HYDRAULIC CONTROL SYSTEM
Advanced
HYDRAULIC CONTROL SYSTEM ADVANCED

HYDRAULIC POWER UNIT (HPU)

The hydraulic power unit is provided with a steel tank suitable for outdoor service able to collect the full volume of oil present in the circuit. The tank is equipped with inspection door, breather with filter, 2 level switches, 1 temperature switch, 1 visual level indicator and 1 electric resistance piloted by thermostat.

Two main motor-pump groups P1 and P2, each one fitted with an electric motor, are provided on the tank; the fixed displacement pump is able to deliver the required flow rate at a pressure of 200 bar.

A filtering/conditioning group composed by fixed displacement pump P3, filter with clogging detector (DPS3) and exchanger (R) with fan piloted by internal thermostat is provided on board.

Functions of the main pumps are :

- n° 1 active pump, to maintain all control valves in closed / open position or under continuous control.
- n° 1 stand-by pump to be activated on alarm signal from low pressure switch mounted on pump common delivery manifold

The pump flow rate is enough to ensure the maximum stroke time required in control mode for each valve without involving the accumulator intervention.

Four pressure switches are installed in the common delivery manifold of the motor-pump groups, as follows:

- PS1 supplies the "low oil pressure signal"
- PS2 supplies the "minimum oil pressure signal" (i.e. plant out of commission).
- PS3 stops the active pump
- PS4 starts the active pump

One accumulator A1, constantly inserted on the delivery manifold, is installed on the hydraulic power unit to grant trouble-free change-over from a motor/pump group to the other one.

The overflow valve VS3 controls the oil pressure in the primary circuit.

Two sealed maximum pressure safety valves VS1 and VS2 are mounted on pump deliveries.

A double filter F provided with electric clogging detectors DPS1-DPS2 is installed at power unit outlet.

The hydraulic power unit is provided with two terminal boxes: the first one is intended for instruments cables, the second one for the electric motor control cabinet (M.C.C.).

Options:

- Inox oil tank
- Triple pressure switches configuration (2/3 logic)
- Fire resistance oil version
- First filling oil
- Charging and testing unit for accumulators
HYDRAULIC DIAGRAM
HYDRAULIC CONTROL PANEL (HCP)

The control panel for control valves consists of:
SV proportional valves, supplied with built-in electronic circuits
ON-OFF, two-position solenoid valves (EV), to perform emergency actions
accumulator

The control panel for ON-OFF valve consist of:
ON-OFF, two-position solenoid valves (EV), to perform emergency actions
accumulator

The response time of ON-OFF valves may be separately adjusted by suitable throttling devices.
The hydraulic circuit should be provided with gate valves to allow maintenance actions.
Complete cycles are allowed, when pumps are still, within 15 minutes from pump stop, because of leakages.

Options:
• Hand pump
• SIL 2 certification for failure actions

HYDRAULIC DIAGRAMS

CONTROL VALVES

ON-OFF VALVES
HYDRAULIC CONTROL SYSTEM ADVANCED
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**ELECTRIC CONTROL CABINET (ECC)**

The electric control cabinet is supplied with a redundant feeder/transformer for auxiliary circuits (240 Vac ⇒ 24 Vdc), warning lights, lamps, contactors and any other necessary component to grant the efficiency of the whole hydraulic equipment.

The cabinet, fitted with a fan (extractor) complete with replaceable cartridge, includes an auxiliary electrical socket.

Manufactured according to the industrial standards, with minimum protection degree IP42, houses the control system for emergency solenoid valves and 1 PLC to manage the Hydraulic Power Unit, the Control Panel and the interchange signals with control room.

Auxiliary circuits are separately protected, even when redundant (pumps control, PLC power supply and proportional valves).

- Cable entry from bottom.
- Max cable run from cabinet to control panel approx. 200 m.
- Max resistance of proportional valves supply cable 2 W.
- Approximate sizes 1200 x 2000 (+ 100) x 600 mm.

*The following warning lights and push buttons are mounted on the front:*

*Lights:*
- Power on
- Main alarm
- Warning

*Push buttons:*
- Emergency
- Alarm reset
- Pumps start
- Pumps stop
- Automatic/manual operation selector.

**PLC CONTROL FUNCTIONS**

The cylinders are managed by one PLC, located inside the electric cabinet. The PLC controls the cylinders position according to the set points transmitted by the Control Room, and manages failure and emergency signals as well as pump change-over.

The PLC is provided with display and keyboard allowing to check the programmed parameters on site, and to modify them when required.

The access to parameter modification is protected by password.

*Functions performed by PLC are listed here below:*

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>1 - Operating mode selection</td>
<td>- manual mode</td>
<td>4 - Main alarm control (shutdown)</td>
<td>- oil pressure too low</td>
</tr>
<tr>
<td></td>
<td>- automatic mode</td>
<td></td>
<td>- minimum oil level</td>
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<tr>
<td>2 - Cylinder control</td>
<td>- PID</td>
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<td>- emergency shut-down</td>
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<tr>
<td></td>
<td>- adjustable offset-to-close</td>
<td></td>
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<tr>
<td></td>
<td>- travel time adjustable (valve under control)</td>
<td></td>
<td>- low oil level</td>
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<tr>
<td>3 - Pump change-over start/stop</td>
<td>- temporary</td>
<td>6 - Actuators failure</td>
<td>- low oil pressure</td>
</tr>
<tr>
<td></td>
<td>- failure</td>
<td></td>
<td>- high oil temperature</td>
</tr>
<tr>
<td></td>
<td>- external commutation</td>
<td></td>
<td>- aut/man selector</td>
</tr>
</tbody>
</table>
1 OPERATING MODE SELECTION

The operating mode may be selected by an apposite selector located on control cabinet front.

Manual Mode
Necessary in order to allow the plant start-up. The PLC does not affect the pump selection, but allows to select the pump to be started (by using the pump change-over push-buttons). By this mode all monitoring functions towards warning lights and Control Room are implemented.

Automatic mode
By this mode the system takes over the active pump and sets to zero the change-over timer. Automatic change-over functions by time and by malfunction are set on.

2 CYLINDER OPERATION

PI
A PI control is performed per each cylinder (proportional/integral action); parameters may be modified. The PI parameter values can be modified on site by acting directly on the PLC keyboard.

Adjustable offset
Per each cylinder it is possible to set an offset-to-close value ($\triangle mA$) to force the valve plug in closed position: the valve closes when the signal value is $4 + \triangle mA$. The offset-to-close value is adjustable, even locally by acting on the PLC keyboard.

Adjustable travel time
The travel time is adjustable for each cylinder even locally by directly acting on the PLC keyboard. Travel time range: $5 \div 30$ seconds (<5s available on request).

3 PUMPS CONTROL

Start-Stop
Timed change-over
Change-over due to failure
External commutation

4 MAIN ALARM CONTROL

Minimum oil level
On minimum oil level signal, the pumps are stopped.
Minimum oil pressure
Pumps are not stopped on minimum oil pressure.
Control cabinet emergency shut-down

5 SECONDARY ALARM CONTROL

Clogged oil filter
Low oil level
Low oil pressure
High oil temperature
AUT/MAN selector on MAN position

6 ACTUATORS FAILURE

Control and On/off valves

Options:
- Control axis expansion
- Redundant PLC
- Alarm signalling with lamps on cabinet door
- Cabinet conditioning equipment for indoor installation
**Control Hydraulic Actuators**

Double acting cylinders built in compliance with ISO 6020-2 and DIN 24554. On board are installed the inductive limit switches (n° 1 open posit. + n° 1 close posit. – SPDT contacts) and position transducer (4 + 20 mA).

**On-Off Hydraulic Actuators**

Double acting cylinders built in compliance with ISO 6020-2 and DIN 24554. On board are installed the mechanical limit switches (n° 1 open posit. + n° 1 close posit. – SPDT contacts).

**Options:**
- DPDT contacts (limit switches)
- n° 4 limit switches (n°2 open posit. + n° 2 close posit.)
- spring for failure position

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**Hydraulic Cylinder for Control Valves**

**Hydraulic Control System Interconnections Diagram**

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**KOSO PARCOL S.r.l. a socio unico**
Sede legale: Via Isonzo, 2, 20010 Canegrate (Milano) ITALY
Partita IVA e Codice Fiscale 09684900963
Cap. Soc. €110.000,00 | R.E.A. MI – 2106767
Phone: +39 0331 413111 | Fax: +39 0331 404 215