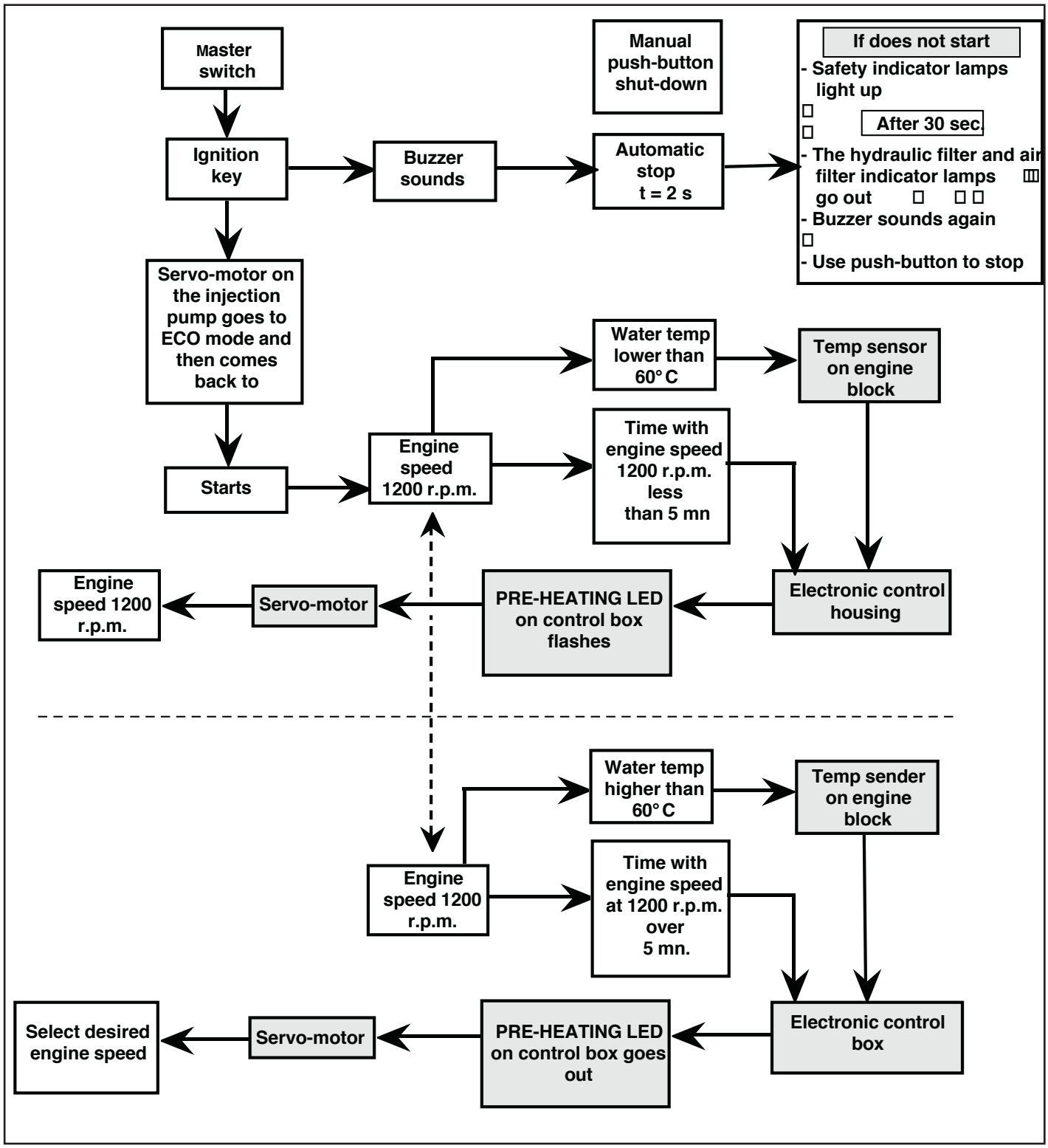
BASIC PRINCIPLES OF ELECTRONICALLY ASSISTED SYSTEMS

STARTING ASSISTANCE



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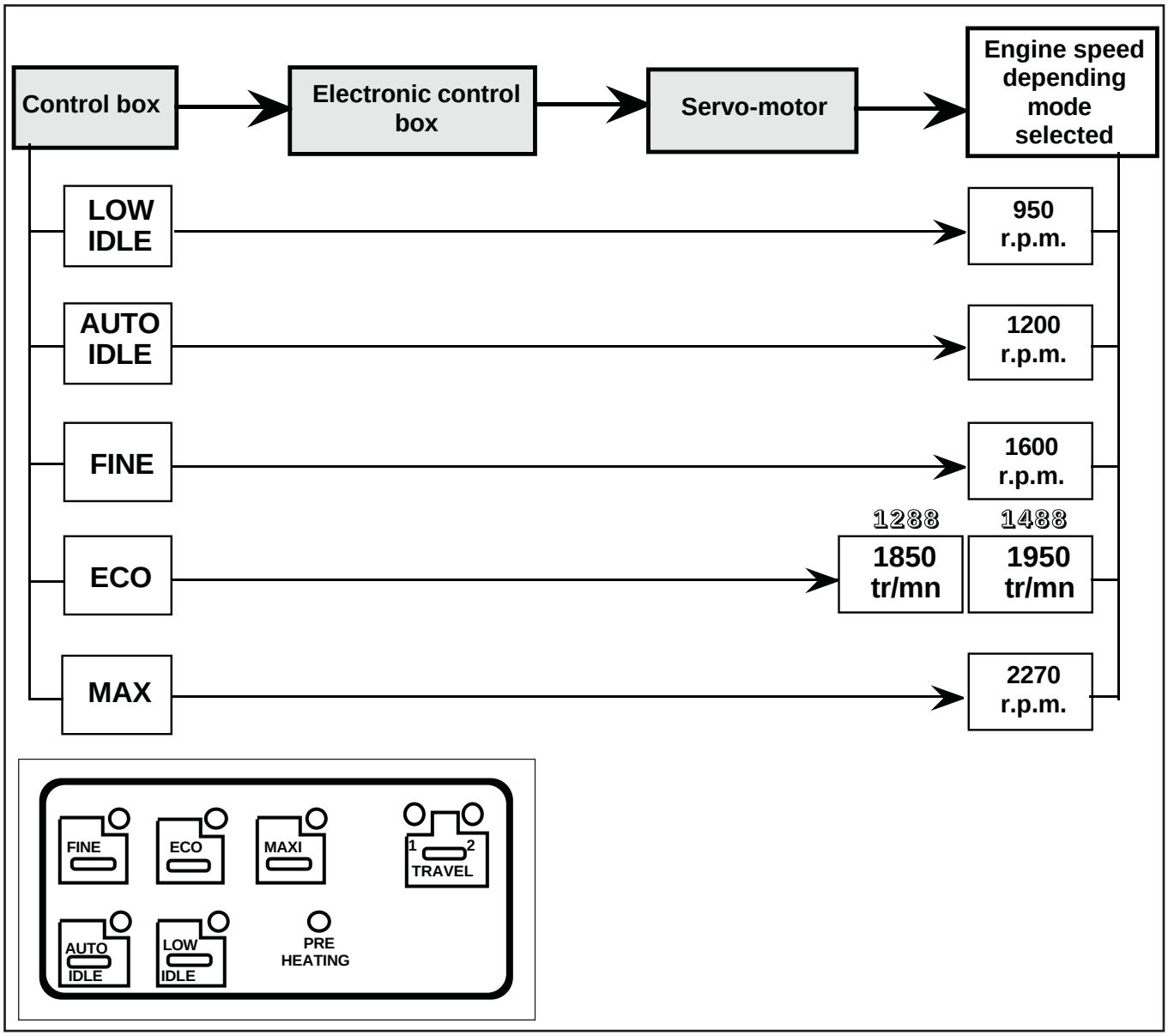
BASIC PRINCIPLES OF ELECTRONICALLY ASSISTED SYSTEMS

ELECTRIC ACCELERATION (AFTER ASSISTANCE WITH STARTING)



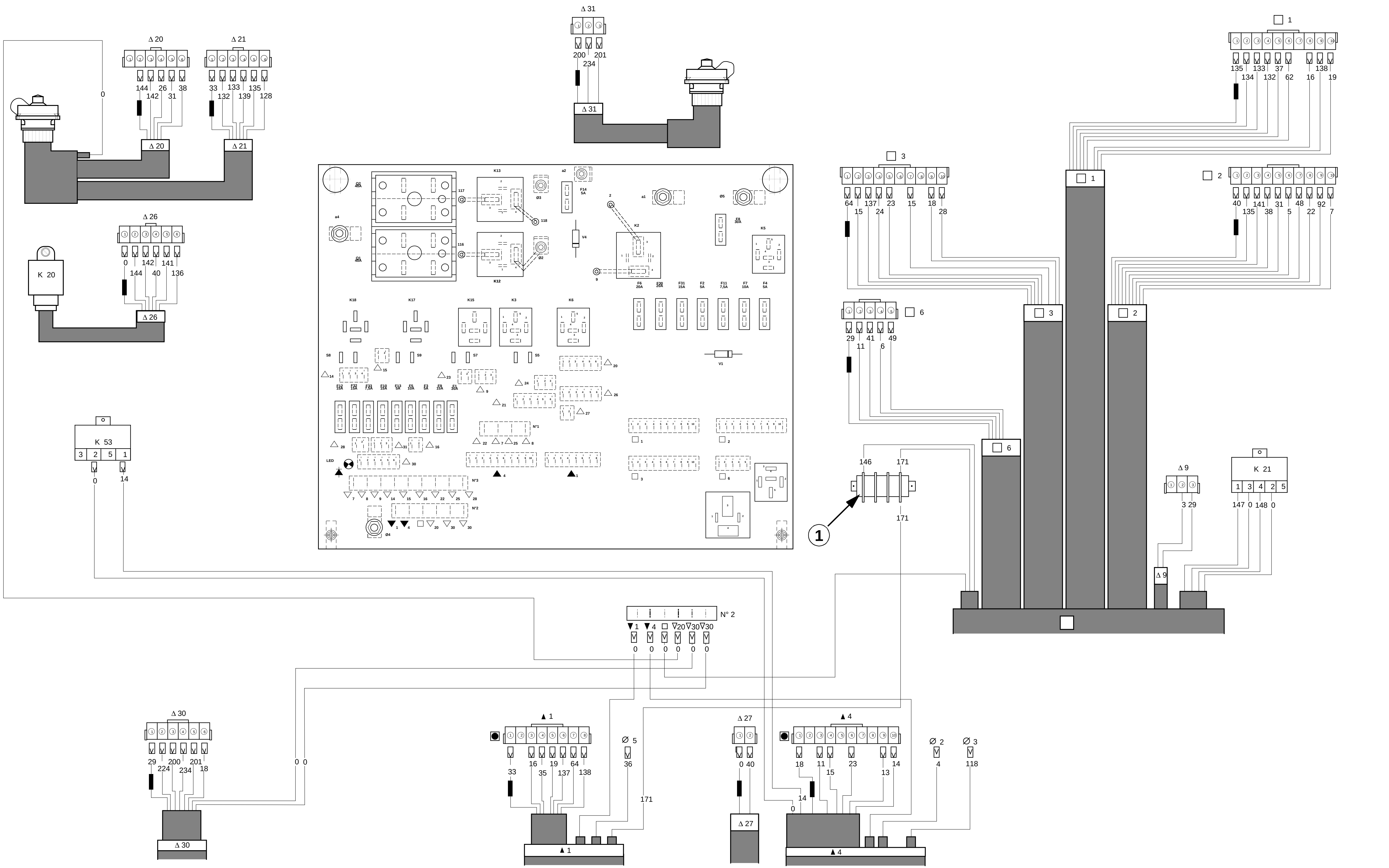
PURPOSE

To set the correct engine speed in accordance with the MODE selection made by the operator.
It provides the following :

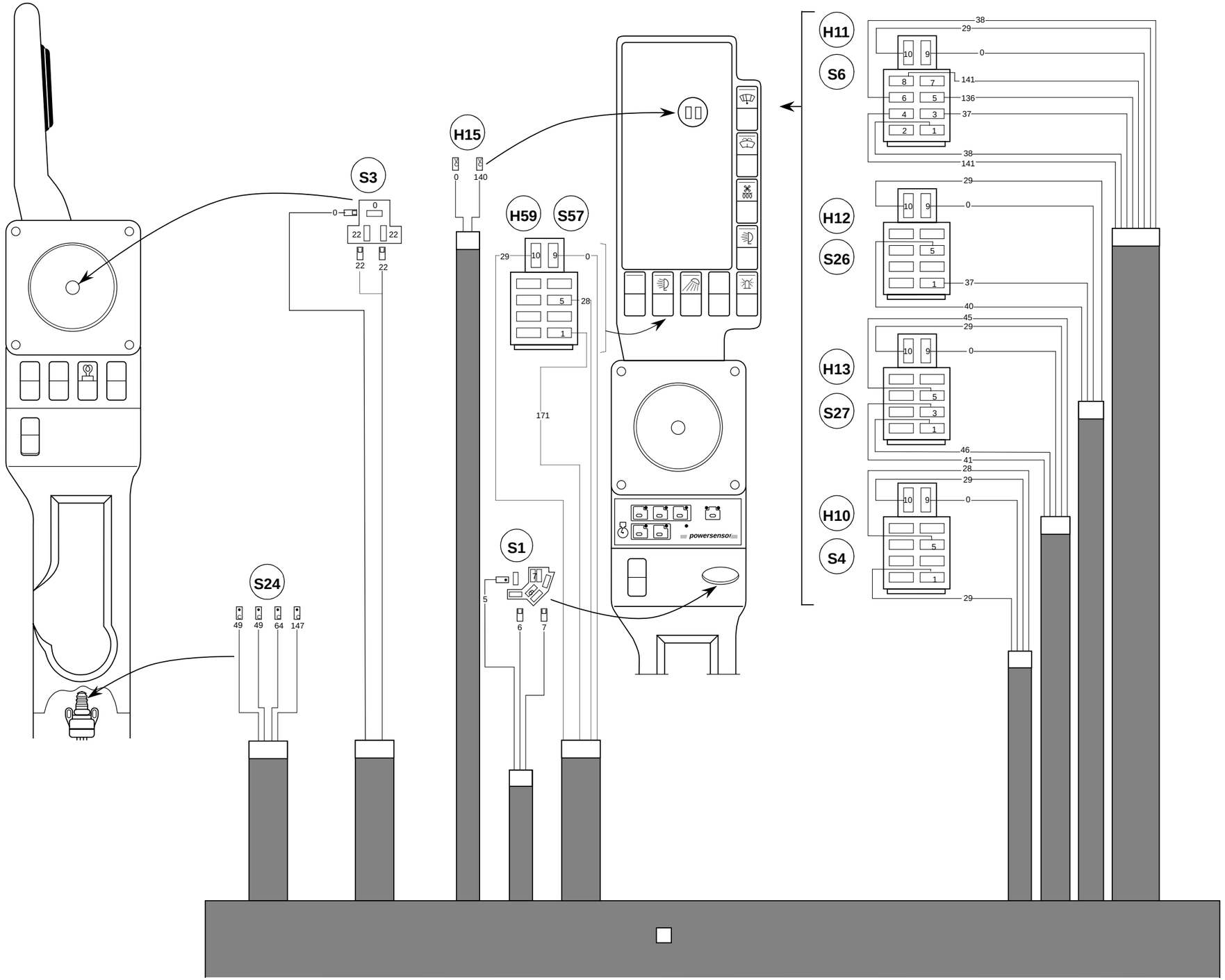
- **2 idle modes**
- **LOW IDLE** is the low idle speed at **950** rpm.
- High idle (**1200 rpm**) cannot be selected and is only obtained automatically during assistance with starting when selecting **AUTO-IDLE** function (see page 1.5.00)

- **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.



CM97C003


S3
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S57
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10
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6
7
S24
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147
H11
S6
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136
37
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141
H12
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H13
S27
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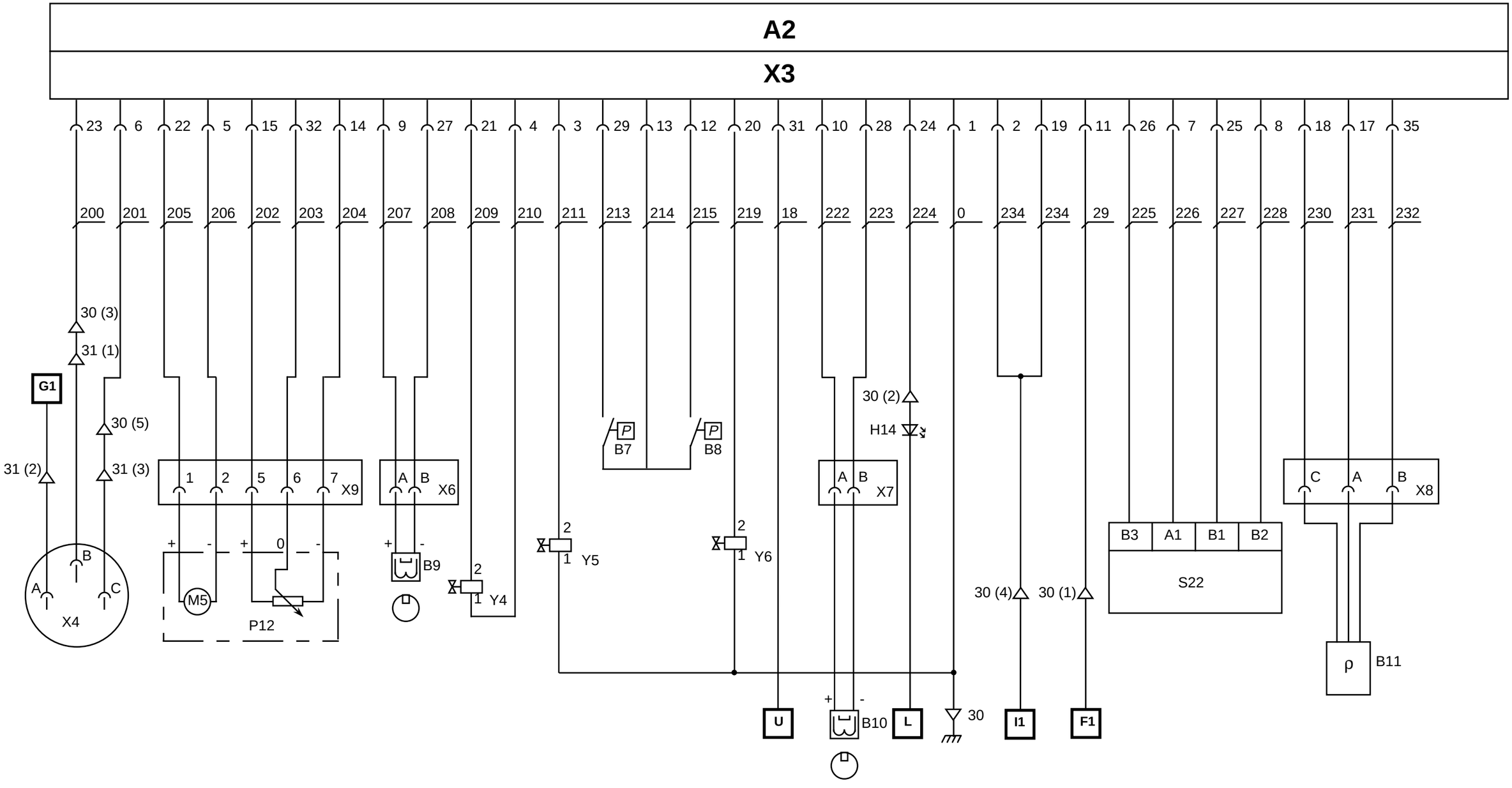
41
H10
S4
28
29
10
9
0
5
1
29
powersensor

CM97C006

TROUBLESHOOTING SOCKET	INJECTION PUMP SERVOMOTOR	ENGINE SPEED DETECTOR	DRE4 PRESSURE REDUCER	SWING BRAKE RELEASE SOLENOID VALVE	PRESSURE SWITCH		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
					SWING	TRAVEL									



BASIC PRINCIPLES OF THE HYDRAULIC CIRCUIT

Feed system to the various hydraulic components 1488

- 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.
- 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.

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 :

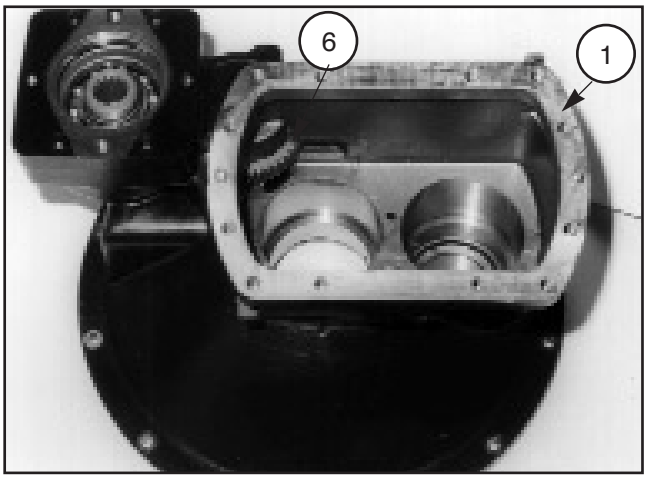
- Cooling of part of the return flow from the attachment, travel, pilot and swing circuits.
- Cooling by air from engine fan.

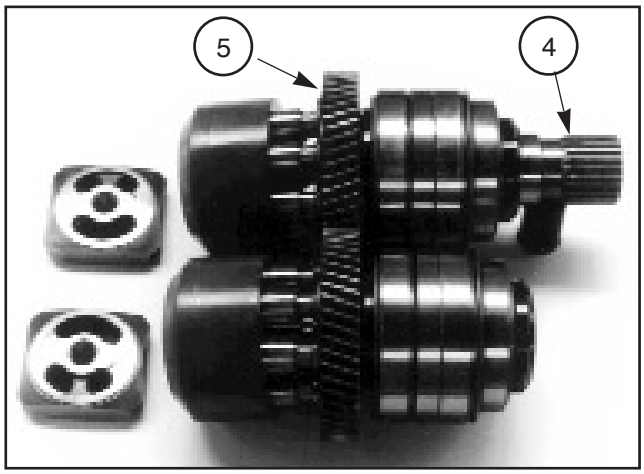
PLUMBING, CONNECTIONS :

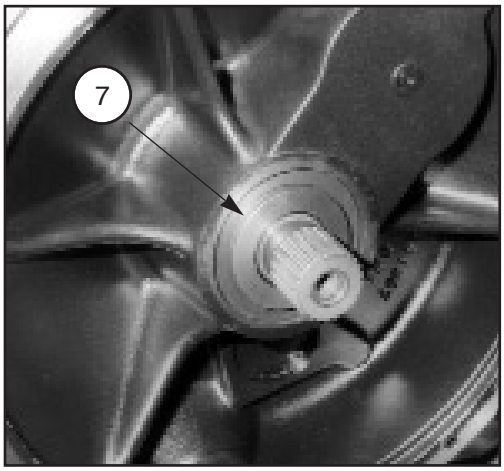
- A great number of flexible hoses are used.
- S.A.E. couplings with I.S.O. seals on pipes of Ø. equal to or greater than 20 mm.
- .A.E. couplings with O.R.F.S. system seals on pipes of Ø. smaller than 20 mm.

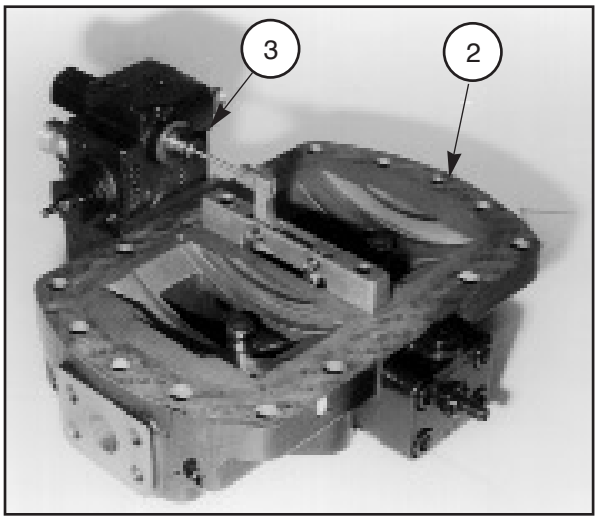
HYDRAULIC PUMPS 12/1488

PISTON PUMPS MAIN TECHNICAL DETAILS





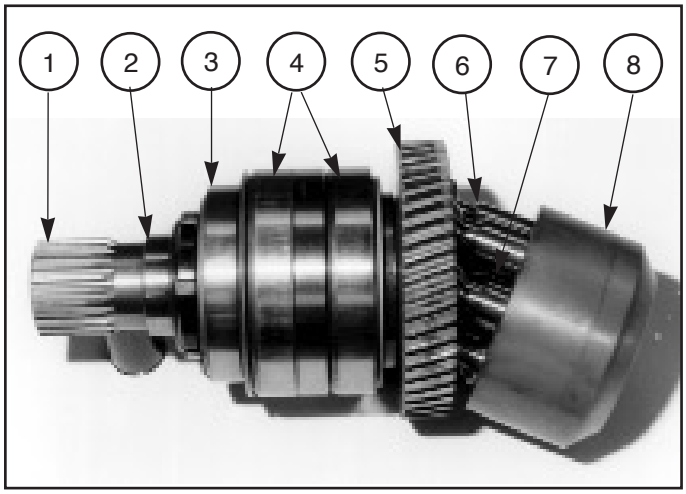




THE VARIABLE DISPLACEMENT DRIVING PUMP BODY

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



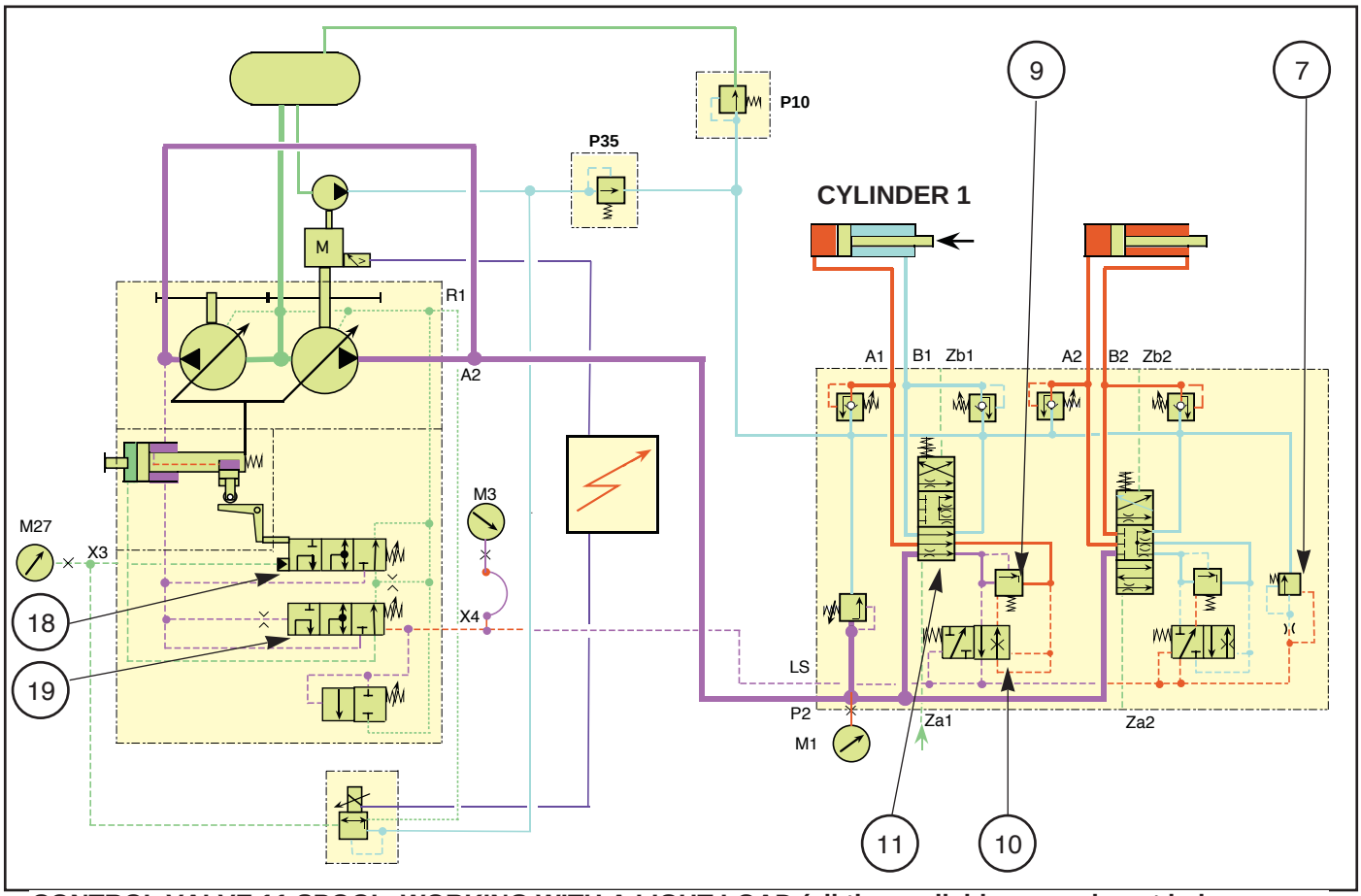
VARIABLE DISPLACEMENT DRIVEN PUMP BODY

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

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

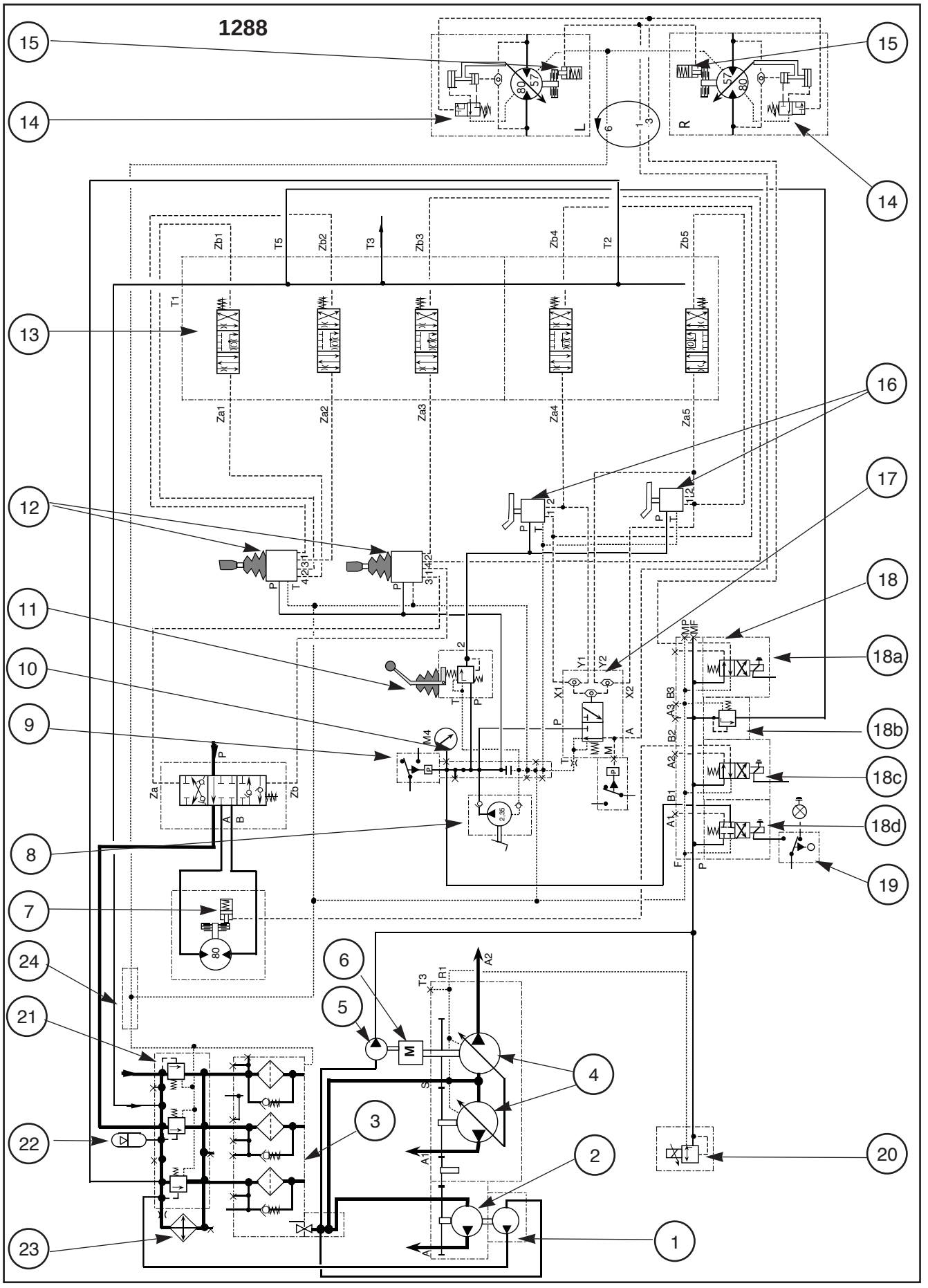
THE LOAD-SENSING SYSTEM

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.


1288
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A3
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R1
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80
57

12/1488 ATTACHEMENT OPTIONS

CONTENTS PAGE

ATTACHMENT OPTIONS

SAFETY VALVES (on boom cylinders)

OPERATION

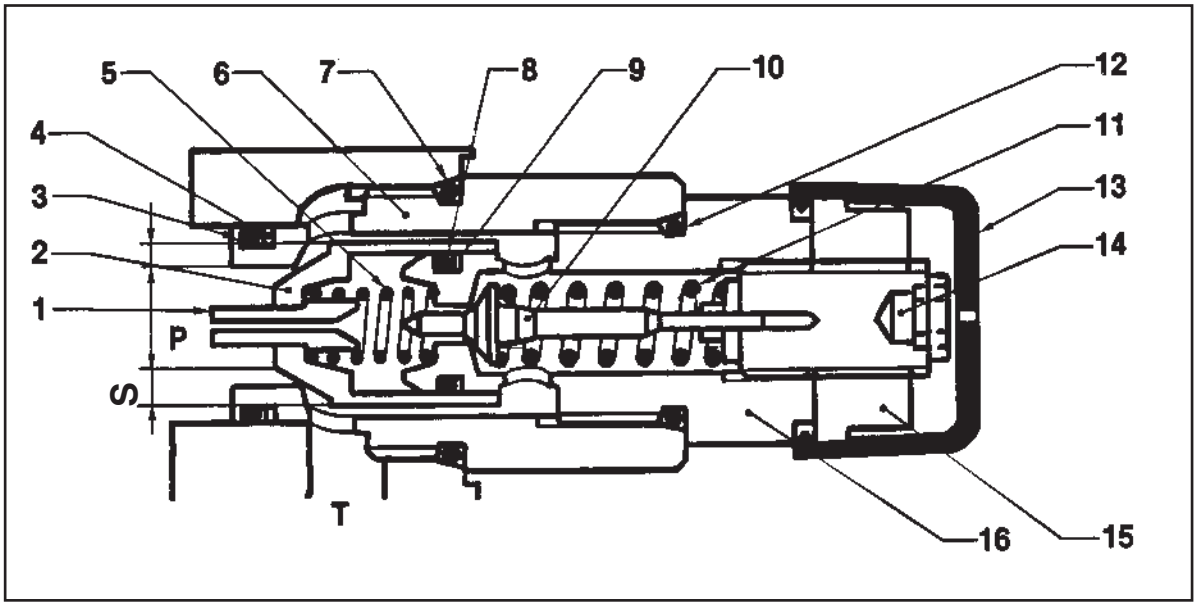
Boom lowering
Phase : 1
The pilot pressure from the control valve spool acts at **X** on piston **19** and via passage **G** on spool **8**. As it moves, piston **19** comes in contact with the stem of balance valve **14** which opens. This enables the pressure from the cylinder chamber to be applied 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

“LOW FLOW” OPTIONS CONTROL VALVE BLOCK.
SAFETY VALVES



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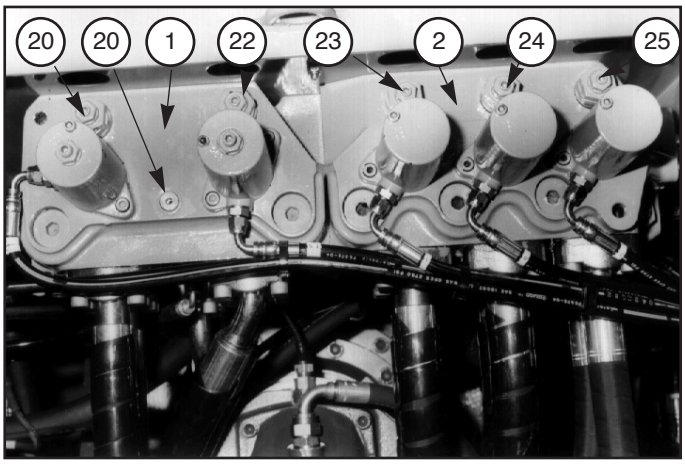
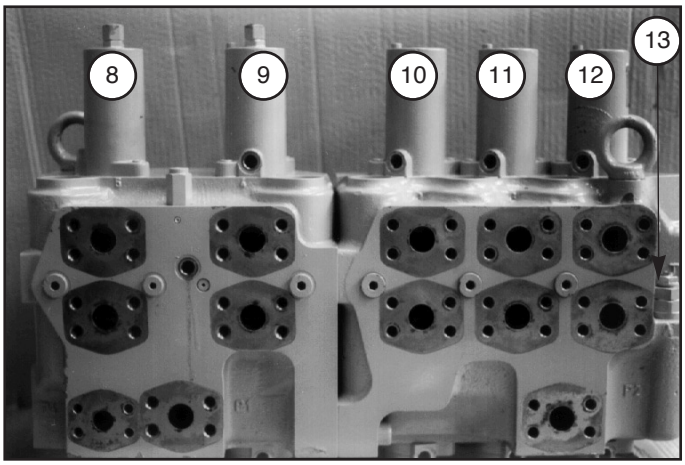
THE ATTACHMENT/TRAVEL CONTROL VALVE BLOCK

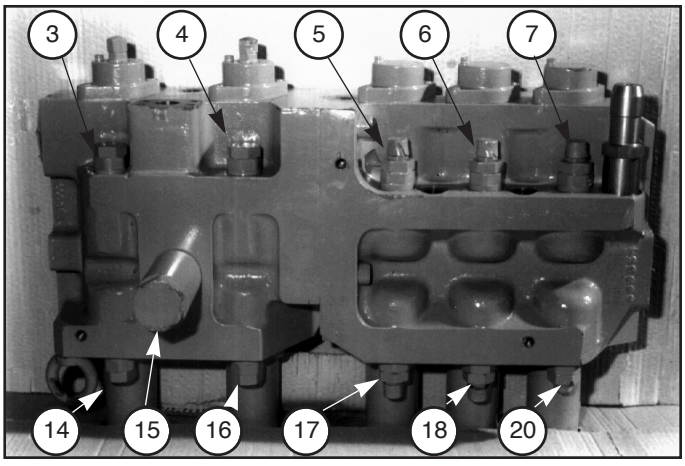
- It is attached to the control valve partition.
- It consists of two one-piece control valves, joined a together by bolts.
- The first block is composed of three elements for feed to the boom, dipper and bucket cylinders.
- The second block has two elements for feed to the hydraulic travel motors.
- 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.



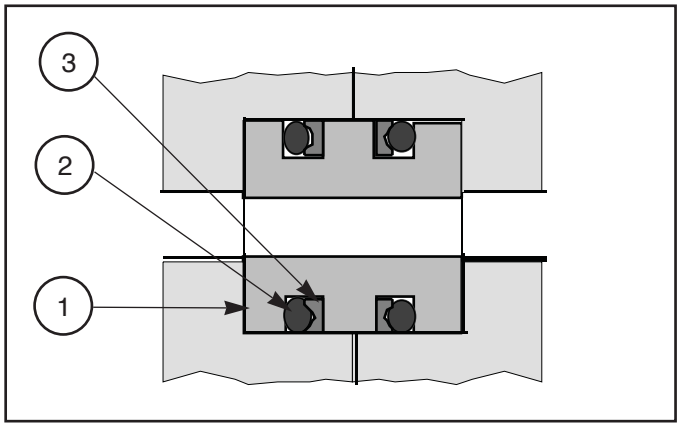
Description:

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.

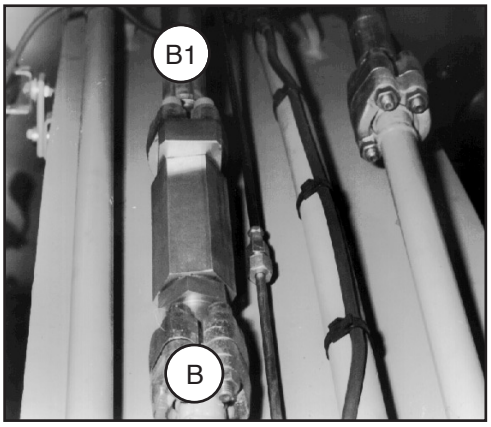


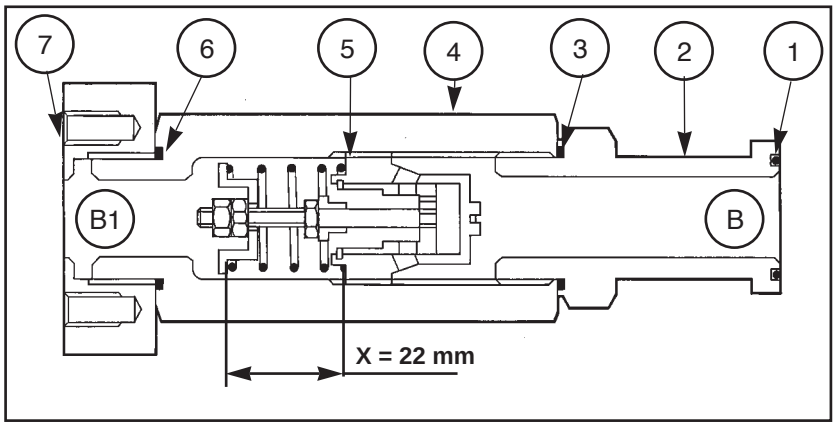
1 - Spacer
2 - O-ring
3 - Back-up ring

FLOW LIMITERS ON BOOM AND DIPPER CYLINDERS

Dipper cylinders flow limiter

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





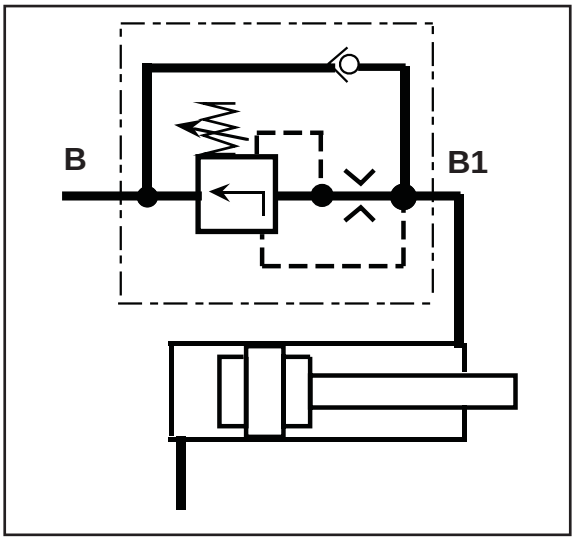
Description

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.