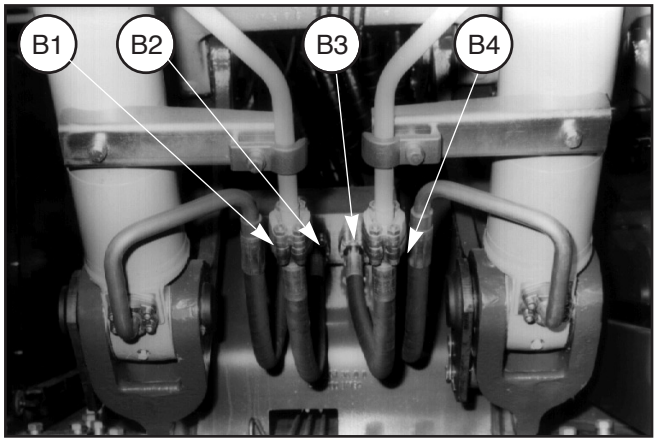
FLOW LIMITERS ON BOOM AND DIPPER CYLINDERS

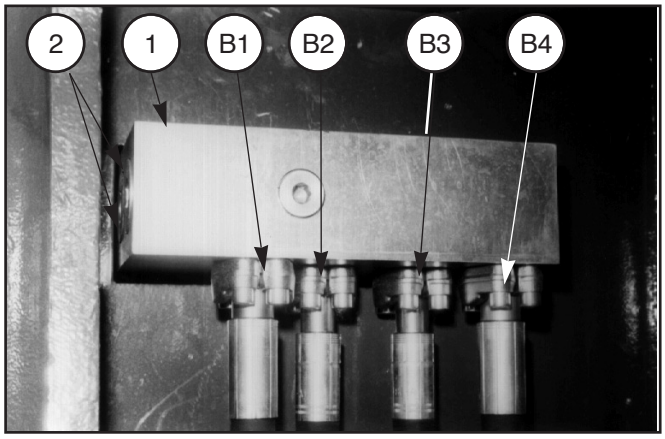
Purpose

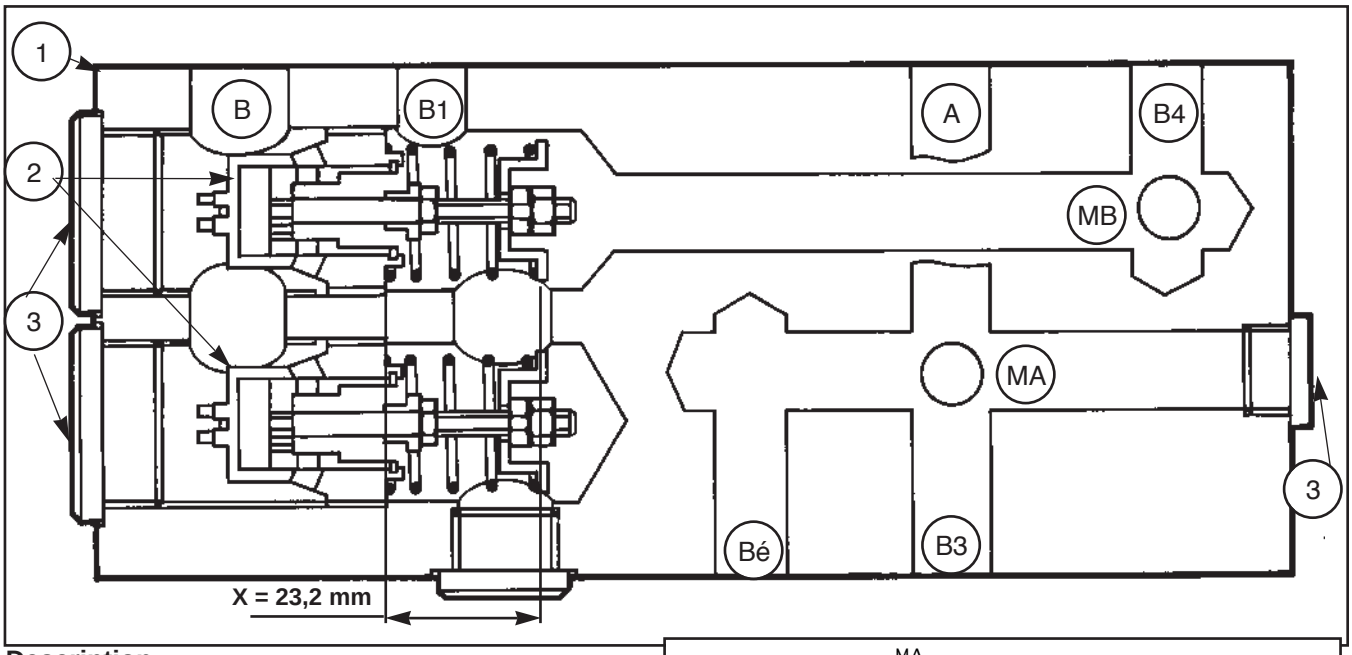
- They control the speed of the return flow from the boom cylinder big chambers and the dipper cylinder small chamber.

Boom cylinders flow limiter

- It is screwed into the boom cylinders feed union block, on the upper structure support bracket.





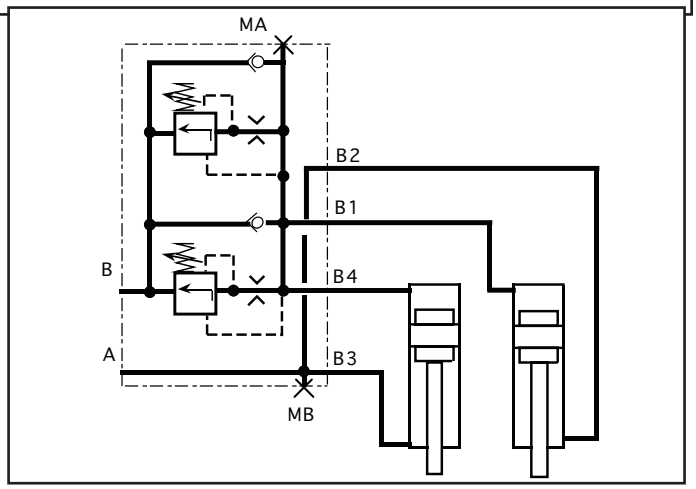


Description :

1 - Feed block
2 - Flow limiters (2)
3 - Plugs

Identification of orifices

A - Feed to boom cylinders small chambers
B - Feed to boom cylinders big chambers
B1-B4 - To boom cylinders big chambers
B2-B3 - To boom cylinders small chambers
MA-MB- Plugs (pressure test point eventyally)

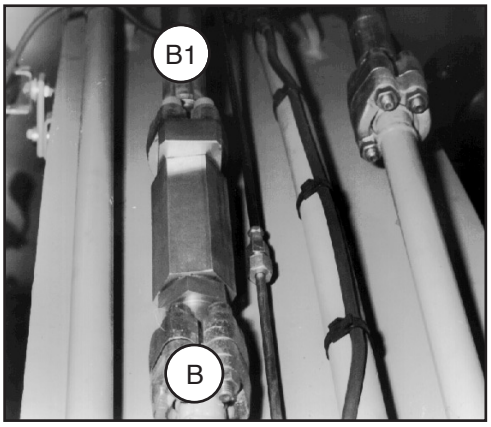


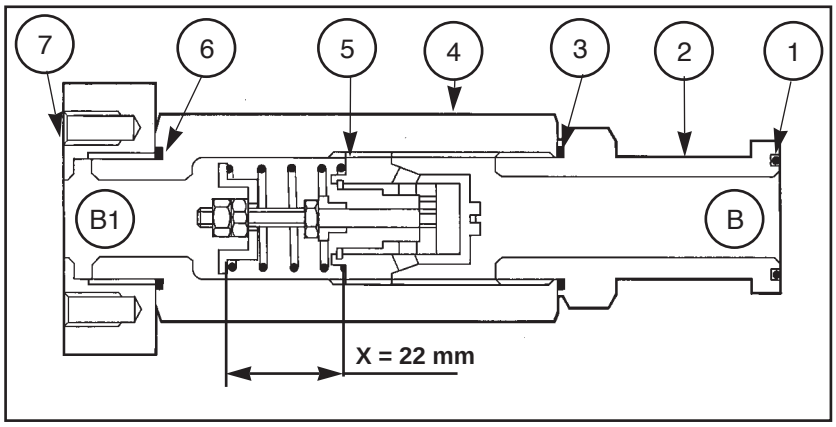
12/1488 ATTACHMENT FUNCTION

FLOW LIMITERS ON BOOM AND DIPPER CYLINDERS

Dipper cylinders flow limiter

- It is fitted on the feed piping for the dipper cylinder small chamber

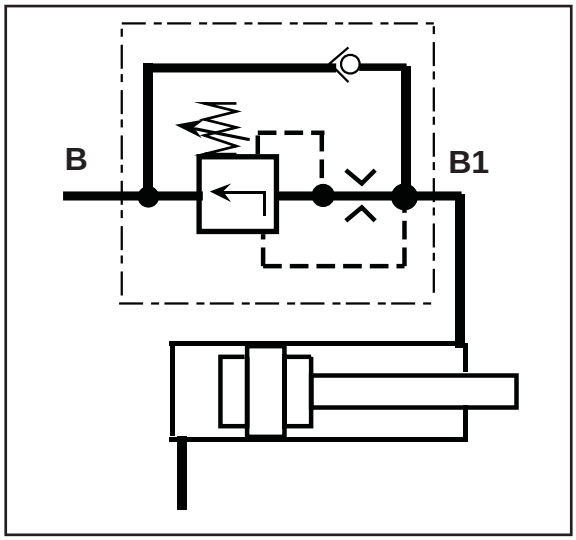




Description

1 - Seal
2 - ORFS union
3 - Seal
4 - Body
5 - Flow limiter
6 - Body
7 - Union with clamp

Note : Flow limiter **5** is fitted into body **1** using oil-tight locking threads



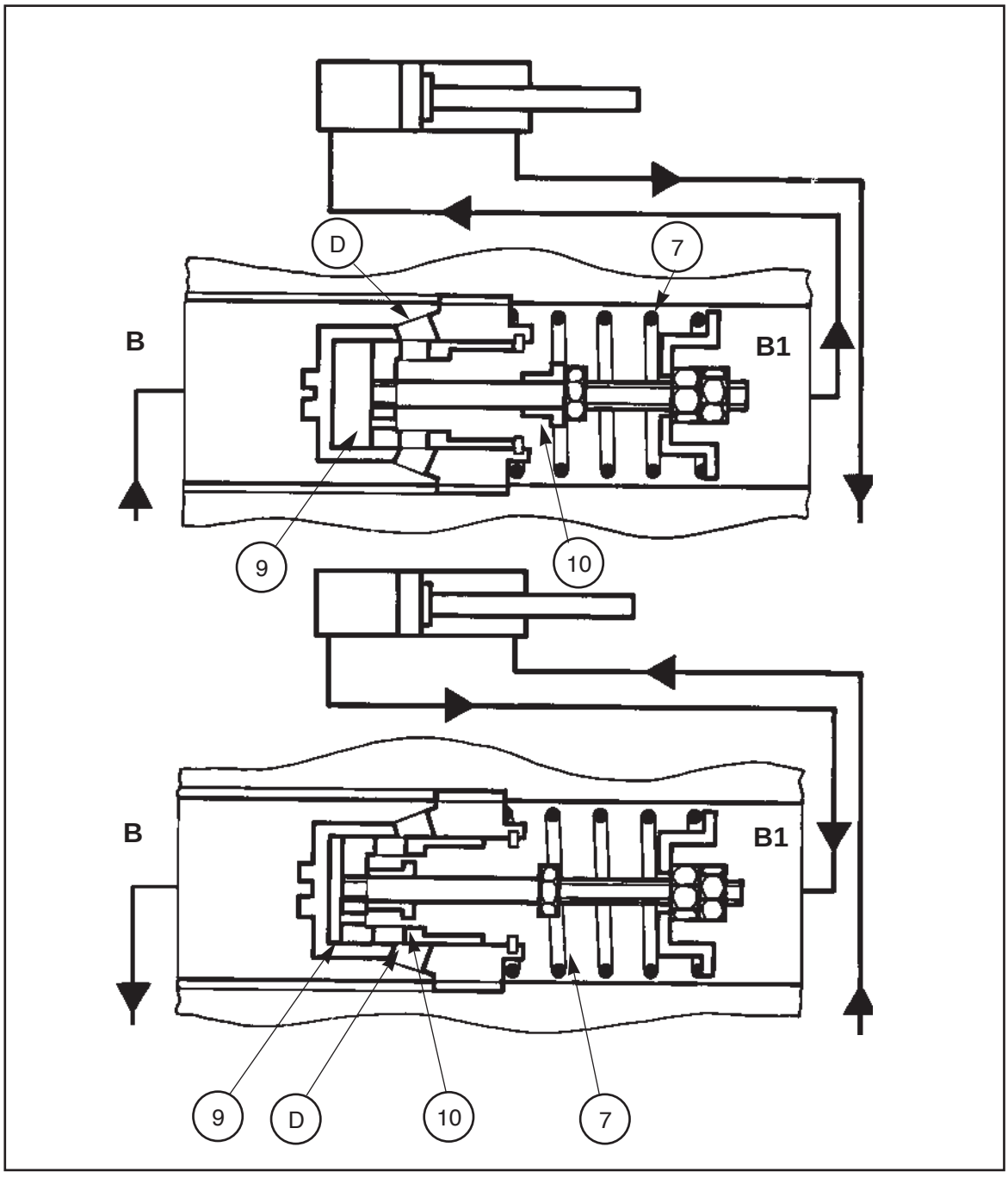
Identification of orifices

B - Dipper cylinder small chamber feed
B1 - To dipper cylinder small chamber

The flow limiters are adjustable. To function correctly they should be :
Dimension X = 23,2 mm for the boom and 22 mm for the dipper.

12/1488 ATTACHMENT FUNCTION

FLOW LIMITERS ON BOOM AND DIPPER CYLINDERS



12/1488 ATTACHMENT FUNCTION

FLOW LIMITERS ON BOOM AND DIPPER CYLINDERS

Working principle (example using boom cylinder feed)

a) Feed to boom cylinders big chambers

Oil from the control valve arrives at **B** and passes through the flow limiter valve via orifice **D**.
Piston **8** is held against the stop by the direction of flow of the oil.
The oil is fed to the cylinder big chambers.
The force of spring **7** holds the spool in the fully open position, in spite of the difference in force in front of and behind spool **9**.
The small chamber is emptied freely via the control valve.

b) Feed to boom cylinders small chambers (boom lowering speed limitation)

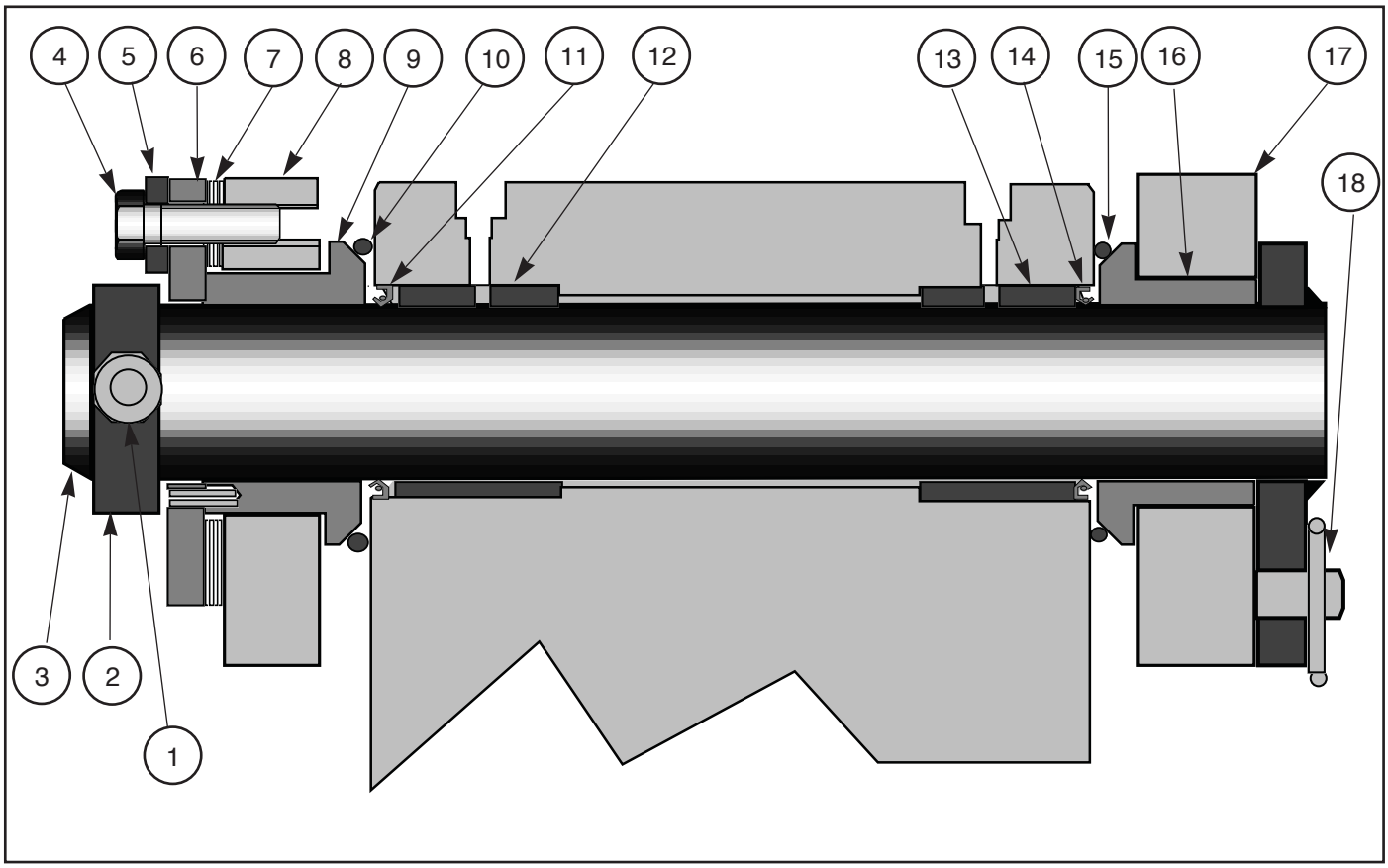
The cylinders' small chambers are fed directly via the control valve.
The oil which is expelled from the cylinders' big chambers arrives at **B1** and piston **8** is pushed to the end of spool **9**.
Spool **9** closes and reduces the section of passage **D**, which causes a decrease in the lowering speed of the boom.

The working principle is identical for the dipper, except that the flow limiter is connected to the cylinder small chamber and that it limits the dipper retraction speed (big chamber feed).

12/1488 ATTACHMENT FUNCTION

DIPPER- BUCKET JUNCTION ADJUSTEMENT

This junction is adjustable (by shims) to minimize the clearence dipper and bucket (maximum clearence **1** mm)



Description

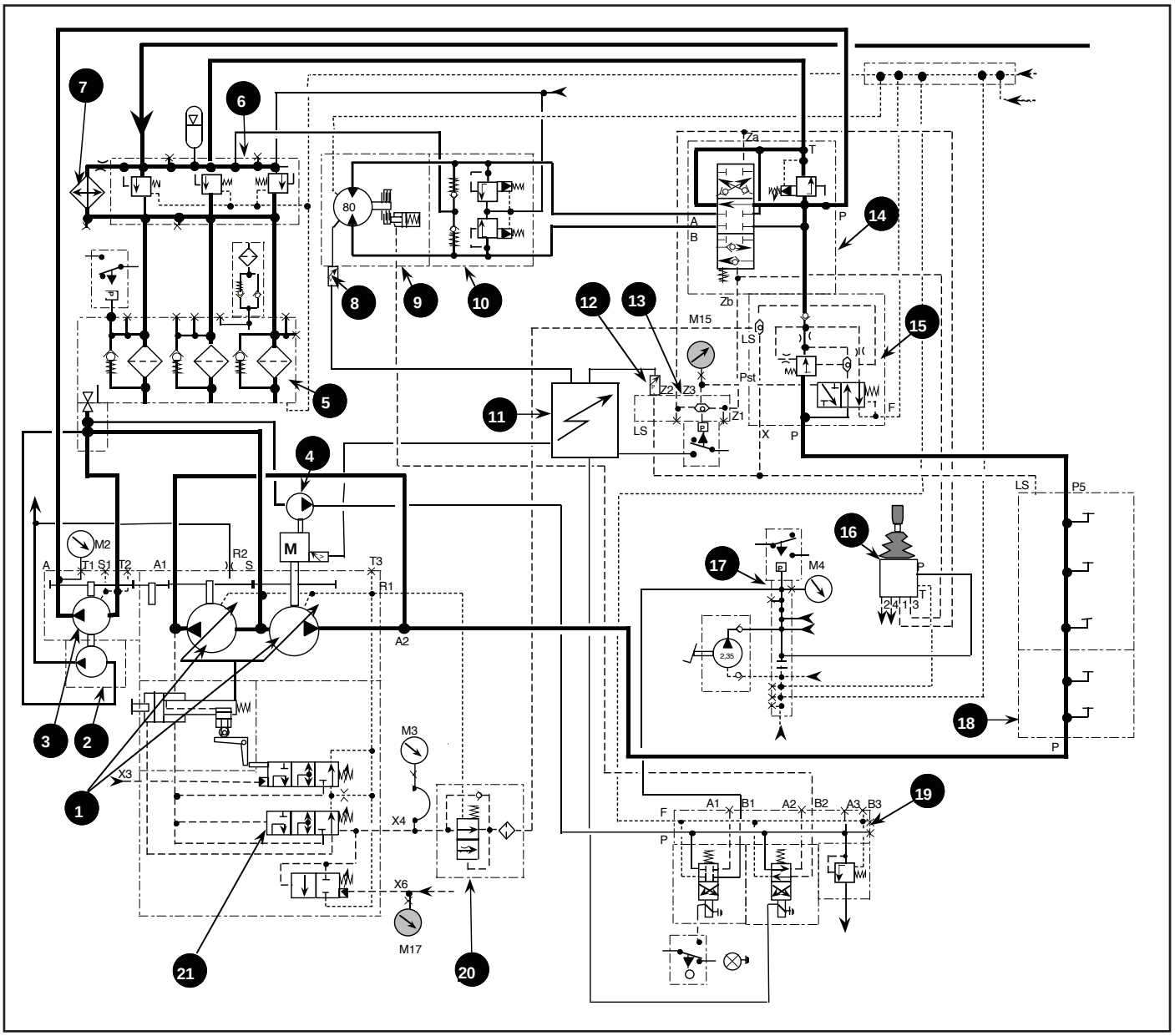
1	-	Bolt
2	-	Lock shim
3	-	Pin
4	-	Screw
5	-	Washer
6	-	Washer
7	-	Shims
8	-	Bucket
9	-	Bush
10	-	O ring
11	-	Seal
12	-	Dipper bushr
13	-	Dipper bush
14	-	Seal
15	-	O ringf
16	-	Bush
17	-	Bucket
18	-	Lock pin

12/1488 SWING FUNCTION

CONTENTS PAGE

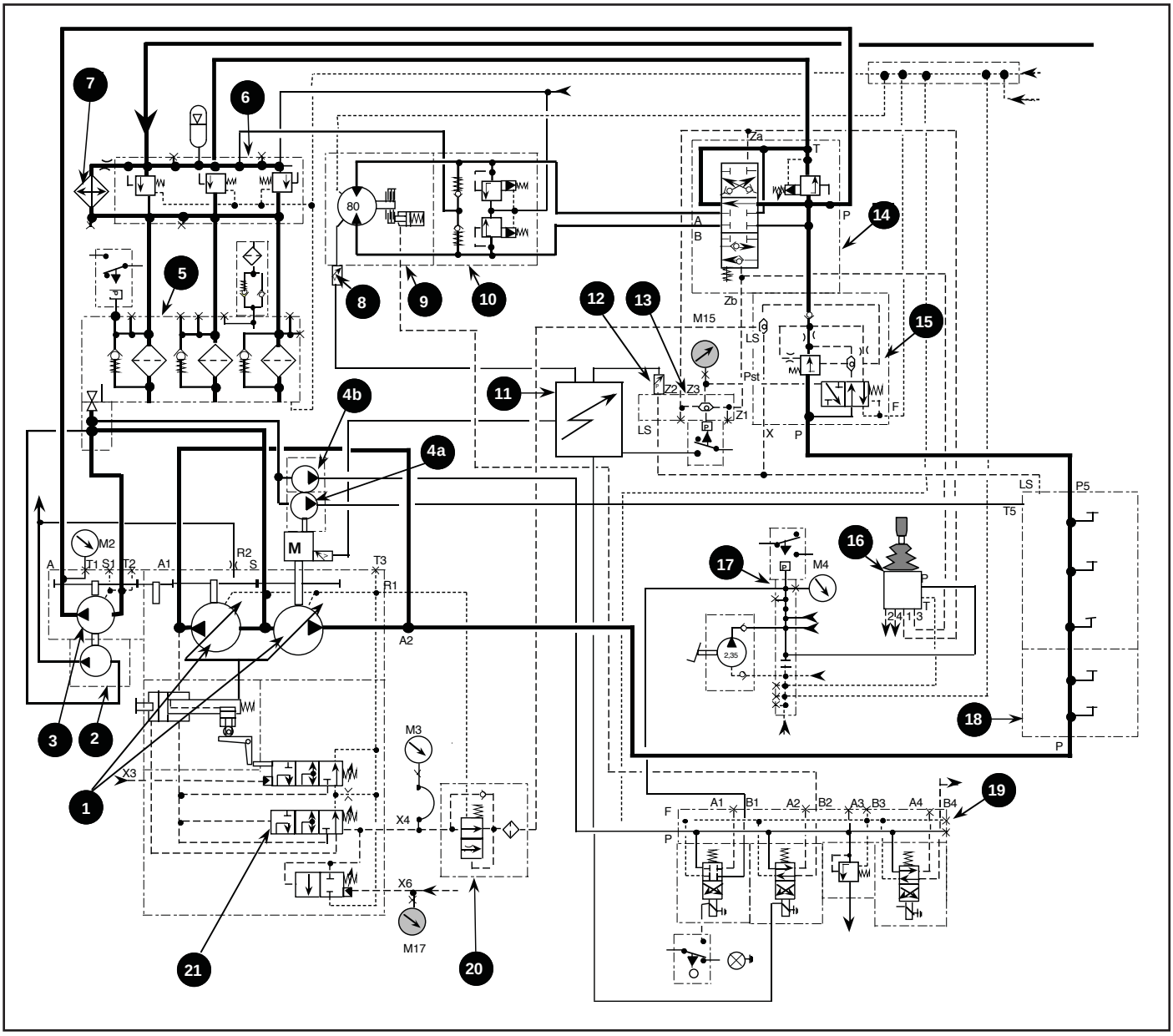
12/1488 SWING FUNCTION

1288 SWING FUNCTION HYDRAULIC DIAGRAM



12/1488 SWING FUNCTION

1488 SWING FUNCTION HYDRAULIC DIAGRAM



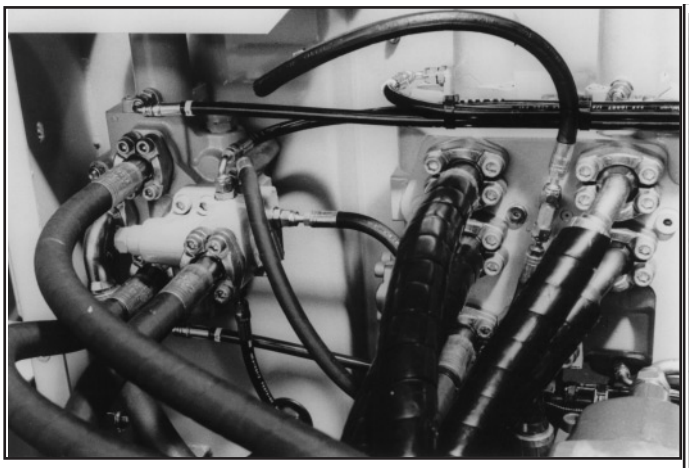
Description

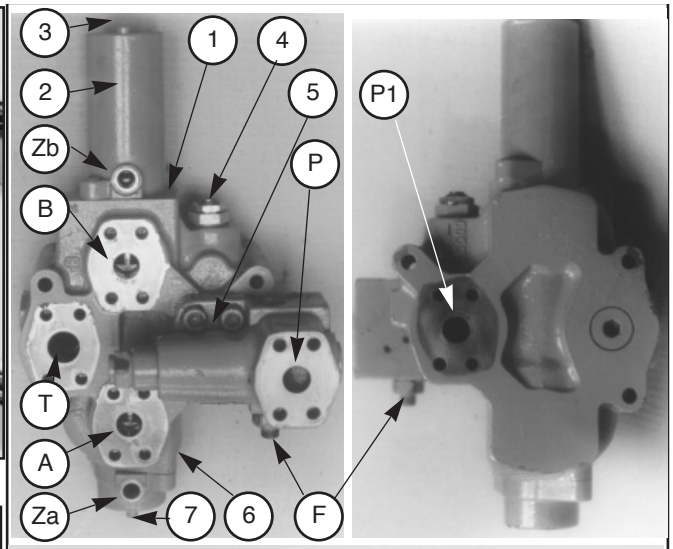
1	-	Attachment and travel pumps
2	-	Anti-cavitation pump
3	-	Swing pump
4	-	Power assistance pump
5	-	Hydraulic tank and filters
6	-	Counter-pressure block (3P10)
7	-	Oil cooler
8	-	Hydraulic swing motor electronic speed sensor
9	-	Hydraulic swing motor with static brake
10	-	Safety/anti-cavitation block
11	-	Electronic control block
12	-	Swing pilot circuit pressure captor
13	-	Swing pilot circuits pressure selector
14	-	Swing control valve
15	-	Selector/Reinjection flow limiter
16	-	Control lever (Swing/dipper)
17	-	Supply block
18	-	Attachments/travel control valve blocks
19	-	Solenoid-actuated control valve
20	-	L-S valve anti-pumping block

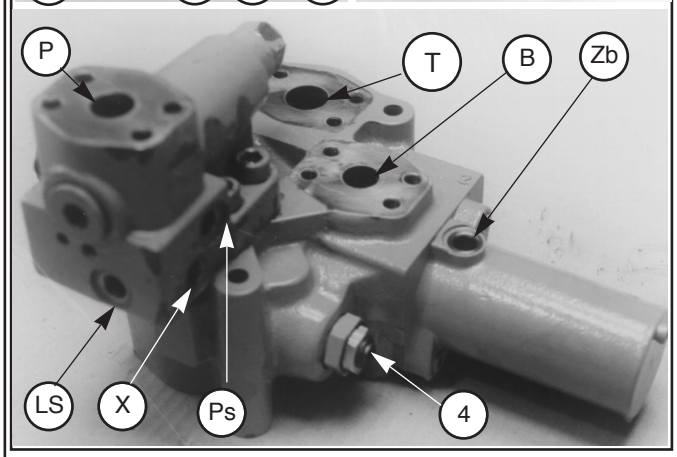
This chapter deals, in order, with components 14, 15, 13, 10, 9. The other components have been dealt with in the preceding chapters

12/1488 SWING FUNCTION

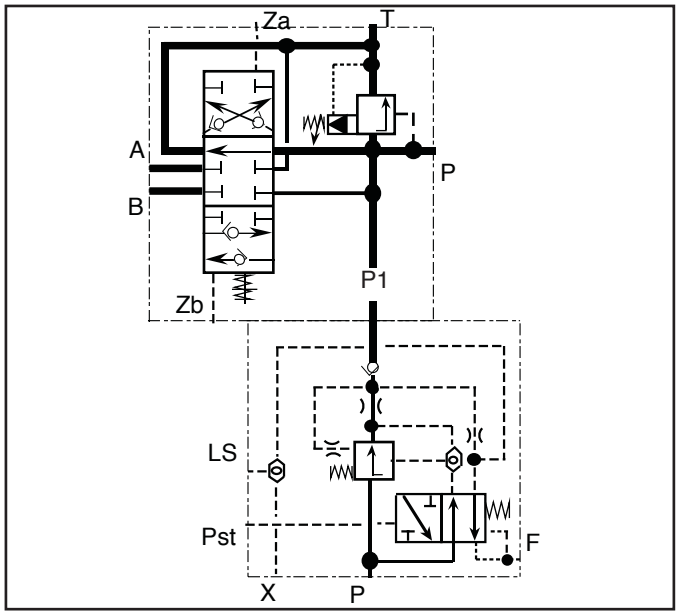
SWING CONTROL VALVE BLOCK







Swing control valve block shown in hydraulic



- It is attached to the control valve wall
- It consists of a one-piece control valve, with a single element of parallel, open centre design
- The spool is piloted by low pressure
- It feeds the hydraulic swing motor
- It is fed by the fixed displacement piston pump and by a partial flow coming from the variable displacement pumps. This partial flow is in relation to the swing control valve pilot spool pressure (max. flow : **100 l/min**).

-A raised block is attached to the valve by screws, consisting of a selector and a flow limiter (balance).

Description

1 - One-piece control valve
2 - Upper cap
3 - Bleed screw
4 - Relief valve
5 - Selector/Flow limiter block
6 - Lower cap
7 - Bleed screw

Orifice identification:

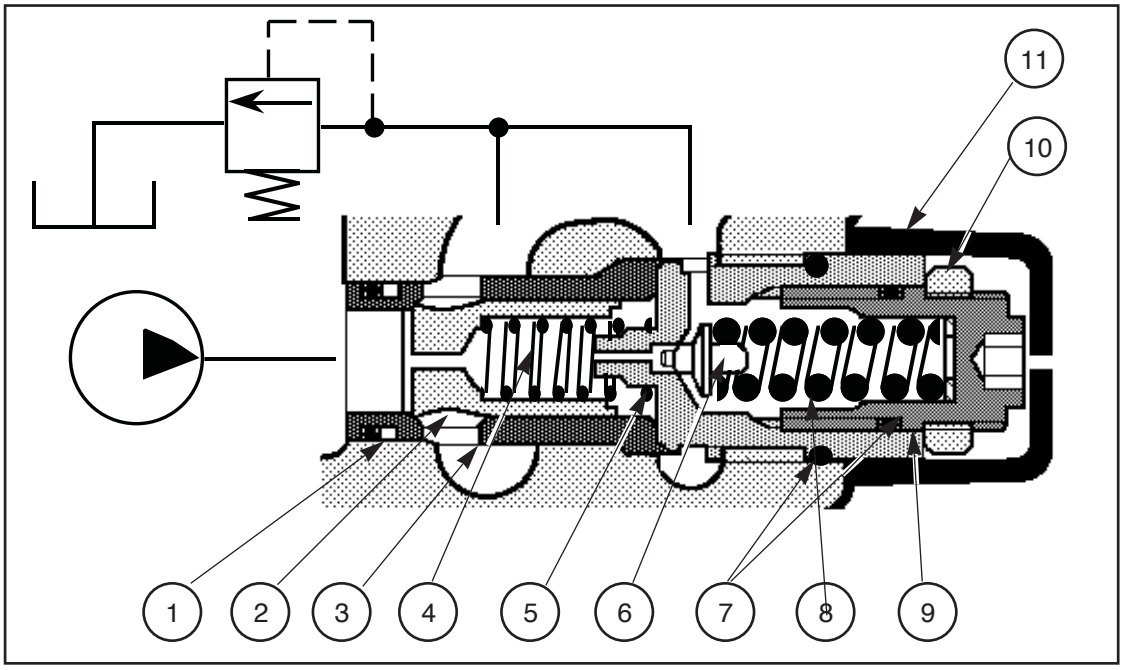
L-S - Pressure selector pressure port to L-S valve
P1 - From fixed-flow pump
T - Return towards one of the counter-pressure valves (P10)
A - Feed to hydraulic motor (left-hand swing)
B - Feed to hydraulic motor (right-hand swing)
Zb - Spool piloting forright hand swing
P - Partial flow inlet, coming from variable flow pumps and passing through the attachments/travel control valves block
F - Leak return from selector to hydraulic tank
Za - Spool piloting for left-hand swing
Pst - Selector piloting
X - Information inlet from L-S circuit of attachments/travel control valves block

12/1488 SWING FUNCTION

SWING CONTROL VALVE BLOCKSWING CONTROL VALVE BLOCK
Relief Valve

Function :

- Helps the safety valve concerned to discharge the flow during a counter-rotation



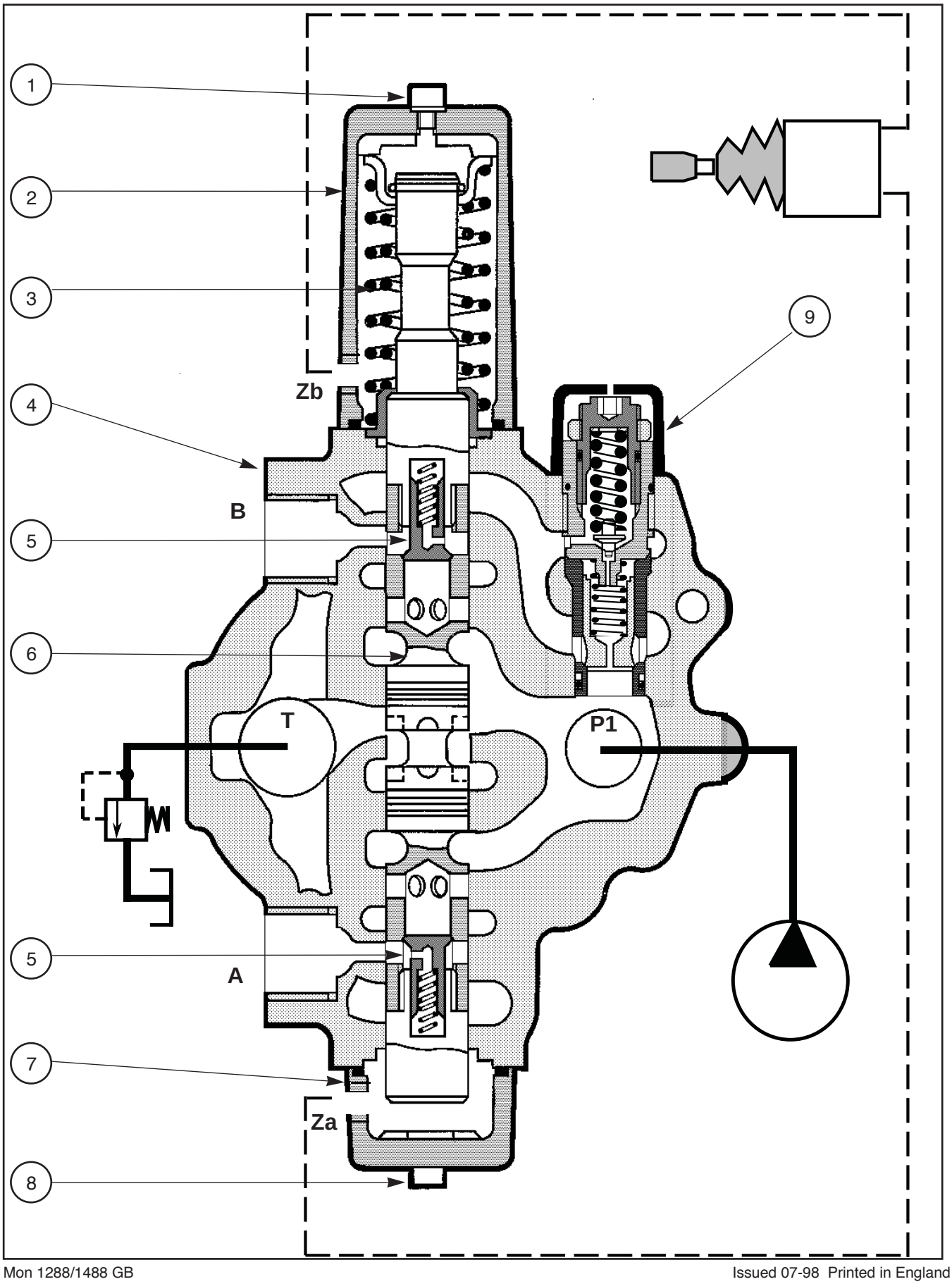
Description :

-The valve is in the form of a cartridge which includes:

1 - Seal and back-up ring
2 - Main check valve
3 - Main check valve seat
4 - Main check valve return spring
5 - Secondary check valve seat
6 - Secondary check valve
7 - Seal
8 - Pressure setting spring
9 - Lock-nut
10 - Pressure setting nut
11 - Protective cap

12/1488 SWING FUNCTION

CONTROL VALVE ELEMENT



12/1488 SWING FUNCTION

SWING CONTROL VALVE BLOCK
Control Valve Element

Function:

- Depending on the position of the spool, the control valve feeds the hydraulic fluid to the hydraulic swing motor, directs the return fluid back to the tank or blocks the motor feed and return orifices when the spool is in the neutral position.

Description :

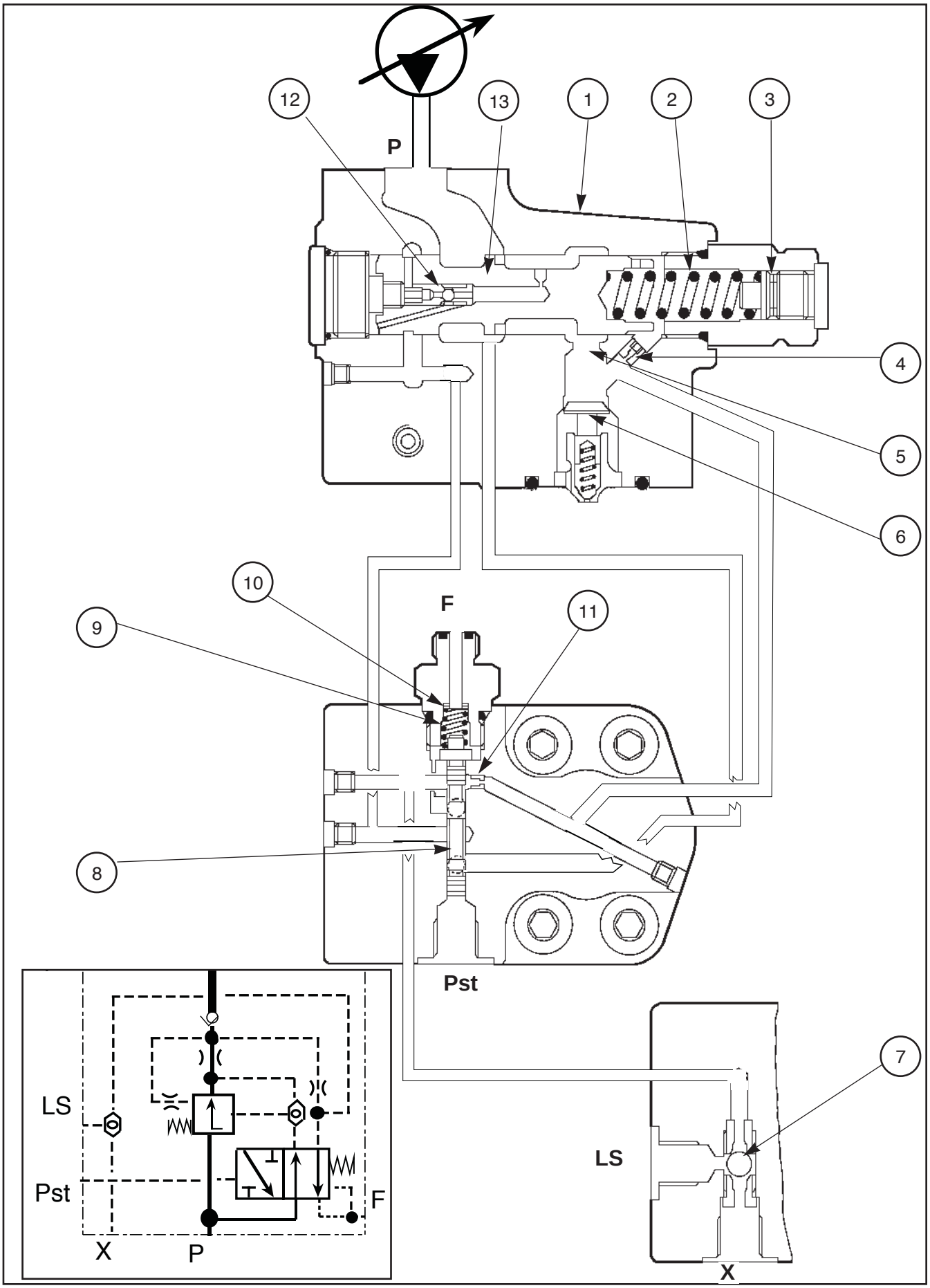
1 - Upper cap bleed screw
2 - Upper cap
3 - Spool return springs
4 - Control valve element body
5 - One-way valves
6 - Control spool
7 - Lower cap
8 - Lower cap bleed screw
9 - Relief valve

Orifice identification:

P - From pump
T - Return to tank, passing through a P10
A - Feed to hydraulic motor (left-hand swing)
B - Feed to hydraulic motor(right-hand swing)
Za - Spool piloting (left-hand swing)
Zb - Spool piloting (right-hand swing)

Function of the one-way valves 5 :

-The control valve element has an open centre and negative overlap.
When the excavator is working on an incline and there is slippage at the control valve spool, the one-way valve prevents slipping of the
upper structure.



12/1488 SWING FUNCTION

SELECTOR/FLOW LIMITER

It has a flange and is attached to the swing control valve. It consists of a balance spool and a selector.

Function:

-It regulates and allows a flow of **100 l/min**, coming from the variable displacement pumps, to feed the hydraulic swing motor in conjunction
with the flow from the fixed displacement pump.

-This is possible when the pilot pressure, acting at the same time on both the control valve element spool and on the selector, is equal to 20 bar.

Description:

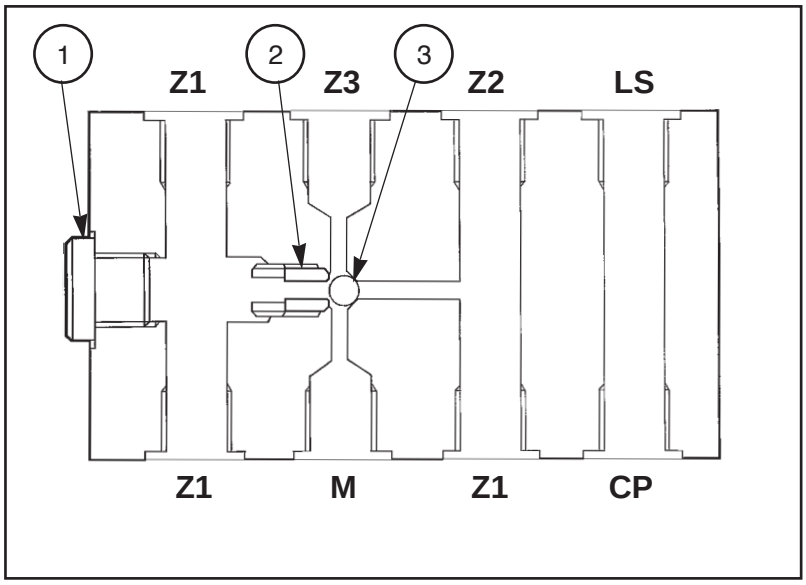
1 - Block
2 - Balance spring
3 - Balance adjustment shims
4 - Jet (Ø : **0,8 mm**)
5 - Load loss(Ø : **9 mm**)
6 - On-way check valve
7 - Pressure selector
8 - Deselection spool
9 - Pressure selector
10 - Schims
11 - Jet (Ø : **0,8 mm**)
12 - Pressure selector
13 - Balance spool

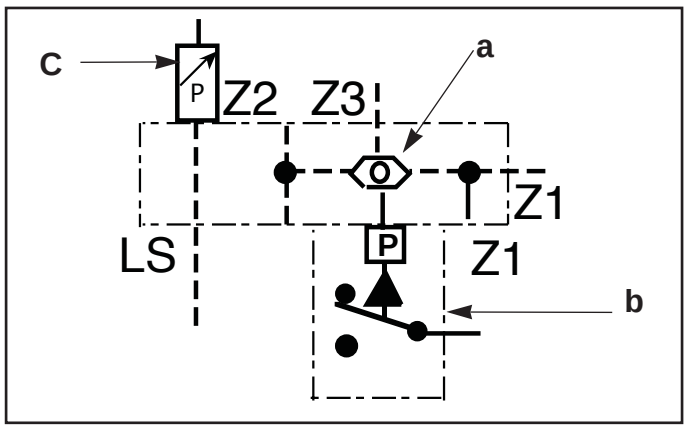
Orifice identification:

L-S - Pressure selector pressure port to L-S valve
P - Partial flow inlet, coming from the variable flow pumps via the attachments/travel control valves block
F - Leak return from selector to tank
Pst - Selector piloting
X - Information from L-S circuit coming from attachments/travel control valves block.

12/1488 SWING FUNCTION

PRESSURE SELECTOR BLOCK





12/1488 SWING FUNCTION

PRESSURE SELECTOR BLOCK

- It is attached under the roof of the cab
- It consists of:
  - a) a pressure selector
  - b) a pressure switch
  - c) a pressure sensor

Function:

- Using the components mentioned above, it enables:
  - Via the pressure selector:**a**
    the selector mounted on the control valve to be piloted, so as to reinject flow into the swing function
  - Via the pressure switch **b**:
    Swing brake and swing brake release functions to be optimised
    it gives informations to the electronic control box for the **auto- idle** function
  - Via the pressure sensor **c**:
    high idle to be reselected, when AUTO-IDLE mode has been selected
  - **for a two-speed excavator**, speed to be changed automatically as a result of a pressure value communicated by the L-S unit

Description:

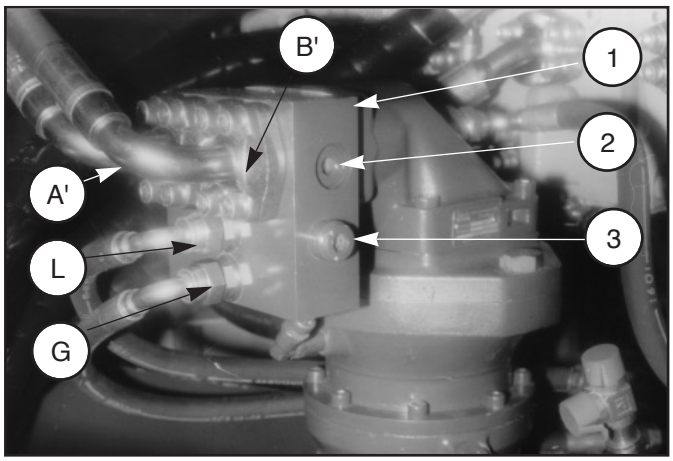
1 - Cap
2 - Pressure selector seat insert
3 - Pressure selector ball

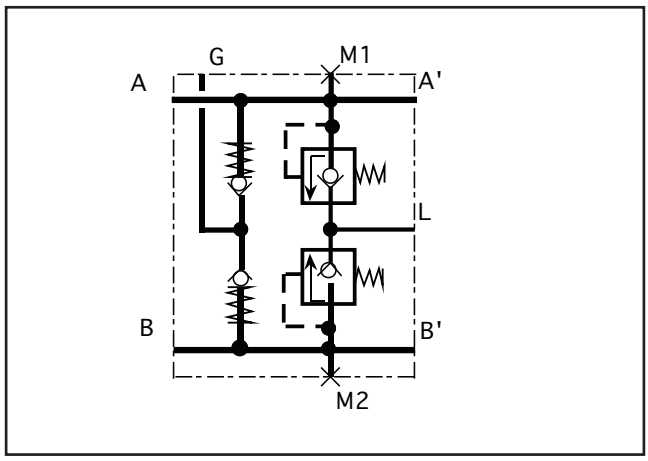
Orifice identification

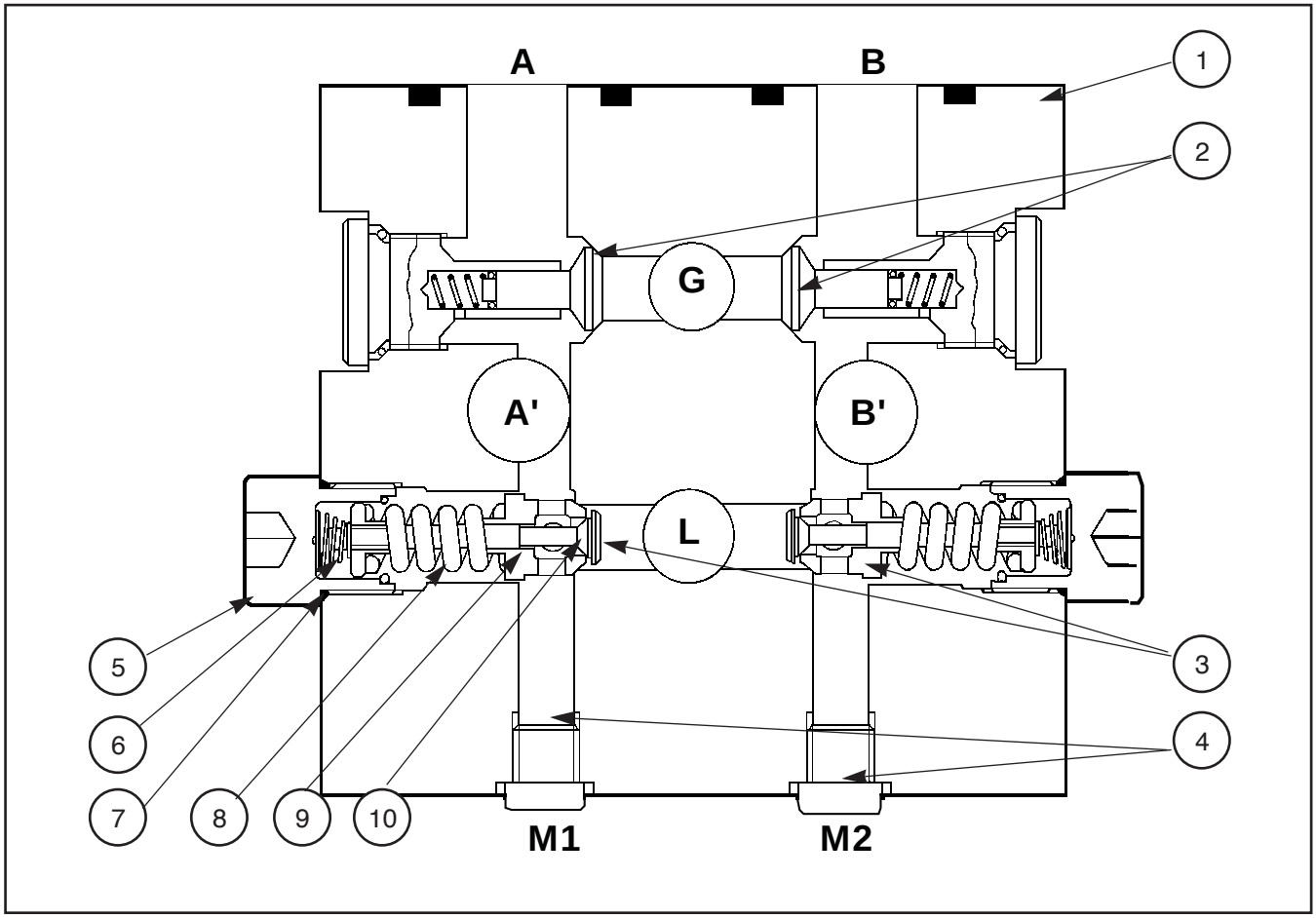
Z1 - Pilot pressure coming from control lever
Z1 - To swing control valve at Zb ((right-hand swing)
Z2 - Pilot pressure coming from control lever
Z2 - To swing control valve at Za (left-hand swing)
Z3 - To flow reinjection selector
M - Pressure switch connection
CP - Pressure sensor connection
LS - L-S information line coming from attachments/travel control valve block

12/1488 SWING FUNCTION

SAFETY/ANTI-CAVITATION BLOCK







12/1488 SWING FUNCTION

SAFETY/ANTI-CAVITATION BLOCK

- It is attached to the hydraulic swing motor

Function

- The safety valves regulate the pressure fed to the motor
- When the control valve spool is in neutral position, they protect the circuit between the spool and the motor during deceleration of the upper structure
- The anti-cavitation check valves prevent cavitation of the motor

Description

1 Block
2 Anti-cavitation check valves with return spring
3 Pre-set safety valves
4 Caps

Orifice identification

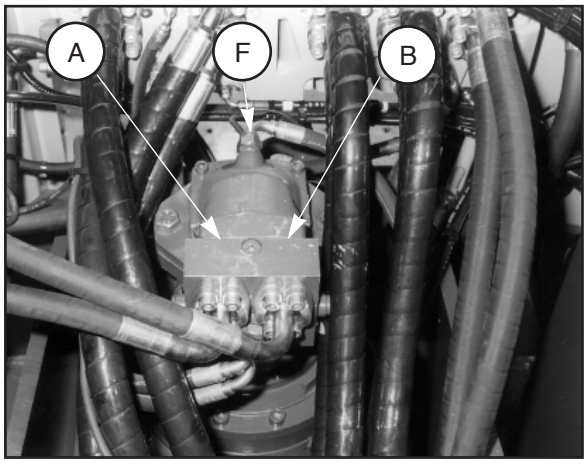
A'- B' - Feed or return of oil from the hydraulic motor
A - B - Orifices in contact with the motor feed face
L - Safety valves discharge towards the oil cooler
G - Anti-cavitation fed from the P10's.block

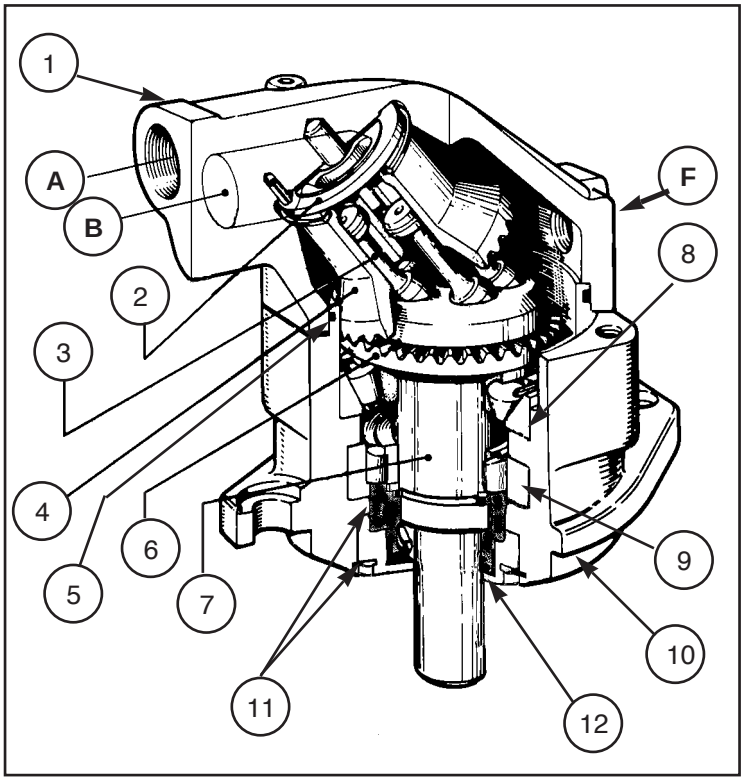
Technical details of the safety valves

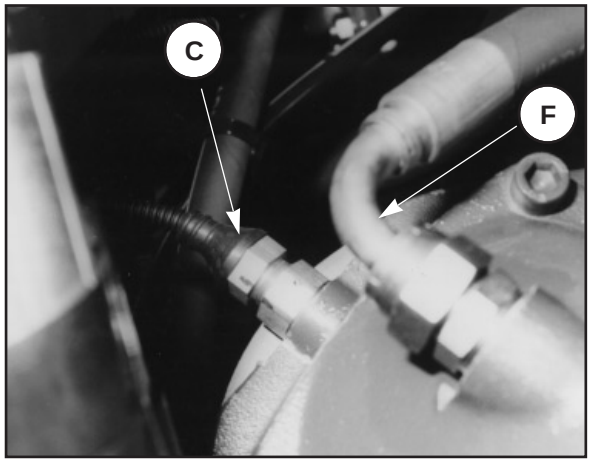
5 - Cap
6 - Return spring
7 - Seal
8 - Pre-set spring
9 - Safety valve plunger and anti-cavitation seat
10 - Safety valve plunger

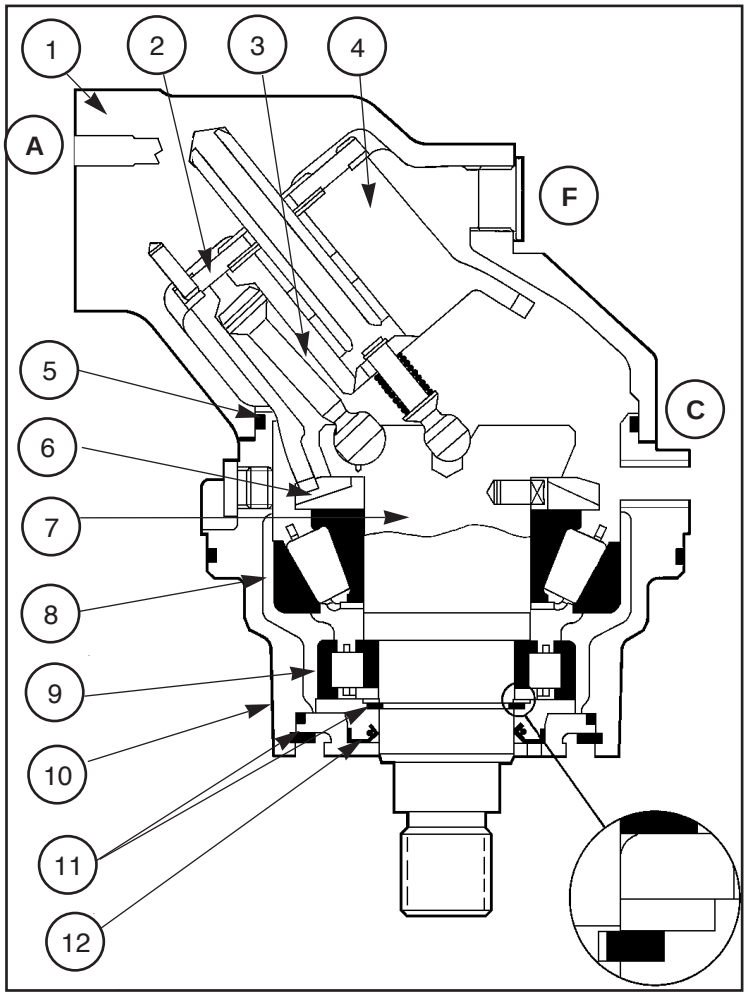
12/1488 SWING FUNCTION

HYDRAULIC MOTOR









12/1488 SWING FUNCTION

HYDRAULIC MOTOR

- This is a high speed, axial piston, fixed displacement motor

Function :

- It transmits a rotary movement to the reduction box so as to cause the upperstructure to swing

Description:

1 - Upper Housing
2 - Distributor face or seat
3 - Pistons with rings
4 - Toothed barrel
5 - Sealing ring between the two housings
6 - Crown-wheel
7 - Shaft
8 - Taper roller bearing
9 - Straight roller bearing
10 - Lower housing
11 - Locking rings
12 - Output shaft lip-seal

Orifice identification

A - Upper structure swing feed, left-hand
B - Upper structure swing feed, right hand
F - Leak return to tank
C - Housing for upper structure automatic swing brake electronic speed sensor

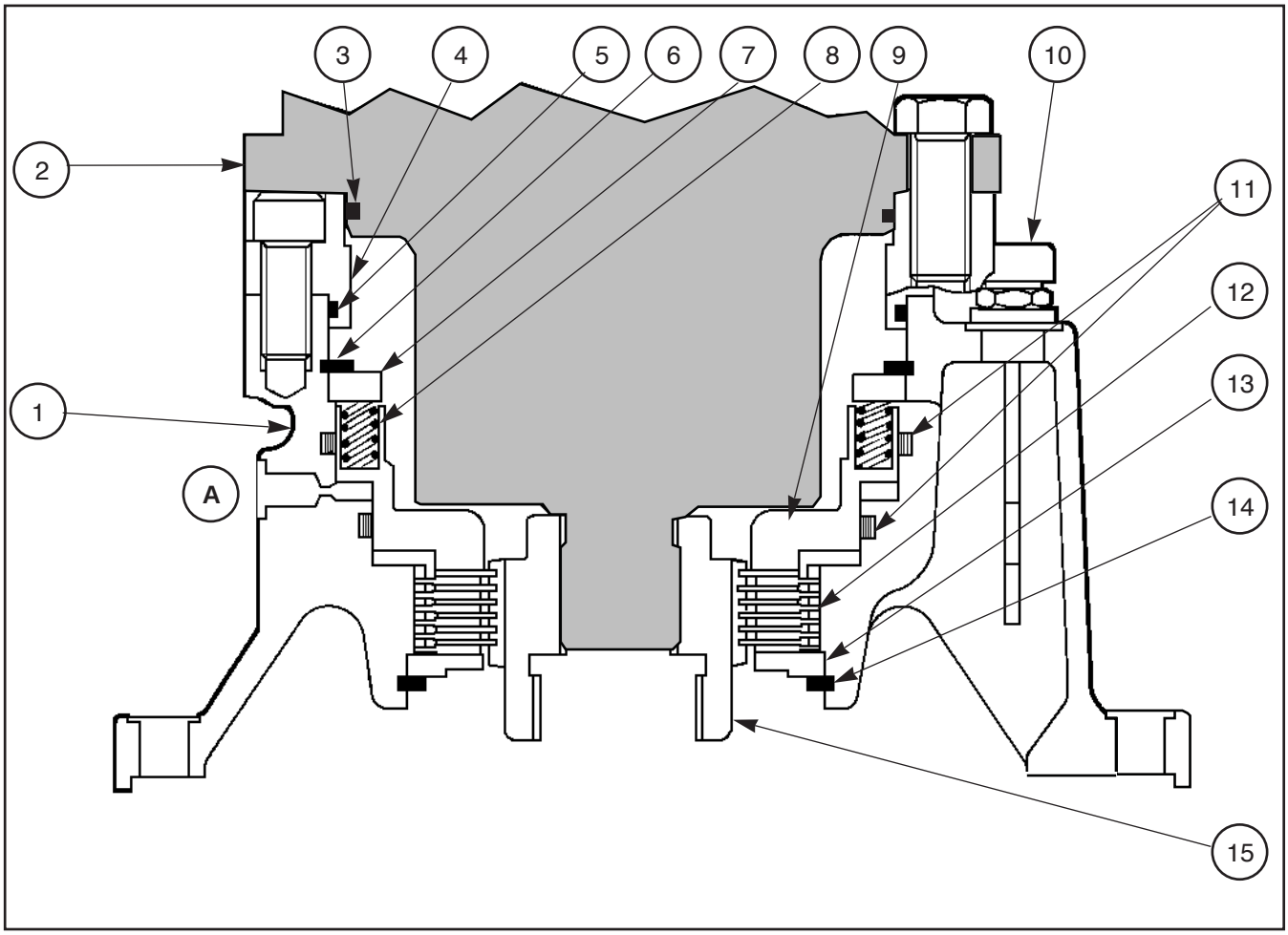
Functional principles

Depending on the direction of feed, the oil enters by one of the orifices **A** or **B**.
The oil is injected onto three pistons through the slots in the fixed distributor face **2**. Three other pistons are at return position and one is in neutral position.
Under pressure, the three pistons move out of barrel **4,** which causes barrel **4** and shaft **7** to turn as an assembly, the movement being synchronised by crown wheel **6**.
The three pistons which are in the return position move into barrel **4**, expelling oil through the other orifice, from which it is directed to the P10's.block

*The electronic sensor located at **C** detects the speed at which t he teeth on crown wheel **6** pass and informs the electronic control box so as to provide automatic upperstructure swing braking.*

12/1488 SWING FUNCTION

AUTOMATIC SWING BRAKE



12/1488 SWING FUNCTION

AUTOMATIC SWING BRAKE

- It is located on the upper portion of the swing reduction box.
- It is a static multi-disc oil-bath brake, mechanically braked by springs and with automatic low pressure brake release using the pilot
  circuit.(**35** bar)

Function :

- It immobilises the upper structure when no swing function is taking place.

Description :

1 - Brake housing
2 - Hydraulic swing motor
3 - Sealing ring between the hydraulic motor and the spacer
4 - Adaptor spacer
5 - Sealing ring between the spacer and the brake housing
6 - Locking ring
7 - Spacer
8 - Brake piston return springs
9 - Brake piston
10 - Gauge and breather
11 - Piston sealing rings
12 - Stack of steel and bi-metallic discs
13 - Flat drum
14 - Locking ring
15 - Splined sleeve connecting the hydraulic motor, the reduction box and the brake

Orifice identification

A - Inlet for low pressure hydraulic brake-release circuit

12/1488 SWING FUNCTION

12/1488 TRAVEL FUNCTION

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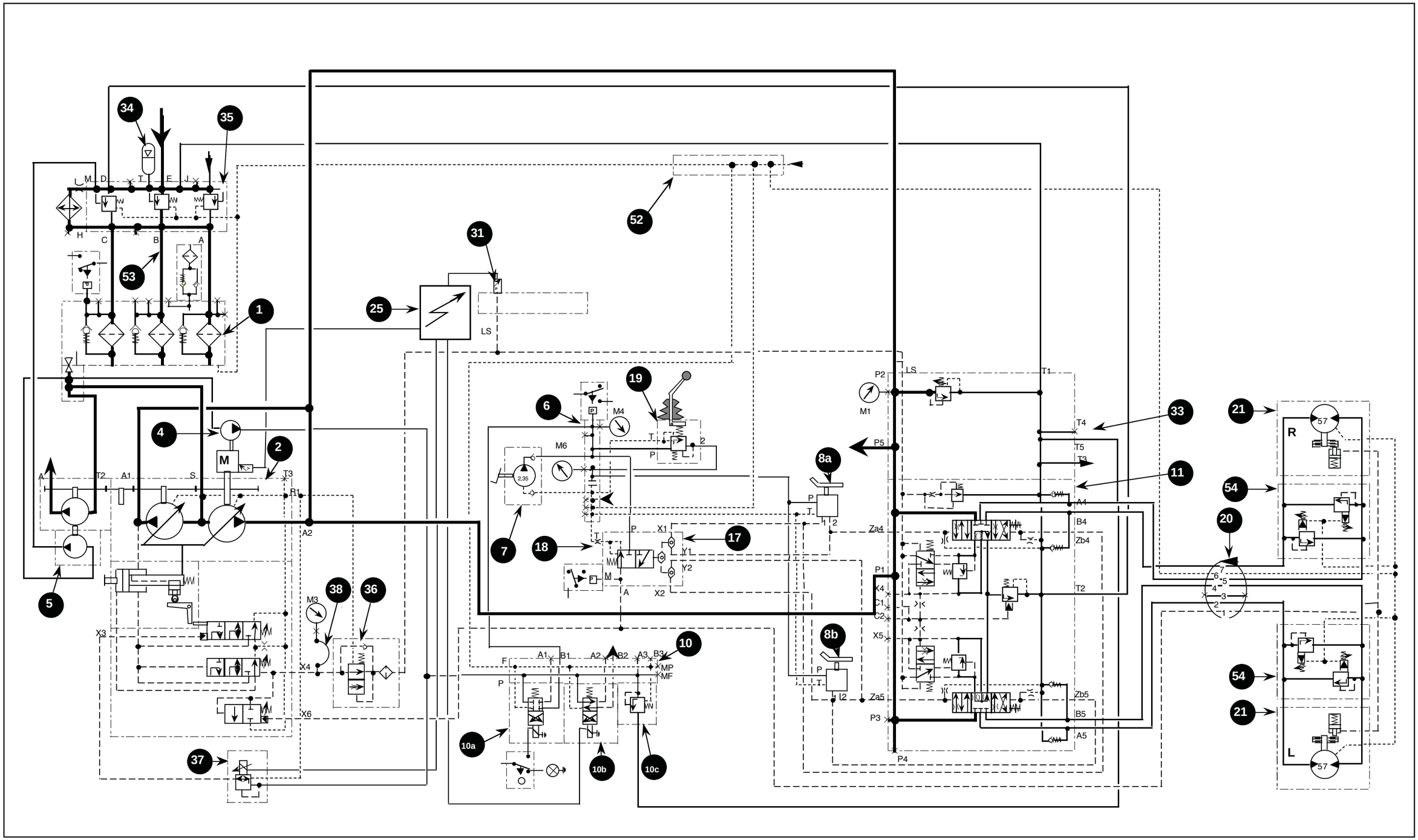
12/1488 TRAVEL FUNCTION

1288 Single-speed travel function hydraulic diagram



12/1488 TRAVEL FUNCTION

1288 SINGLE-SPEED TRAVEL FUNCTION HYDRAULIC DIAGRAM

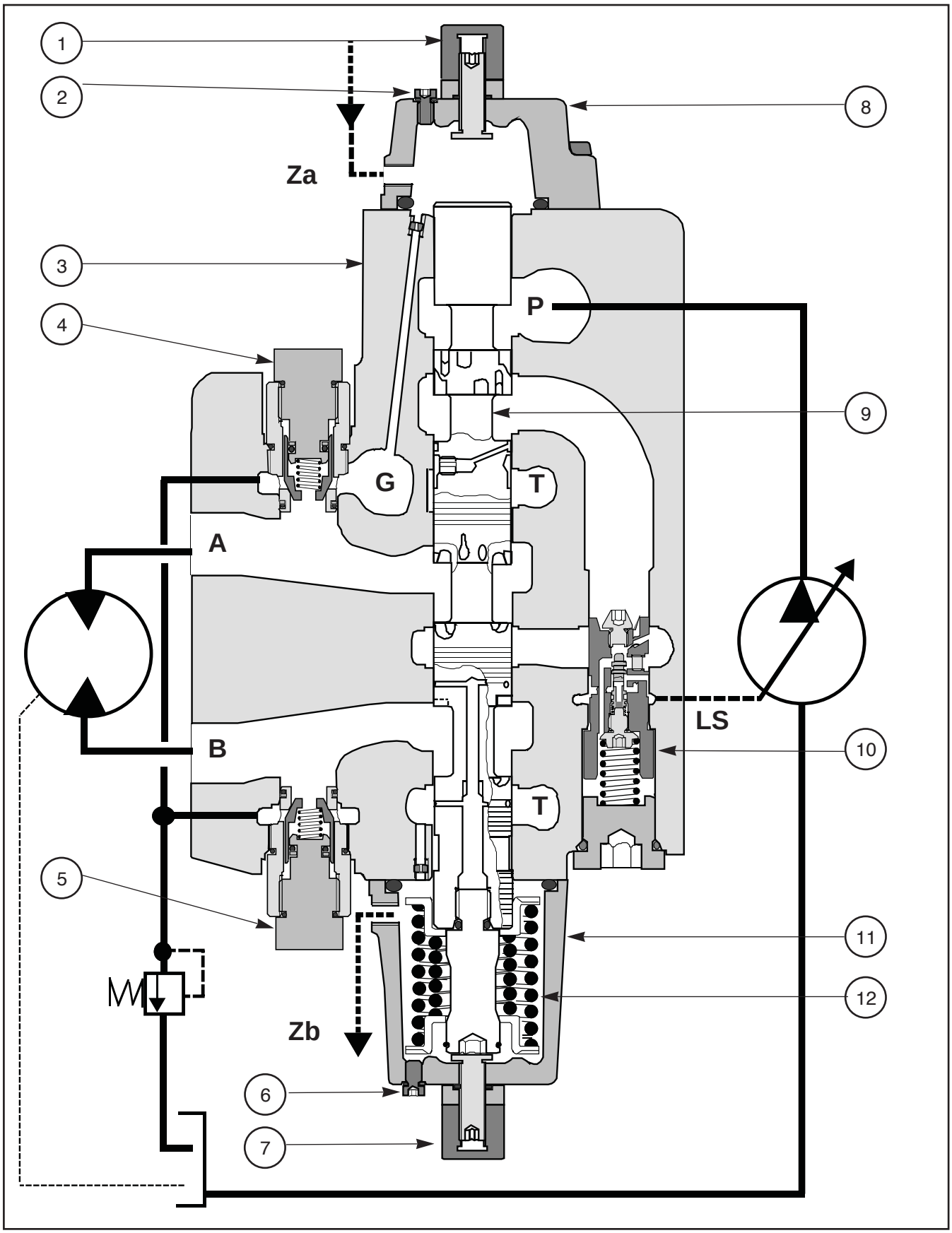
Description

1 - Tank and filters
2 - Variable flow pump
4 - Pilot circuit pump
5 - Force-feed pump
6 - Pilot circuit collector block
7 - Emergency foot pump
8a - LH travel control block
8b - RH travel control block
10 - Solenoid valve block consisting of:
10a - Arm-rest safety solenoid valve
10b - Swing brake release solenoid valve
11 - Travel control valve block
17 - Hydraulic travel motor automatic brake release selector block
18 - Calibrated orifice for travel brake release selector flow limiter
19 - Inching valve
20 - Swivel joint
21 - Fixed capacity hydraulic travel motor
25 - Electronic control box
31 - LS information electronic sensor
33 - Calibrated orifice for cooling circuit
34 - Accumulator
35 - P10 pressure limiters
36 - LS valve anti-hunting block
37 - Electrohydraulic proportional valve
38 - Accumulator hose on LS valve circuit
53 - Return circuits manifold
54 - Travel circuits safety block

This chapter deals with the following components: 11, 21, 17, 20, 54. The others have been covered in the previous chapters.

12/1488 TRAVEL FUNCTION

TRAVEL CONTROL VALVE ELEMENT

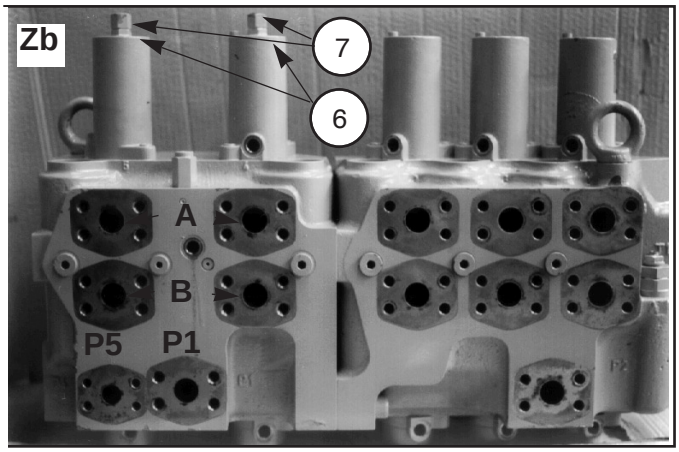


12/1488 TRAVEL FUNCTION

TRAVEL CONTROL VALVE ELEMENT

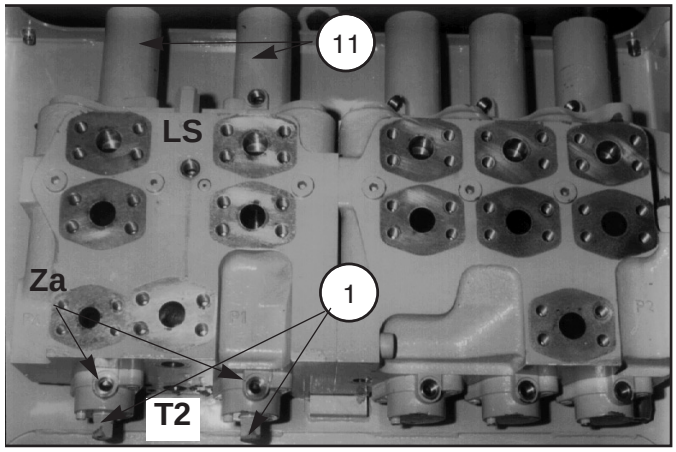
Purpose:

- In neutral position, it closes off the feed and return orifices to the motor
- Depending on the position of the control spool, it directs the fluid to the motor or returns it to the tank.



Differences in design compared with attachment valve elements:

- Force-feed valves are fitted instead of and in the same position as relief valves
- Spool caps are fitted with adjustable stops for adjusting the flow from each side of the travel in each feed direction
- The progressivity grooves on the spool are different

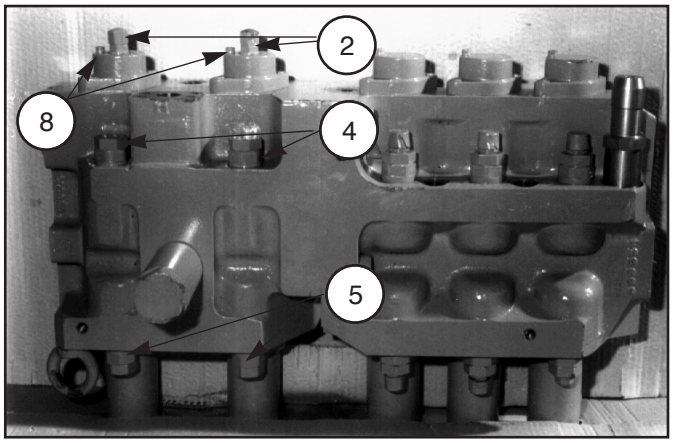


Identification of orifices:

A	-	Rear drive travel feed
B	-	Forward drive travel feed
Za	-	Rear drive travel pilot
Zb	-	Forward drive travel pilot
G	-	Force-feed manifold, return to the P10 block
P	-	Control valve feed manifold
T	-	Return from motors to speed limiter
LS	-	LS information manifold

Description:

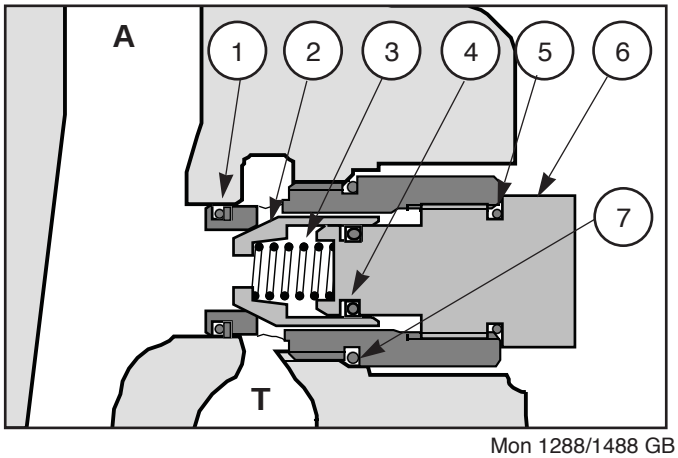
1	-	Forward drive travel flow adjustment screw (to restrict the spool stroke)
2	-	Small caps bleed screw
3	-	Element body
4	-	Reverse drive travel force-feed valve
5	-	Forward drive travel force-feed valve
6	-	Big caps bleed screw
7	-	Reverse drive travel flow adjustment screw
8	-	Cap
9	-	Control valve spool
10	-	Pressure selector/compensator
11	-	Cap (spring side)
12	-	Control valve spool return spring



Force-feed valves

Purpose:

- Ensure oil-tightness between high pressure and low pressure circuits when the circuits in which they are fitted have no cavitation.
- Enable oil to pass from the force-feed circuit to the circuit where cavitation is occurring.

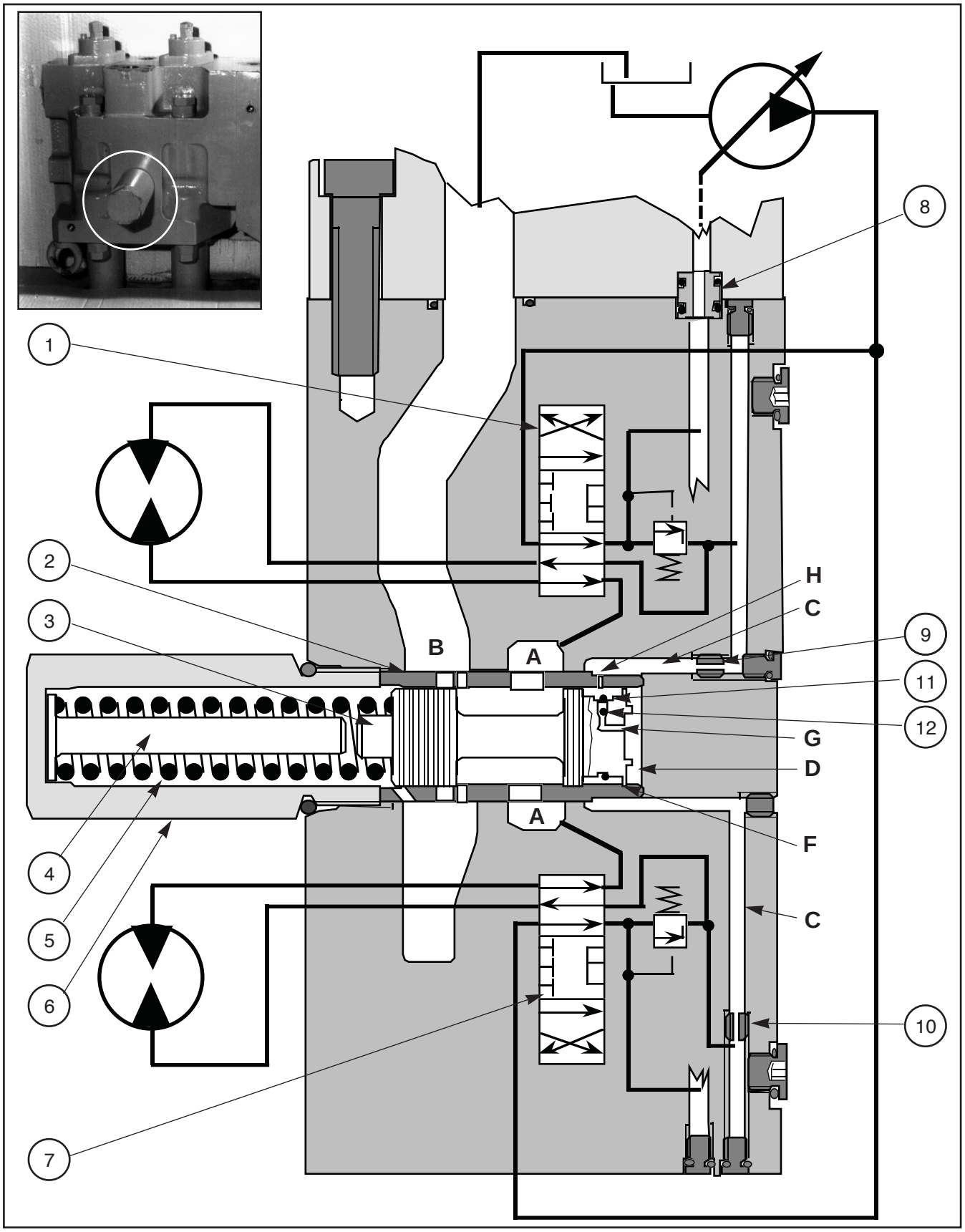


Description:

1	-	Seals and back-up rings
2	-	Check-valve
3	-	Spring
4	-	Seal and back-up ring
5	-	O-ring
6	-	Check-valve guide
7	-	O-ring

12/1488 TRAVEL FUNCTION

CONTROL VALVE BLOCK
FLOW CONTROL VALVE (SPEED LIMITER)



12/1488 TRAVEL FUNCTION

CONTROL VALVE BLOCK

Flow control valve (speed limiter)

Purpose:

- It enables the speed of the excavator to be controlled when moving downhill in forward or reverse gear.

Identification of orifices:

A - Return from the hydraulic travel motors via the control valve spools, before the flow control valve
B - Common return from the travel motors to the tank, after the flow control valve, passing via the P10's
C - Pilot passages
D - Valve spool pilot chamber
F - Ring jet
G - Jet (**Ø 0,1 mm obtained by drilling to Ø 0,6 mm then placing a Ø 0.5 steel wire in that orifice**)
H - Orifice

Description:

1 - LH travel control valve spool
2 - Sleeve
3 - Flow control valve spool
4 - Stop
5 - Pre-set spring
6 - Spring cap
7 - RH travel control valve spool
8 - Sealing spacer on LS information line (between the travel control valve block and the attachment control valve element)
9 - Jet in LH travel
10 - Jet in RH travel
11 - Anti-return check-valve ball retaining ring
12 - Anti-return check-valve

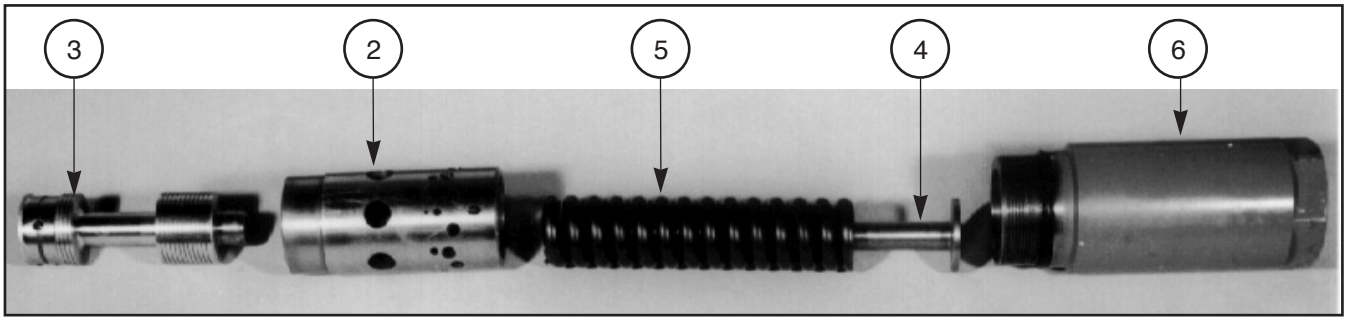
Working principle:

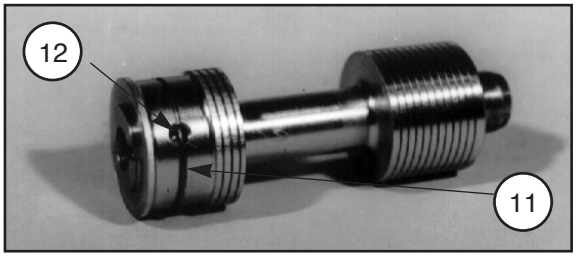
a) Machine on the flat or moving up-hill

If a resistance is encountered by the hydraulic travel motors, a medium or high pressure will be created in the travel and LS information circuits.
The pressure coming after the compensator passes via jets **9** and **10,** passages **C**, orifice **H** and ring jet **F** to arrive in chamber **D** and, on the way, presses anti-return check-valve **12** against its seat.Spool **3** moves and contacts stop **4**.Passages **A** and **B** communicate freely via the orifices in sleeve **2** and the return from the motors passes to the tank via the **3 P10**.block

a) Machine going downhill

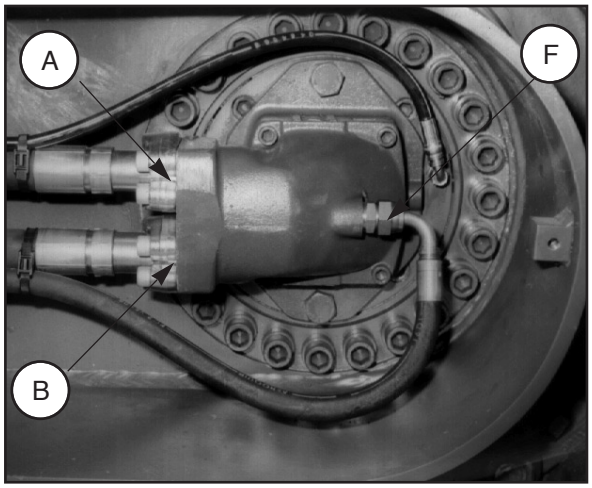
In this case, there is no resistance encountered by the travel motors, so there is no pressure at **D.**
Under the action of spring **5**, the volume of oil expelled passes via jet **G** and anti-return check-valve **12.**
This ensures that the speed of movement of spool **3** is limited.
Spool **3** returning to the rest position partially obstructs the orifices at chamber **B** so that passage between **A** and **B** becomes more difficult.
Therefore the pressure increases on the motor return and feed.
There is an automatic balance between the position of spool **3** and the feed pressure (after the compensator)which ensures that the excavator moves downhill correctly.

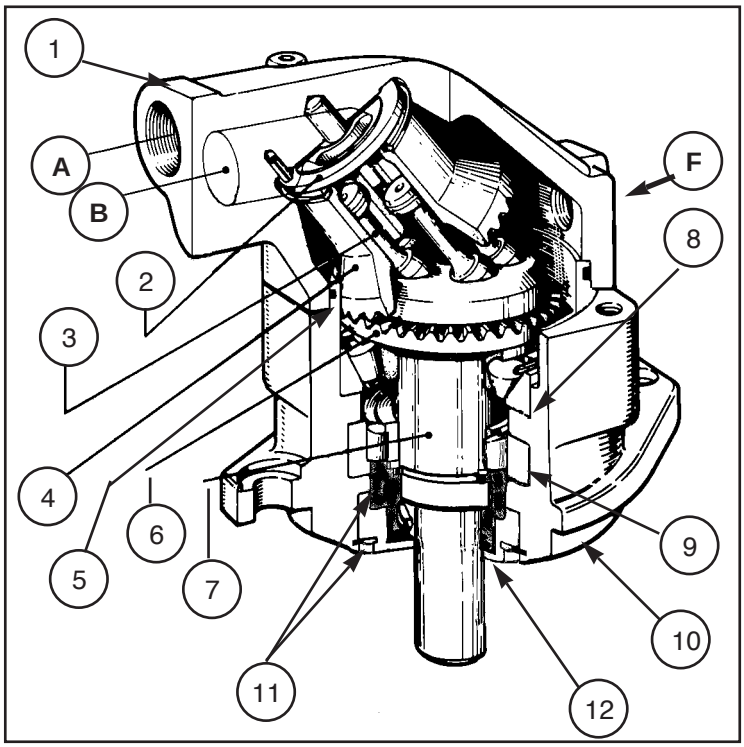


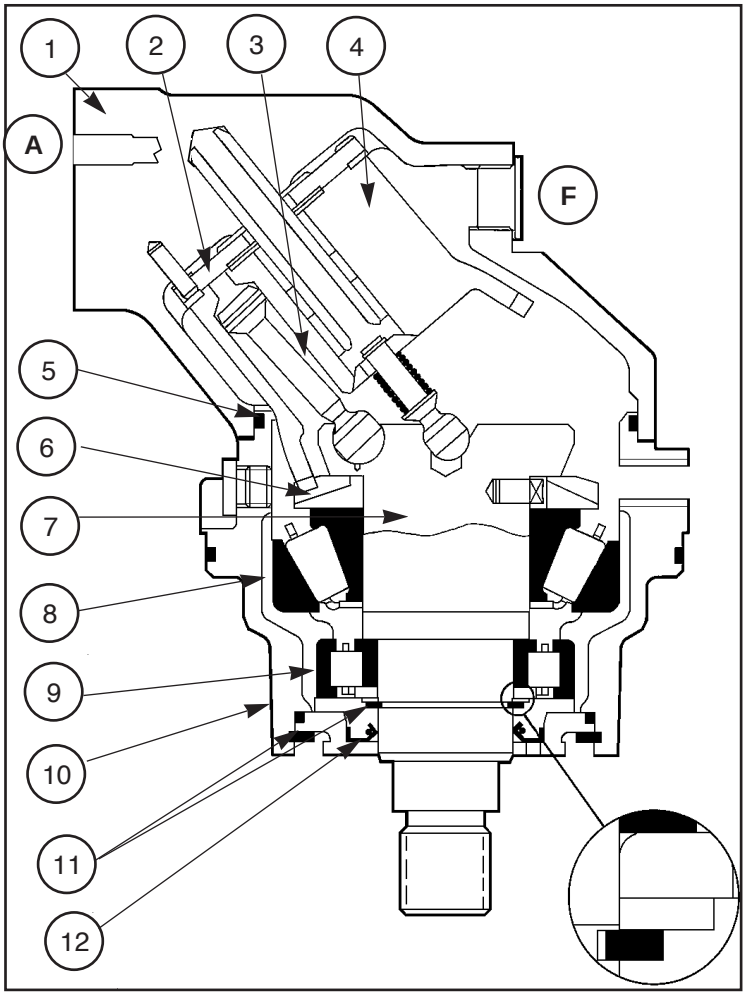


12/1488 TRAVEL FUNCTION

1288 SINGLE-SPEED HYDRAULIC TRAVEL MOTORS







12/1488 TRAVEL FUNCTION

1288 SINGLE-SPEED HYDRAULIC TRAVEL MOTORS

They are flush-fitted to each travel reduction box

They are high-speed type, fixed displacement, axial motors of an identical design to that of the swing motor (See Chapter 8J)

Purpose:

- They transmit a rotary movement to the reduction box so as to drive the sprockets and the tracks.

Description:

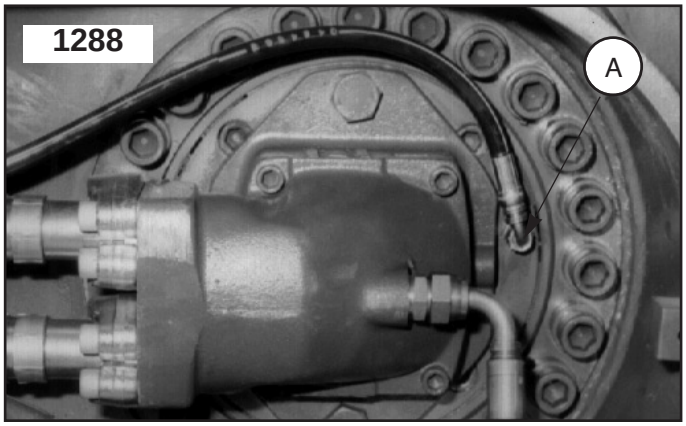
1 - Upper housing
2 - Distribution face
3 - Pistons and rings (7)
4 - Barrel with gear-teeth
5 - Seal between the two housings
6 - Crown with gear-teeth
7 - Shaft
8 - Conical roller bearing
9 - Straight roller bearing
10 - Lower housing
11 - Locking rings
12 - Shaft output oil-seal

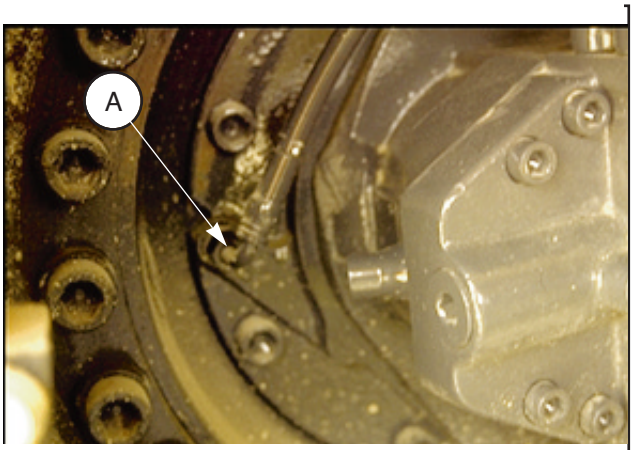
Identification of orifices

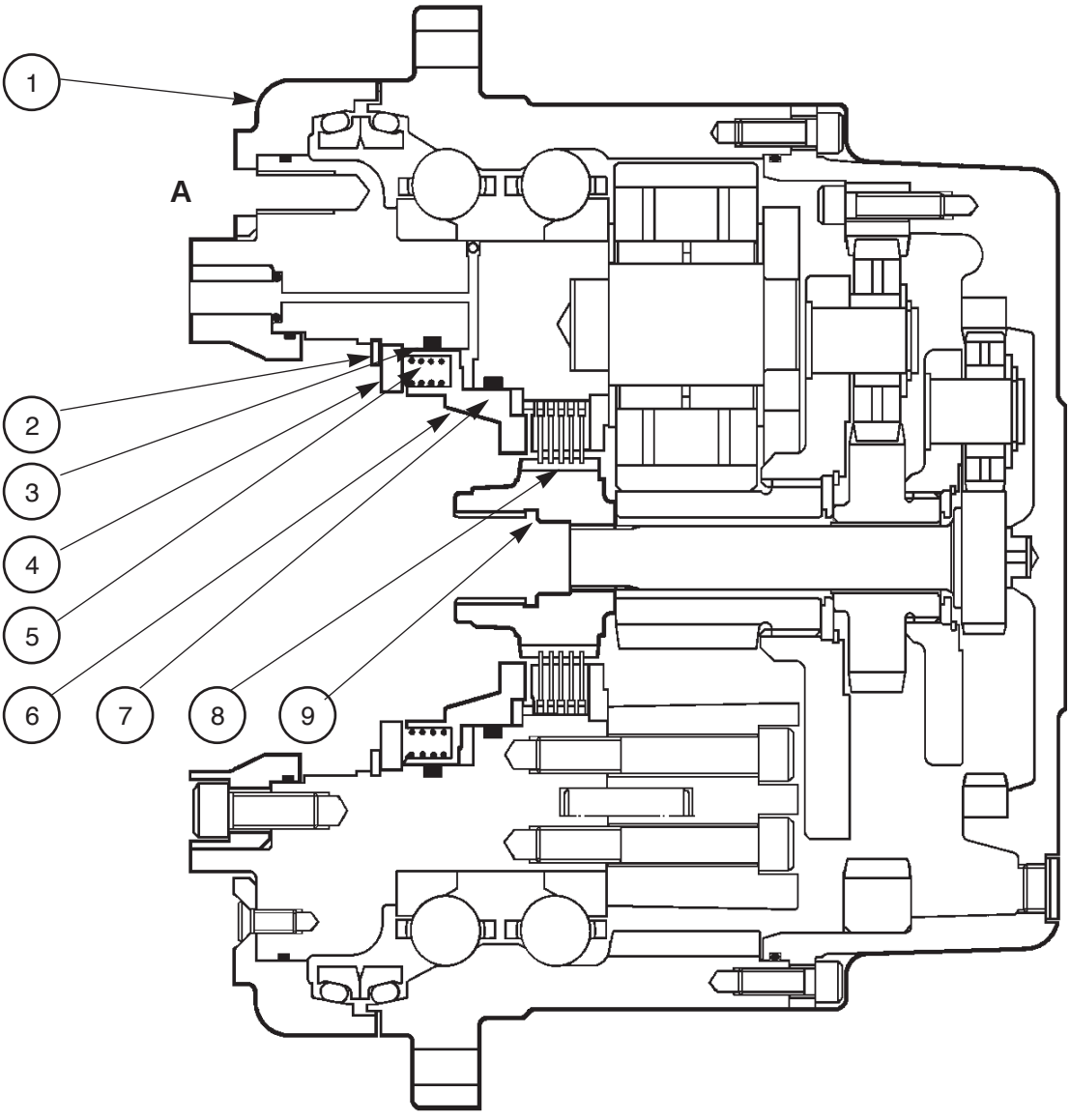
		LH TRACK	RH TRACK
A	-	Reverse drive feed	Forward drive feed
B	-	Forward drive feed	Reverse drive feed
F	-	Working leak return to tank	Working leak return to tank

12/1488 TRAVEL FUNCTION

AUTOMATIC TRAVEL BRAKE







12/1488 TRAVEL FUNCTION

AUTOMATIC TRAVEL BRAKE

- It is incorporated in both travel reduction boxes
- It is a multidisc static oil-bath brake, with mechanical braking by springs and low pressure hydraulic brake release provided from the pilot circuit

Purpose:

- To immobilize the excavator when the travel function is not activated

Description:

1 - Reduction box housing
2 - Locking ring
3 - Seal
4 - Stop
5 - Springs
6 - Piston
7 - Seal
8 - Set of discs
9 - Coupling sleeve: Motor shaft/Reduction shaft

Identification of orifices:

A - Brake release orifice

Working principle:

- At rest position

There is no pressure in brake release circuit **A**, springs **5** press piston **6** against the set of discs **8**. The reduction box is kept in the braked position.

- At travel position

The travel spool pilot pressure moves the brake release valve spool which allows the pilot pressure to reach the chamber of piston **6**.

As soon as that pressure reaches **6** bar, the force applied on the piston is sufficient to compress springs **5**.

The piston moves back and releases the set of discs, so that the reduction box brake is released.

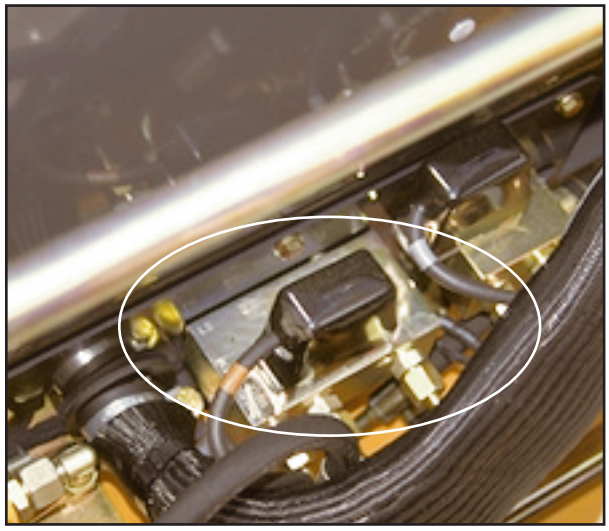
The beginning of the brake release pressure is lower than the beginning of the control valve spool pilot pressure, so the reduction box brakes are released before high pressure reaches the travel motors.

The reduction boxes are braked after the control valve spools have returned to their rest position (By a restriction orifice on the brake return and on the brake release valve).

12/1488 TRAVEL FUNCTION

AUTOMATIC TRAVEL BRAKE RELEASE SELECTOR BLOCK

- It is mounted behind the cab floor

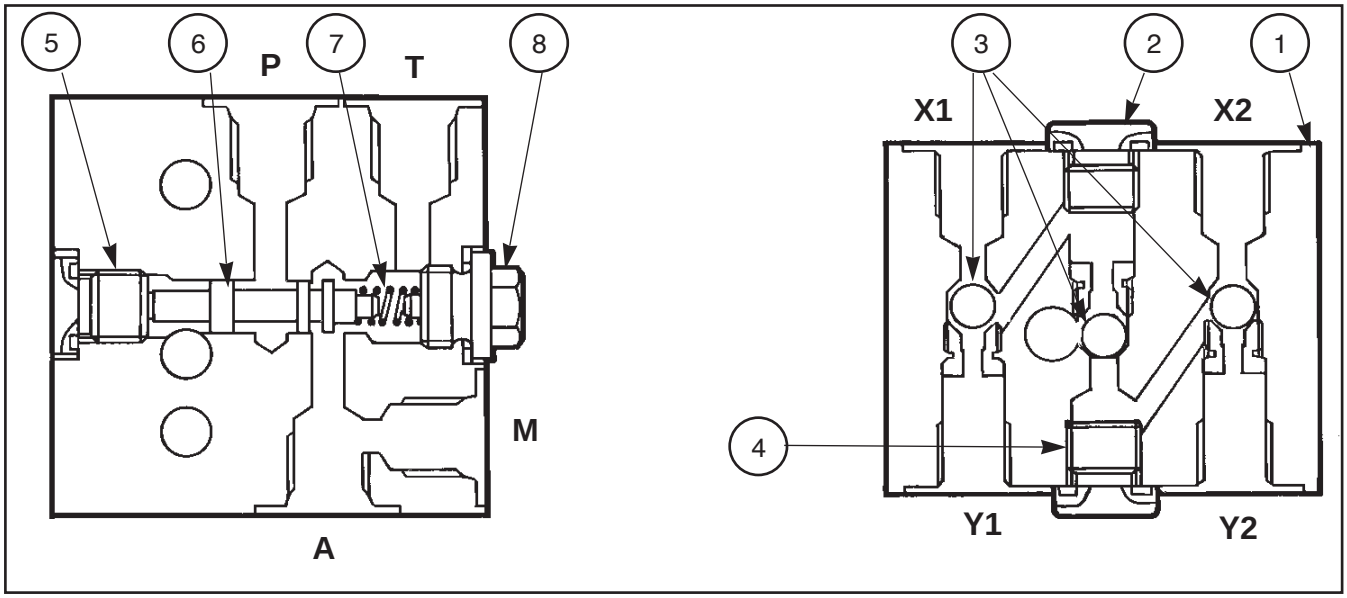


Purpose:

- It enables the travel motor/reduction box brakes to be released automatically during any type of work
- It is fitted with a pressure switch to maintain the engine in the chosen mode when the excavator is going downhill and the Auto-Idle mode has been selected. On a two-speed excavator it enables the capacity of the variable displacement hydraulic motors to be changed automatically (with the information of L.S pressure sensor)

Description

1	-	Block	**5**	-	Plug
2	-	Cap	**6**	-	Selector spool
3	-	Shuttle ball	**7**	-	return spring
4	-	Plug	**8**	-	Spring guide plug



Identification of orifices

P	-	Pressure inlet (35 bar)
T	-	Brake return to tank
A	-	Pressure line to brakes (brake release)
M	-	Pressure sensor
Y1	-	RH reverse travel pilot pressure inlet
Y2	-	LH reverse travel pilot pressure inlet
X1	-	RH forward travel pilot pressure inlet
X2	-	LH forward travel pilot pressure inlet

Working principle:

- **At the rest position** the force of spring **7** holds spool **6** against plug **5**. This enables communication to take place between **A** and **T** and also to return brake circuit A to the tank.
- **At the working position** Using the shuttle balls **3**, the highest travel control valve spool pilot pressure is selected. This pilots spool **6** and by moving it cuts off communication between **A** and **T** and opens communication between **P** and **A** so as to release the motor/reduction box brakes.

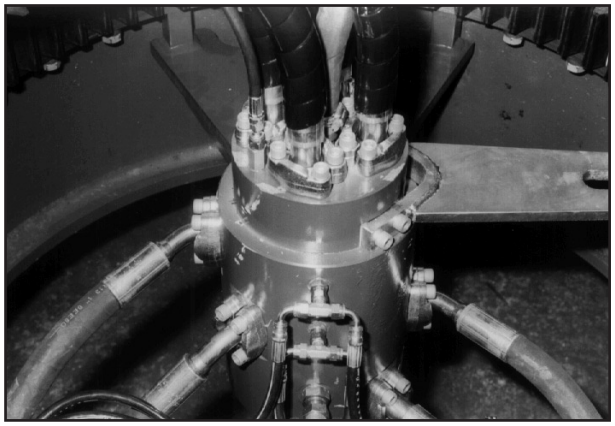
12/1488 TRAVEL FUNCTION

SWIVEL JOINT

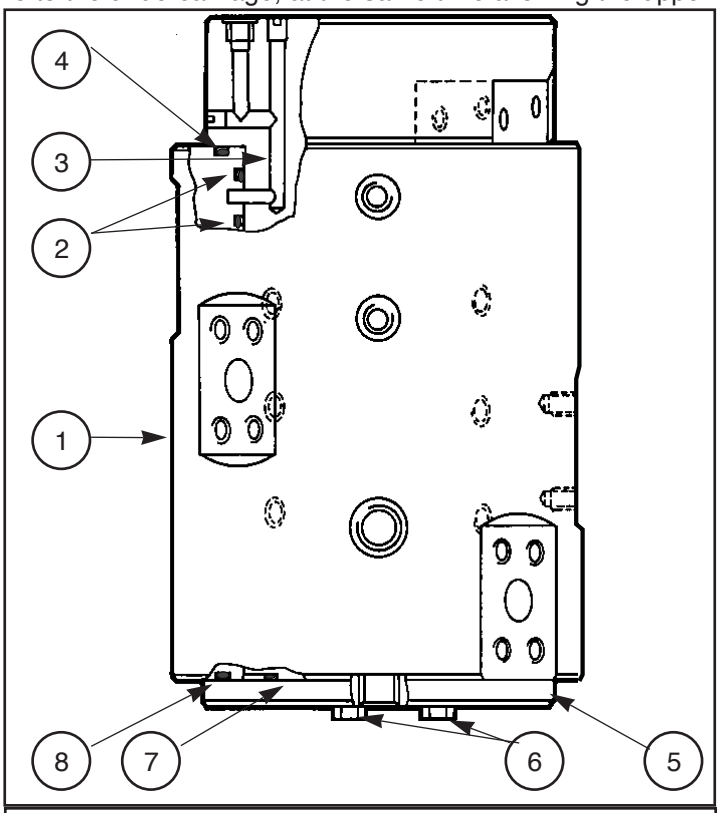
- It is attached to the undercarriage by its external sleeve and its central pivot is rotated at the same time as the upper structure by a lug.

Purpose:

- It transmits hydraulic power from the upper structure to the undercarriage, at the same time allowing the upper



structure to rotate completely.

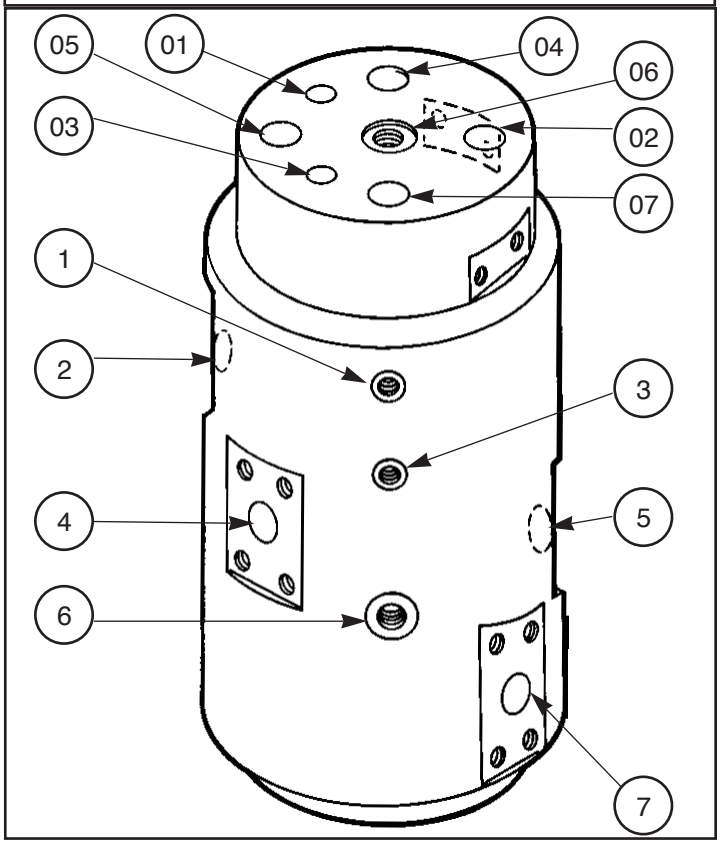


Description

1	-	Outer sleeve
2	-	Composite seals
3	-	O-rings
4	-	Central pivot
5	-	Plate
6	-	Screw
7	-	O-ring
8	-	O-ring

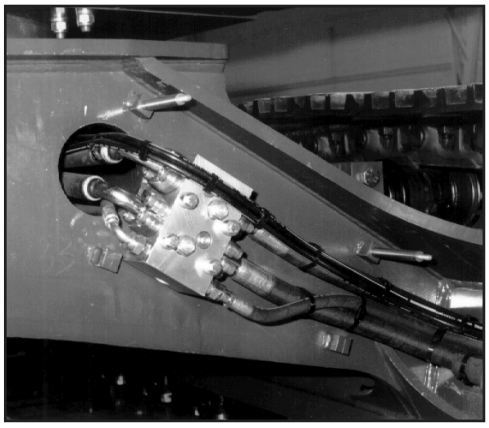
Identification of orifices

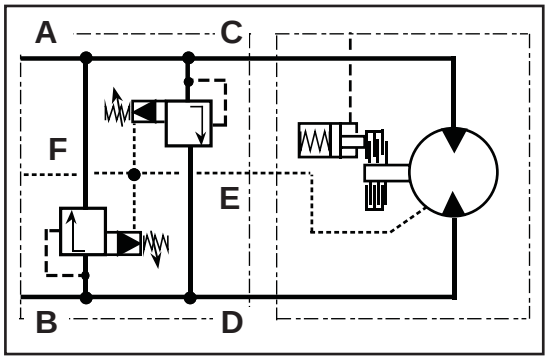
Pivot			**Sleeve**
01	-	travel brake	**1**
02	-	LH forward travel	**2**
03	-	Hydraulic motor capacity change (two-speed excavators) Blanked off on 1288 single-speed	**3**
04	-	LH reverse travel	**4**
05	-	RH forward travel	**5**
06	-	Hydraulic motors leak return	**6**
07	-	RH reverse travel	**7**

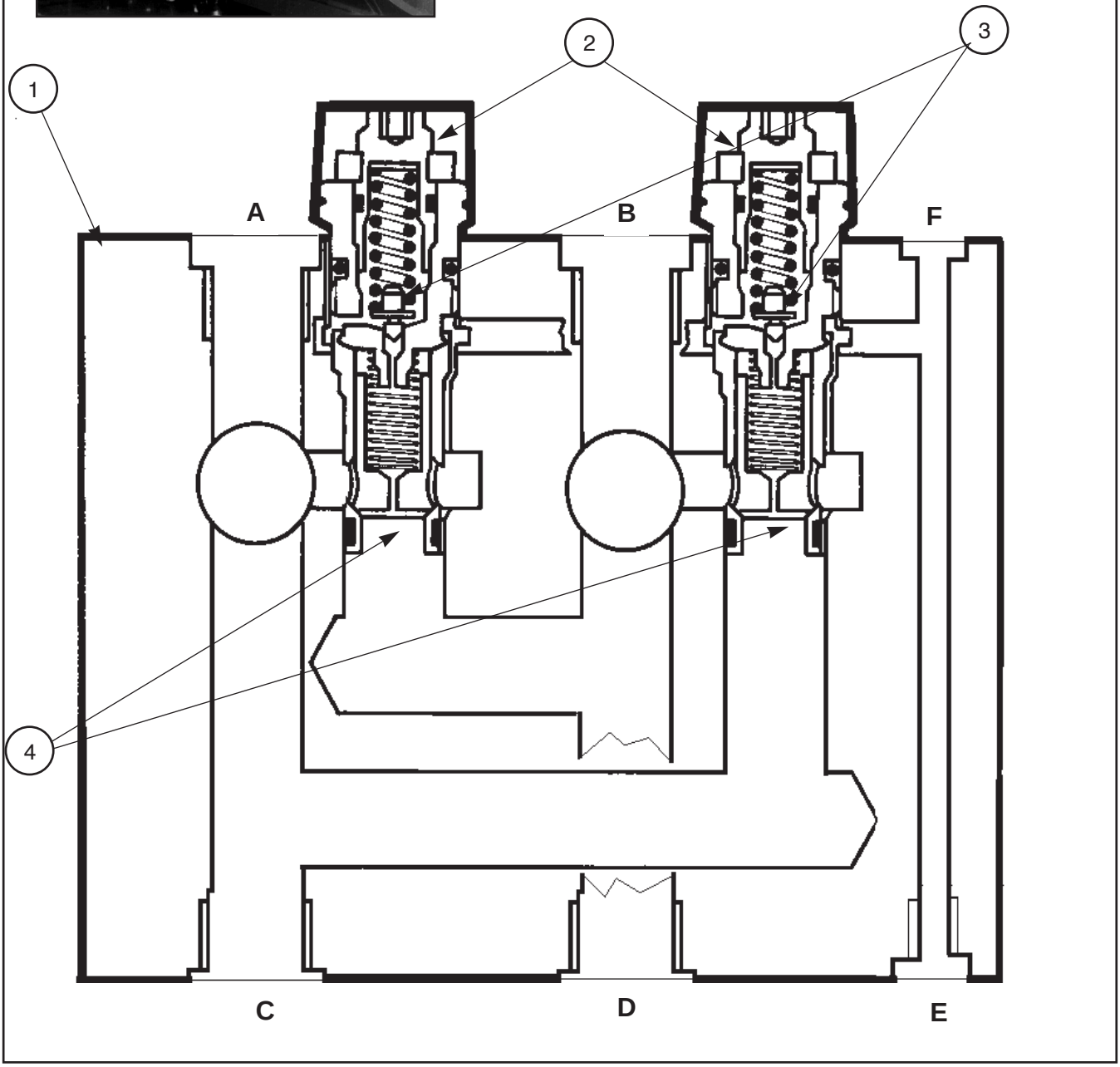


12/1488 TRAVEL FUNCTION

TRAVEL SAFETY BLOCKS







12/1488 TRAVEL FUNCTION

Travel safety blocks

- There are two of them (1 block for RH travel and 1 for LH)
- They are attached to the undercarriage, next to the hydraulic motors

Purpose:

- They protect the hydraulic circuits between the control valve and the hydraulic motors when machine travel is stopped.

NOTE:

At maximum authorized pressure on the travel, there is no flow cut-off at the variable displacement pumps.
It is the control valve block relief valve which opens

Description

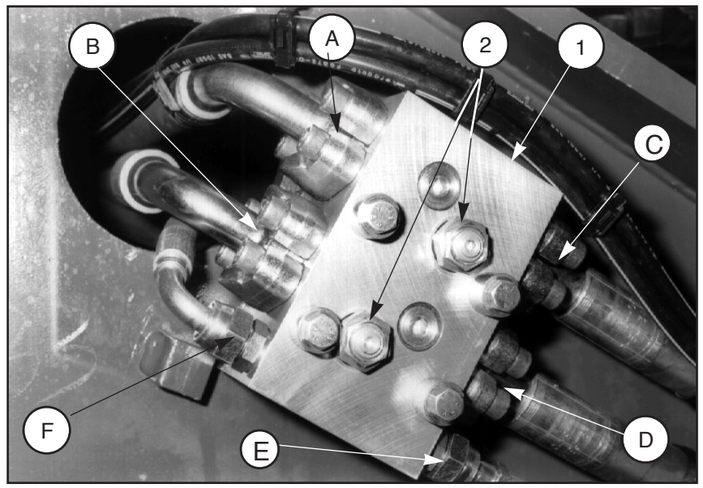
1 - Block
2 - Safety valves
3 - Secondary check-valve
4 - Primary check-valve

Special feature of safety valves

- They are indirect action type and are intercommunicating. This means that the flow from the open primary valves 4 is fed directly into the feed for the other motor by this same block.
- On the other hand, the flow from the opened secondary valves 3 is fed to the tank along with the working leaks from the hydraulic motors.

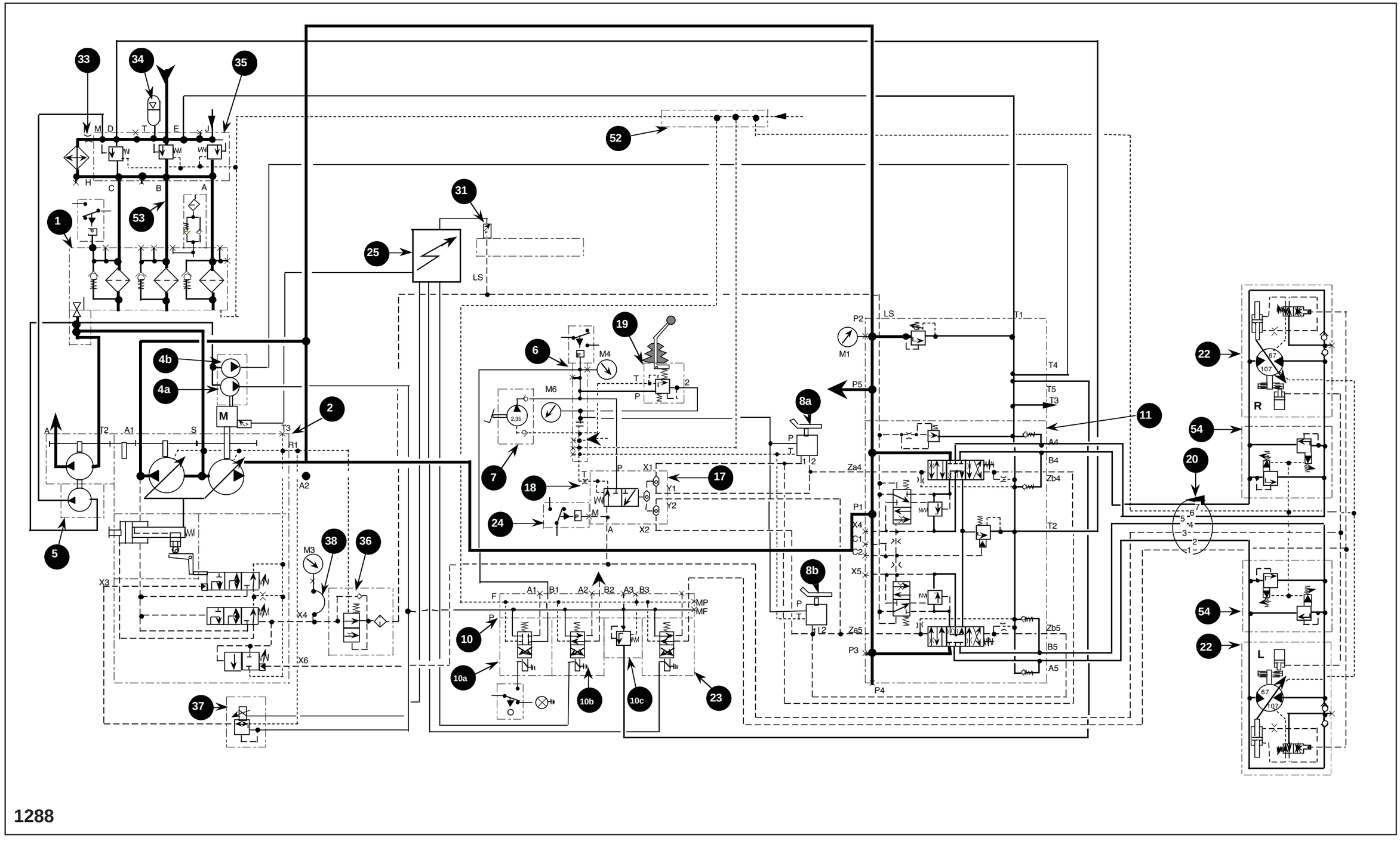
Identification of orifices

A - Feed inlet from control valve
B - Feed inlet from control valve
C - Outlet to travel motor
D - Outlet to travel motor
E - Inlet from hydraulic motors working leaks return
F - Return to tank of working leaks and flow from safety valves open secondary check-valves.



12/1488 TRAVEL FUNCTION

1288 Two-speed travel function hydraulic diagram



1288

12/1488 TRAVEL FUNCTION

1288 TWO SPEED HYDRAULIC CIRCUIT

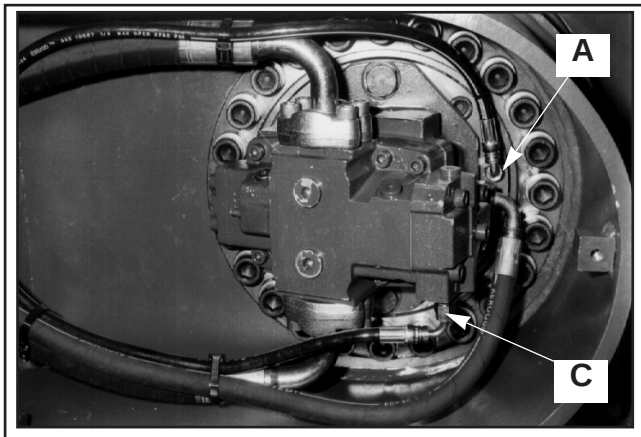
Differences compared with the single-speed circuit

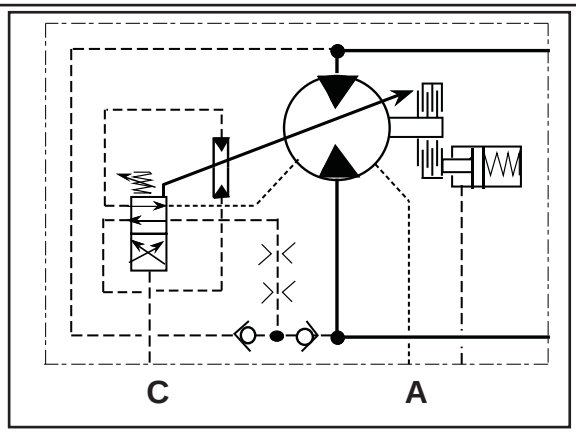
22L - Variable capacity RH hydraulic travel motor
22R - Variable capacity LH hydraulic travel motor
20 - The swivel joint passage **3** is used for piloting the travel motors capacity change selector
23 - There is a solenoid valve to effect the hydraulic travel motors capacity change (This is controlled electrically from the electronic control box)

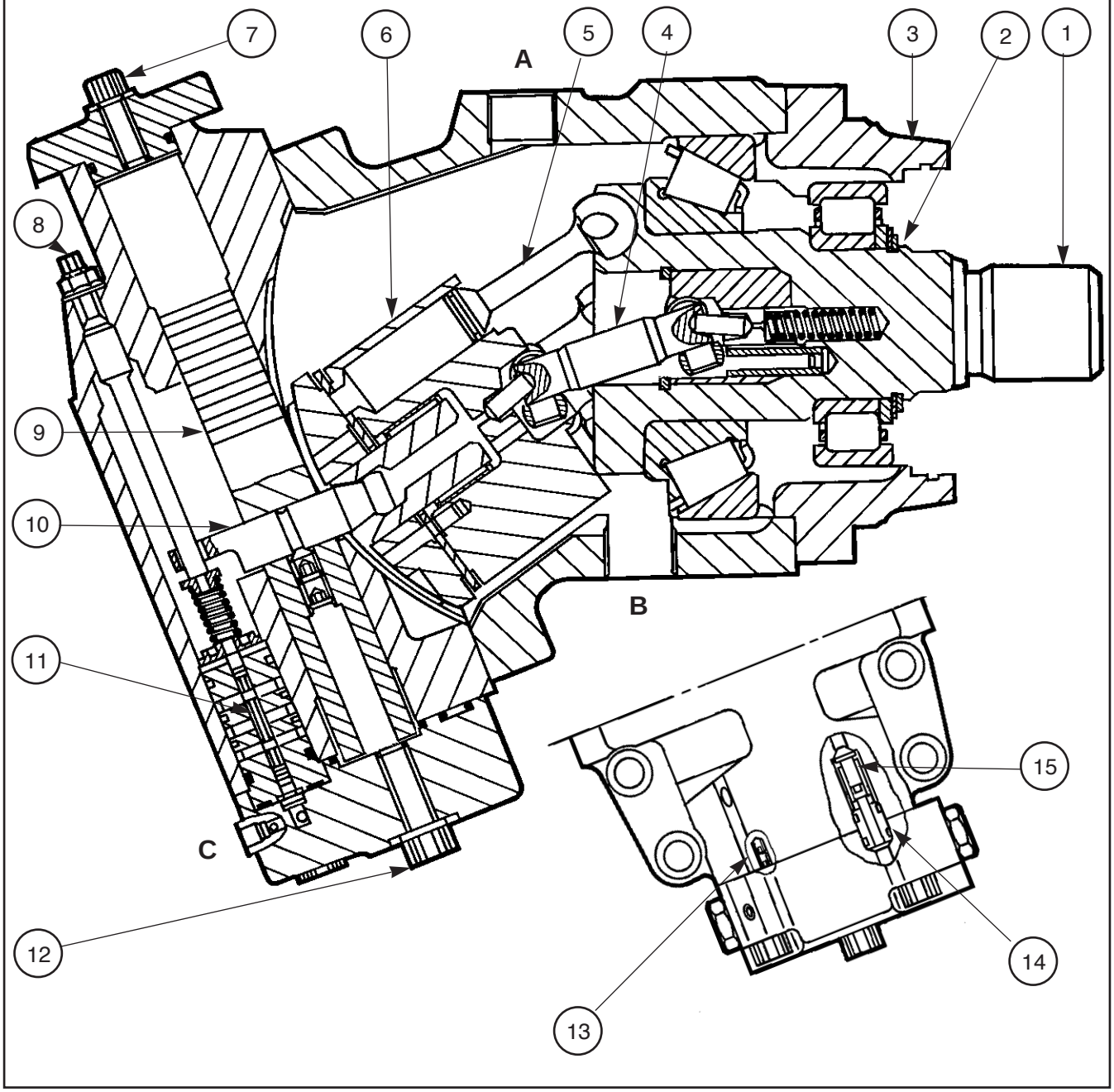
The following pages deal only with the variable capacity hydraulic motor. The other components have already been covered in the previous pages

12/1488 TRAVEL FUNCTION

1288 Two-speed variable capacity hydraulic travel motors







12/1488 TRAVEL FUNCTION

1488 two-speed variable capacity hydraulic travel motors

- These are high-speed axial piston hydraulic motors with a barrel which can be inclined so as to obtain two speeds

Purpose:

- They transmit a rotary movement to the reduction box, which is equipped with an automatic static brake, to drive the sprockets.

Description

1 - Output shaft
2 - Output shaft seal assembly
3 - Housing
4 - Tripod
5 - Piston with rings (7)
6 - Barrel
7 - Minimum capacity stop screw
8 - Capacity change pressure adjustment screw
9 - Capacity change control piston
10 - Barrel inclination control finger
11 - Capacity change selector
12 - Maximum capacity stop screw
13 - Calibrated orifice
14 - Spacer seal
15 - Anti-return spring

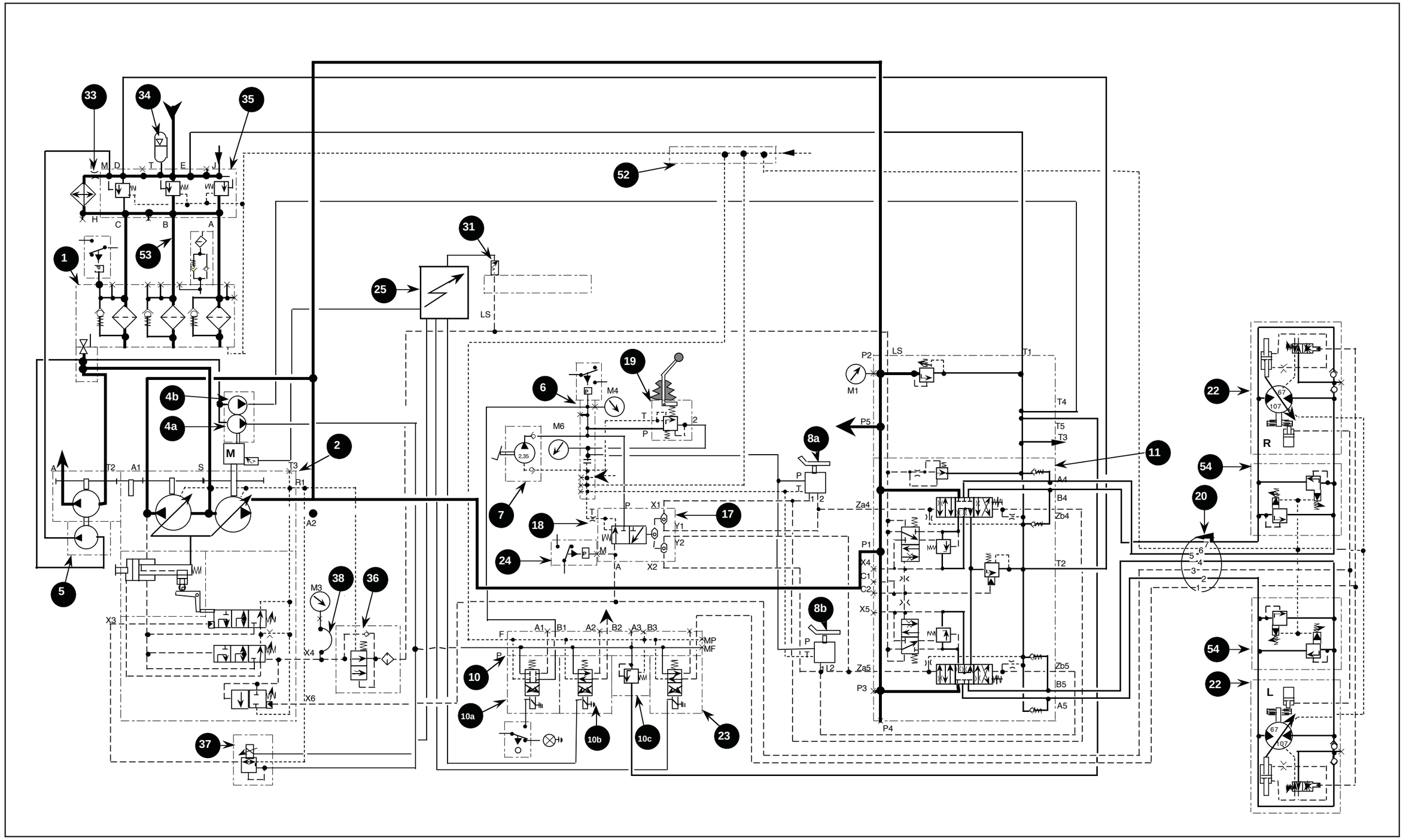
Identification of orifices

A - Motor working leaks return
B - Plug
C - Capacity change pilot pressure inlet (**35** bar)

*For capacity change method, see automatic travel sequencing (**Chapter 1 : Principles of electronically piloted systems**)*

12/1488 TRAVEL FUNCTION

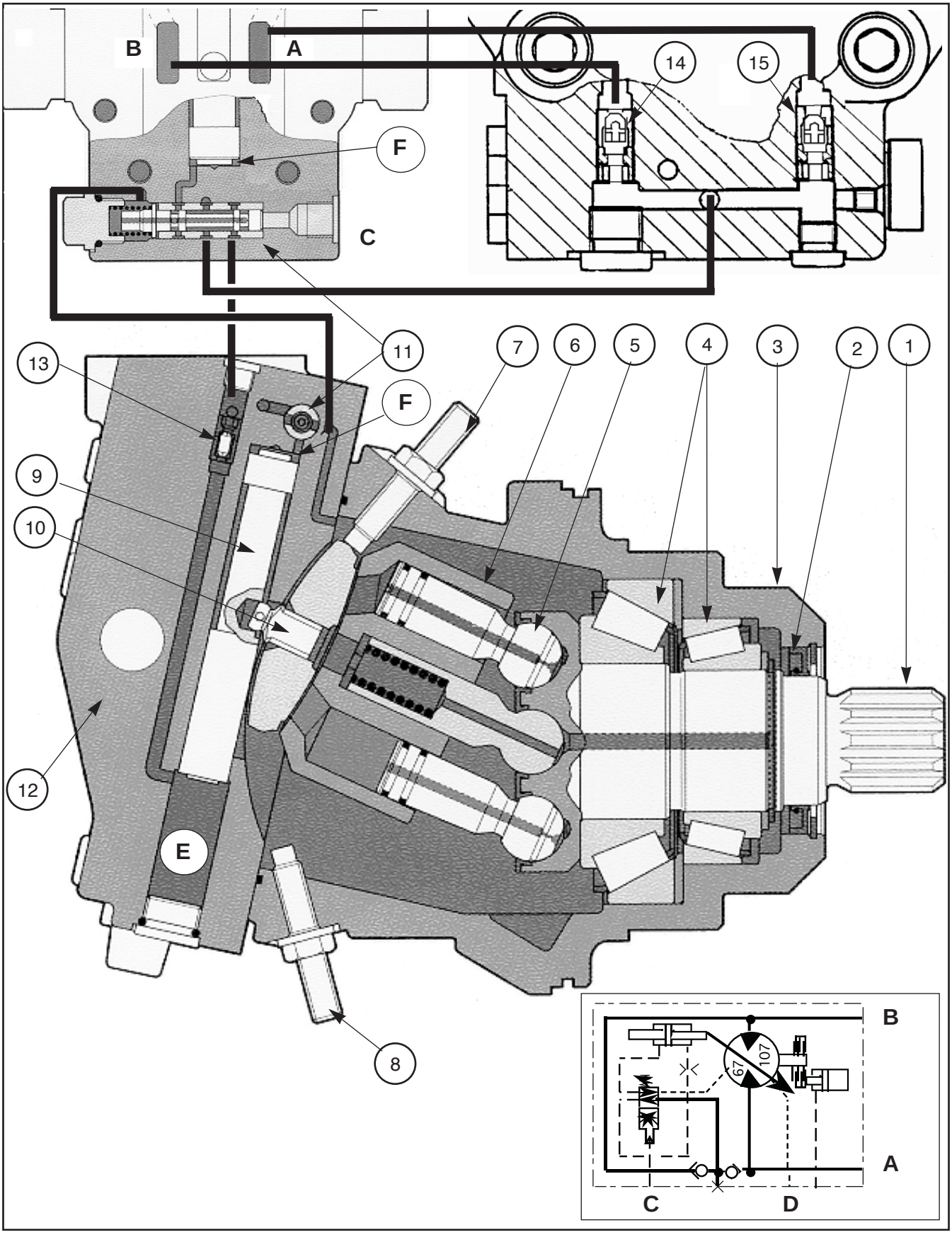
1488 travel function hydraulic diagram



12/1488 TRAVEL FUNCTION

12/1488 TRAVEL FUNCTION

1488 VARIABLE DISPLACEMENT HYDRAULIC TRAVEL MOTORS



12/1488 TRAVEL FUNCTION

1488 VARIABLE DISPLACEMENT HYDRAULIC TRAVEL MOTORS

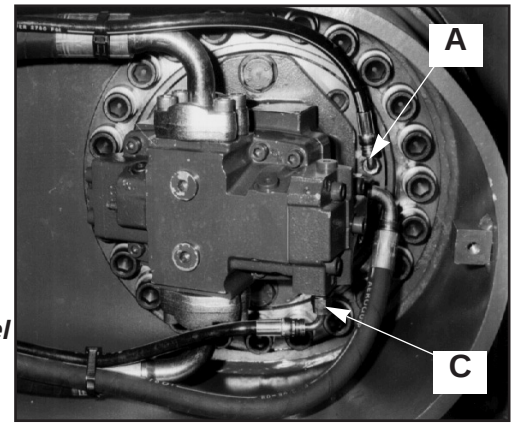
- These are high-speed variable flow axial piston motors with a barrel which can be tilted to provide two displacements.

Purpose/

- They transmit a rotary movement to the reduction gear, fitted with a static automatic brake, to drive the drive sprockets.

Description/

1 - Output shaft
2 - Shaft output sealing assembly
3 .- Housing
4 - Taper roller bearings
5 - Pistons and rings
6 - Barrel
7 - Max. displacement stop screw
8 - Min. displacement stop screw
9 - Displacement change control piston
10 - Barrel angle control arm
11 - Displacement change selector
12 - Servo-control
13 - Calibrated orifice
14 - Non-return check valve
15 - Non-return check valve



Port identification

A and **B** -. Hydraulic motor supply or return
C - Pilot pressure inlet for displacement change (35 bar)
D - Motor operating leaks return
E and **F** - Servo-control piston chamber

For cylinder displacement change operation, see automatic travel sequencing (Chapter 1: The principle of electronically assisted systems)

Hydraulic motor displacement change operation

A) Electro-control valve (10d) at rest. C goes to the reservoir, Selector 11 at rest due to the spring.
The supply pressure at **A** passes via the non-return check valve **15**, presses the check valve **14** against its seat, passes through selector **11** and calibrated orifice 13 and ends up in chamber **E** of the servo-control piston.
In this case, the position is shown on the left-hand page.
The fluid which is expelled from chamber **F** goes through selector **11** and returns to the reservoir with the motor operational leaks.
The motor is in high displacement mode, so the travel is in low speed, but with high torque.

B) Electro-control valve (10d) is activated, pressure at C is 35 bar, Selector 11 is piloted.
The movement of selector **11** enables the supply pressure from the motor to pass into chamber **F** of the servo-control piston. This moves in the opposite direction. The fluid expelled from chamber E passes through the calibrated orifice **13** and selector **11** and goes to the reservoir.
The motor is in small displacement mode, so the travel is in high speed mode, but with low torque.

In the other travel direction
The supply pressure at **B** pushes the non-return check valve **14**, presses the non-return check valve **15** against its seat and moves into selector **11.**
After that, the operation is the same as that mentioned above.

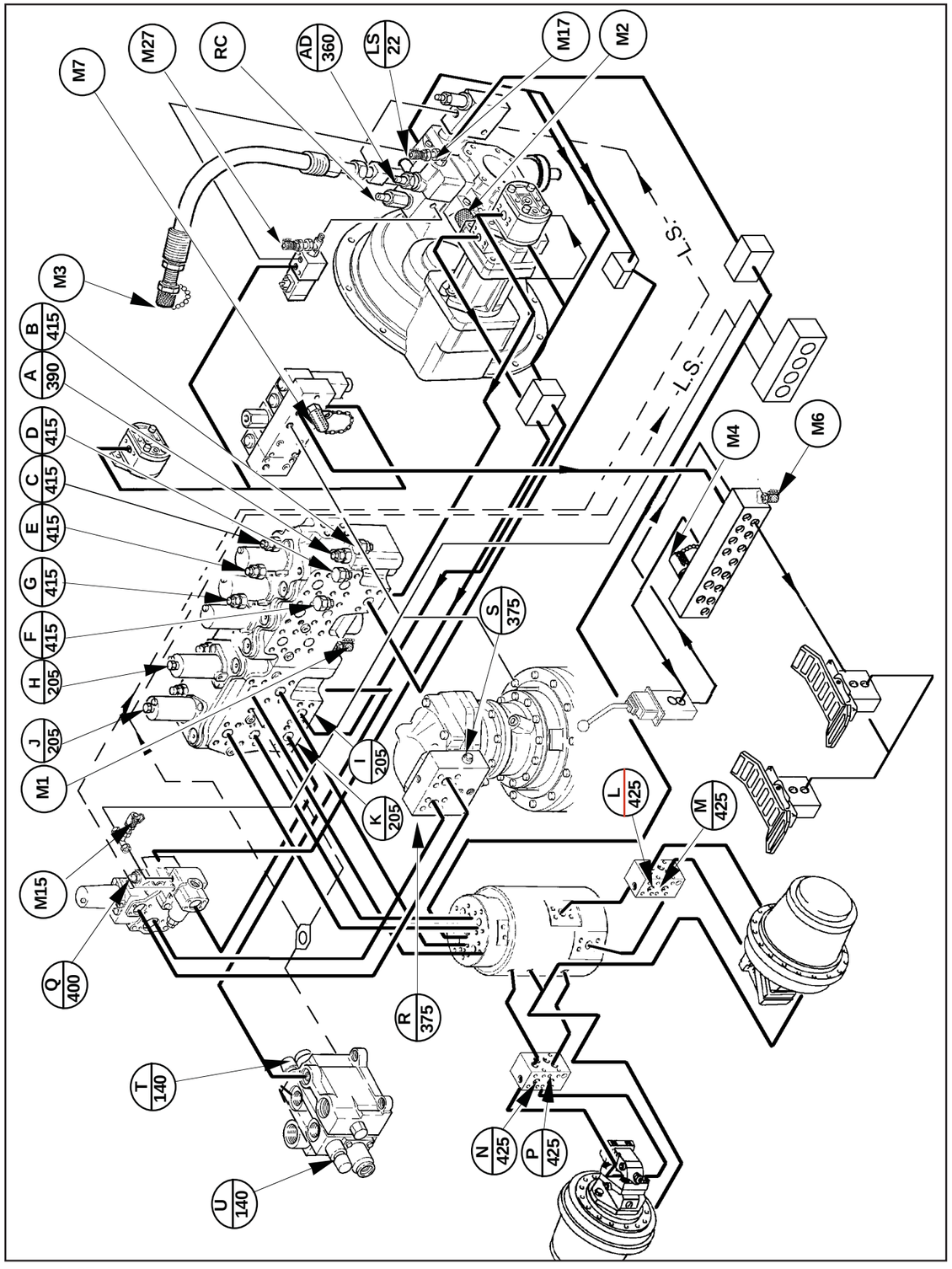
NOTE
The calibrated orifice **13** provides more gradual acceleration and deceleration.

12/1488 TRAVEL FUNCTION

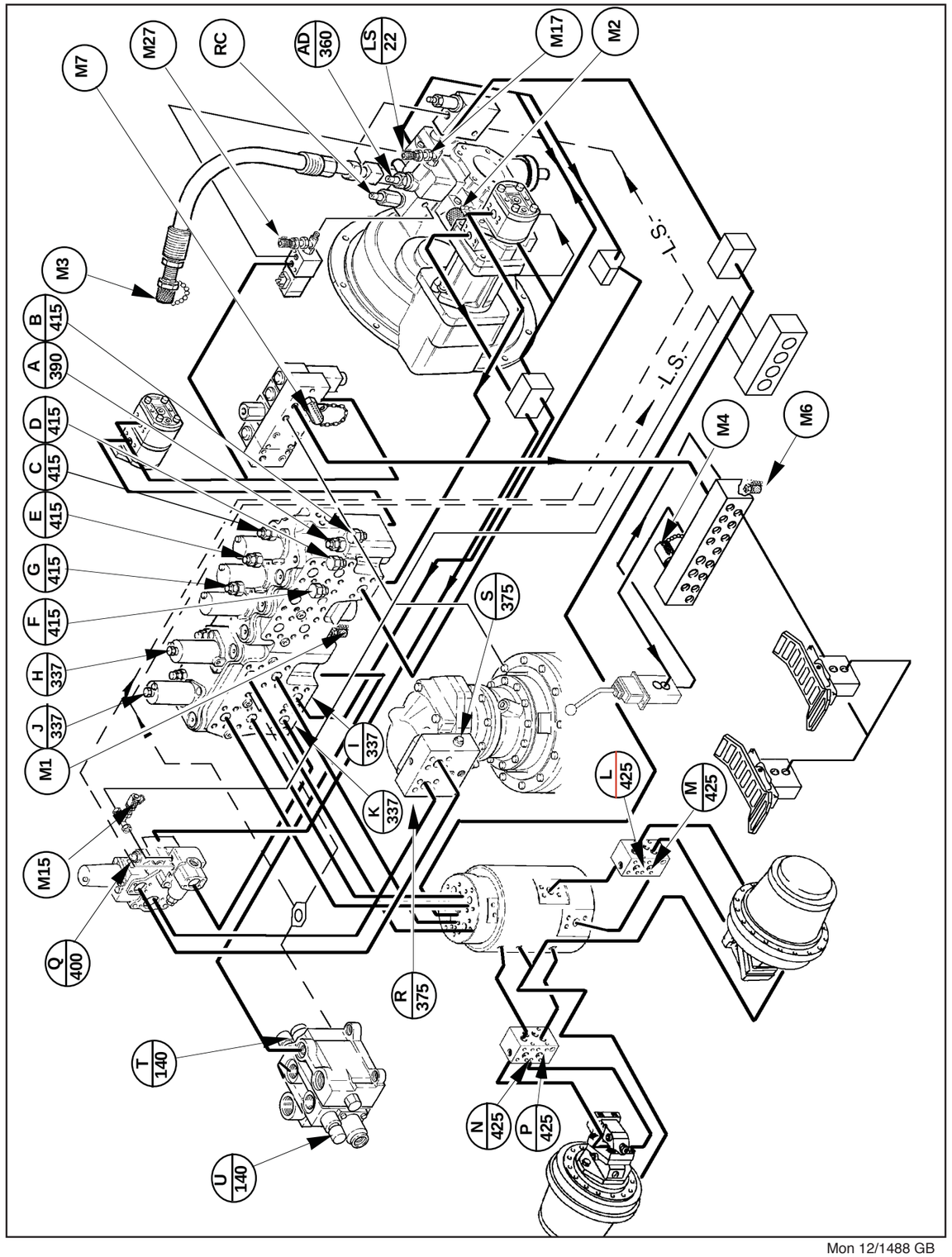
PRESSURE SETTINGS FOR 1288 C and 1488C

CONTENU Page

PRESSURE SETTINGS 1288 C



PRESSURE SETTINGS 1488C



PRESSURE SETTINGS FOR 1288 C./1488C

Location of the various pressure test points fitted to the machine.

- **M1** on the attachment control valve.
- **M2** on the swing pump.
- **M3** on the anti-surge valve.
- **M4** on the manifold.
- **M7** on the electro-control valve base.
- **M27** on the proportioning valve.

Pressure test points to be fitted.

- **M6** on the manifold (on Port Z2 of the manifold)
- **M15** pressure test union at Pst on the reinjection balance valve.
- **M17** pressure test union on **A.D**. valve at **X6**.
- **M19** on the boom safety block, cab end.
- **M20** on the other safety block.
- **M21** on the dipper safety block.

Installing the turbine on the A1 pump body (attachment and travel).
Disconnect and plug the parallel connection of the two pump bodies at the pump outlet.
Install the turbine (**D 31444-71**) with the hose (**W 54319-76**) specified in the list of tools.

Bringing the circuit temperature up to 50 to 55°C.
Connect the electronic console to the diagnostic plug and the multitester at **M27**
Use the attachment to raise one track off the ground. Operate the travel control with the bucket or clamshell up against the stops.

Checking the engine speeds with no load and the pressures supplied by the proportioning valve.

	1288		1488	
Modes	**Speeds (rpm)**	**Pressures (bar)**	**Speeds (rpm)**	**Pressures (bar)**
MEDIUM - IDLE	1180 to 1220	26 to 30	1180 à1220	26 to 30
LOW-IDLE	900 to 1000	26 to 30	930 to 970	26 to 30
FINE	1430 to 1470	21 to 25	1580 to 1620	15 to 20
ECO	1830 to 1870	3 to 7	1930 to 1970	3 to 7
MAX	2240 to 2300	3 to 7	2240 to 3000	3 to 7

If these speeds are out of tolerance, first check the geometry of the servomotor connecting rod.

	1288	1488
Old ball-joint (adjustable) (length end-to-end)	**126 mm** (+or- 1 mm)	
New ball-joint (not adjustable) (length axis to axis)	**103 mm** (+or- 1 mm)	**106 mm** (+ or -1 mm)

Make the angular stroke symmetrical (+ or - 1° between minimum and maximum).
Perform calibration.
CAUTION ! ALL CHECKS AND ADJUSTMENTS ARE TO BE MADE AT VARIOUS ENGINE SPEEDS AND AT 50° C TEMPERATURE.

AFTER EVERY CHECK, IF THE PARAMETERS ARE WRONG, ADJUST AT THE COMPONENT CONCERNED, OR REPLACE THE COMPONENT.

PRESSURE SETTINGS FOR 1288 C./1488C (continued)

Checking pilot pressure with the control arm-rest lowered.
Connect the multitester to the manifold at **M4.**
Set MAX mode.
The pressure should be between **34 and 42** bar).
If it is not, check the **P35** or the electrical circuit.

Pressure setting the L.S. valve
Static test**,** using a 0/40 bar pressure gauge:
CAUTION! *Start the engine before connecting the pressure gauge at M1.*
Raise the LEFT-HAND control arm-rest as a safety precaution.
Set **FINE** mode.
Connect the pressure gauge at **M3**. The pressure should be between **8** and **12** (bar). If it is not, check the **P10**.
Connect the pressure gauge at **M1**. The difference between **M1** and **M3** should be **20** to **24** (bar).
Dynamic test: using the multitester :
Install the spacer on the boom raising control valve push-rod.
Connect the two multitester outlets at **M1** and **M3**.
Operate the boom raising function.
The pressure differential should be between **20** and **22** (bar).

Checking the variable displacement pump maximum flow, using only one flowmeter turbine.
Set **MAX** mode.
Connect the multitester to measure the flow.
Retract the dipper and close the bucket simultaneously.
The flow should be greater than **202** (l/min) and the pressure at **M1** lower than :
- **140** (bar).for the **1288** and
- **165** (bar) for the **1488**.

CHECKING FLOWS:.

Attachment control valves (no adjustment possible).
Operate the large chambers of the boom, bucket and dipper, one after another.
FOR THE 1288 :
The flows should be between : **184** and **216** (l/min) for the boom
: **120** and **140** (l/min) for the bucket.
: **184** and **216** (l/min) for the dipper.
FOR THE 1488 :
The flows should be between : **184 and 216** (l/min) for the boom.
: **155** and **185** (l/min) for the bucket.
: **184** and **216** (l/min) for the dipper.

Travel control valve.
Forward and reverse travel.
Select **speed 1** (two-speed excavators).
Use the attachment to raise one track off the ground. With the Inching control valve lever in maximum position,
Operate the travel control in both travel directions.
The flows noted should be between
- **98** and **107** (l/min) for the **1288** and
- **160** and **177** (l/min) for the **1488**.

Do the same for the other track.
To make the four flows symmetrical, turn the adjusting screws on the control valve spool caps - Large caps = forward travel).

Right-hand travel control valve section next to that of the dipper.
Using a chronometer.
The number of revolutions of the track drive sprocket should be between :
- **27.3 and 30** (rpm) for the **1288** and
- **27.8** and **30.7** (rpm) for the **1488**.

PRESSURE SETTINGS for 1288 C./1488C (continued)

Checking hydraulic power and pressures supplied by the proportioning valve, with the engine under load.
Connect the multitester at **M1** and **M2**.
Set **MAX mode**.
Lock the travel and the swing mechanically. Supply these two functions independently.
The pressures noted should be between **385** and **400** (bar) for the travel and **370** and **380** (bar) for the swing.
Disconnect the multitester from **M2** and connect it at **M27**.
A) Operate the travel function alone.
a) The pressure supplied by the proportioning valve should be between
- **13** and **17** (bar) for the **1288** and
- **12** and **16** (bar) for the **1488**.

b) The pump flow should be greater than :
- **96** (l/min) for the **1288** and
- **112** (l/mn) for the **1488**.

c) the engine speed should be equal to or greater than:
- **1980** (rpm) for the **1288** and
- **1970** (rpm) for the **1488**.

B) Operate the travel and swing function simultaneously.
The pressure supplied by the proportioning valve should be between
- **23** and **28** (bar) for the **1288** and
- **19** and **24** (bar) for the **1488**.

the engine speeds should be those given previously.
IF THEY ARE NOT, SEE TROUBLESHOOTING METHOD.

WHEN THESE ADJUSTMENTS HAVE BEEN COMPLETED, REMOVE THE FLOW METER TURBINE.

Checking or adjusting all valves..
Connect the multitester at **M1**.
Set **MAX** mode**.**
Overtighten the relief valve by one turn.
Overtighten the attachment flow cancellation valve by two turns.

Safety valves on attachment control valves.
Still in **MAX** mode.
Raise the left-hand control arm-rest and install the spacer on each push-rod of the control lever concerned.
For an excavator which is not fitted with load-holding or safety valves.
Operate each function in both directions, except boom lowering.
The pressures noted should be between **405 and 420** (bar).
Swap over the small chamber boom safety valve with the bucket safety valve.
Then check the valve mounted on the bucket control valve section.
NOTE :
If the large chambers of the boom cylinder and the small chamber of the dipper cylinder are fitted with safety valves or load-holding valves, proceed as follows:

A) With LOAD-HOLDING block on the boom cylinders and on the dipper cylinder
Overtighten the LOAD-HOLDING block valves by one turn.
Check the boom large chamber safety valves and the dipper cylinder small chamber safety valve.
Then adjust the load-holding valves to between **390** and **410** (bar).

B) With SAFETY blocks..
Overtighten the safety valve check valves by one turn.
Check the safety valves on the boom large chamber and dipper small chamber control valve safety valves.
Then set the valves on the safety valves as follows:
1) FOR THE BOOM :
Disconnect and plug the small hose connecting the safety valves (plugs J37374-16 and M37374-19).

PRESSURE SETTINGS for 1288 C./1488C (continued)

On the safety block at the cab end:
Disconnect the load contact switch pipe and install a pressure test point (**M19**).
Disconnect and plug the pilot line (above the block, **N37374-20**).
On the other safety block, open the lever valve.
Connect the multitester at **M19**.
Set FINE mode..
Raise the boom.
When lowering, the pressure at **M19** should be between **405** and **425** (bar).
Reinstall all the components, except the small hose connecting the two safety blocks.
On the second block:
Remove the plug at **M20** (14x150, to the same place as when the load contact switch is connected and install a pressure test point.
Proceed in the same manner as previously mentioned.
2) FOR THE DIPPER :
Remove the plug at **M21** and install a pressure test point
Disconnect and plug the pilot line (plug N37374-20)
Connect the multitester at **M21**.
Set FINE mode..
When the dipper is retracted, the pressure should be between **405** and **425** (bar).

Safety valves on travel control valve:
Lock the tracks mechanically in both travel directions.
Set Max mode, with the Inching valve lever at maximum.
Supply each track one after another, in both directions.
The pressures noted should be between **415** and **430** (bar).

Adjusting the relief valve.
Operate the travel function.
Reduce the pressure setting on the relief valve between **385** and **400** (bar).

Adjusting the attachment flow cancellation valve.
Untighten this valve by two turns.
Operate the bucket control up against the stops.
Set to between **355** and **365** (bar).

Checking or adjusting the swing.
Circuit pressure with no load.
Connect the multitester at **M2**.
Set Max mode.
The pressure noted should be between **15** and **17** (bar).

Swing control valve relief valve
Lock the upperstructure mechanically.
Overtighten the safety valve by one turn.
Operate the swing direction concerned.
The pressure noted should be between **390** and **405** (bar).

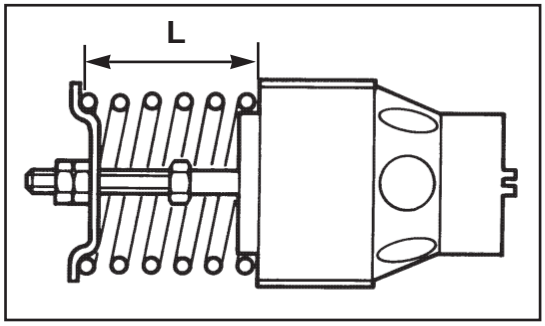
Swing safety valves
Operate the swing in each direction.
The pressures should be between **370** and **380** (bar).

Checking the swing brake release.
Connect the two multitester outlets at **M2** and **M7**.
With the upperstructure immobilised, operate the swing control lever up against the stop.
The pressure at **M7** should be **35** (bar) before the pressure increases at **M2**.

PRESSURE SETTINGS for 1288 C./1488C (continued)

Checking the travel brake release.
Install a pressure test point at **M17**.
Connect both outlets of the multitester at **M1** and **M17**.
Lock one track mechanically.
Press fully down on the foot pedal concerned. Operate against the stop at the Inching valve.
The pressure at **M17** should be **35** (bar) before the pressure increases at **M1**.

Checking the boom and dipper flow limiters.
When the dipper is retracted, the pressure at **M1** should be between **40** and **70** bar.
If it is not, set the limiter spring to **LENGTH = 22 mm**.
If the boom lowering speed is not correct, set the spring to **LENGTH = 23,2mm**.



CASE

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