Hydraulics

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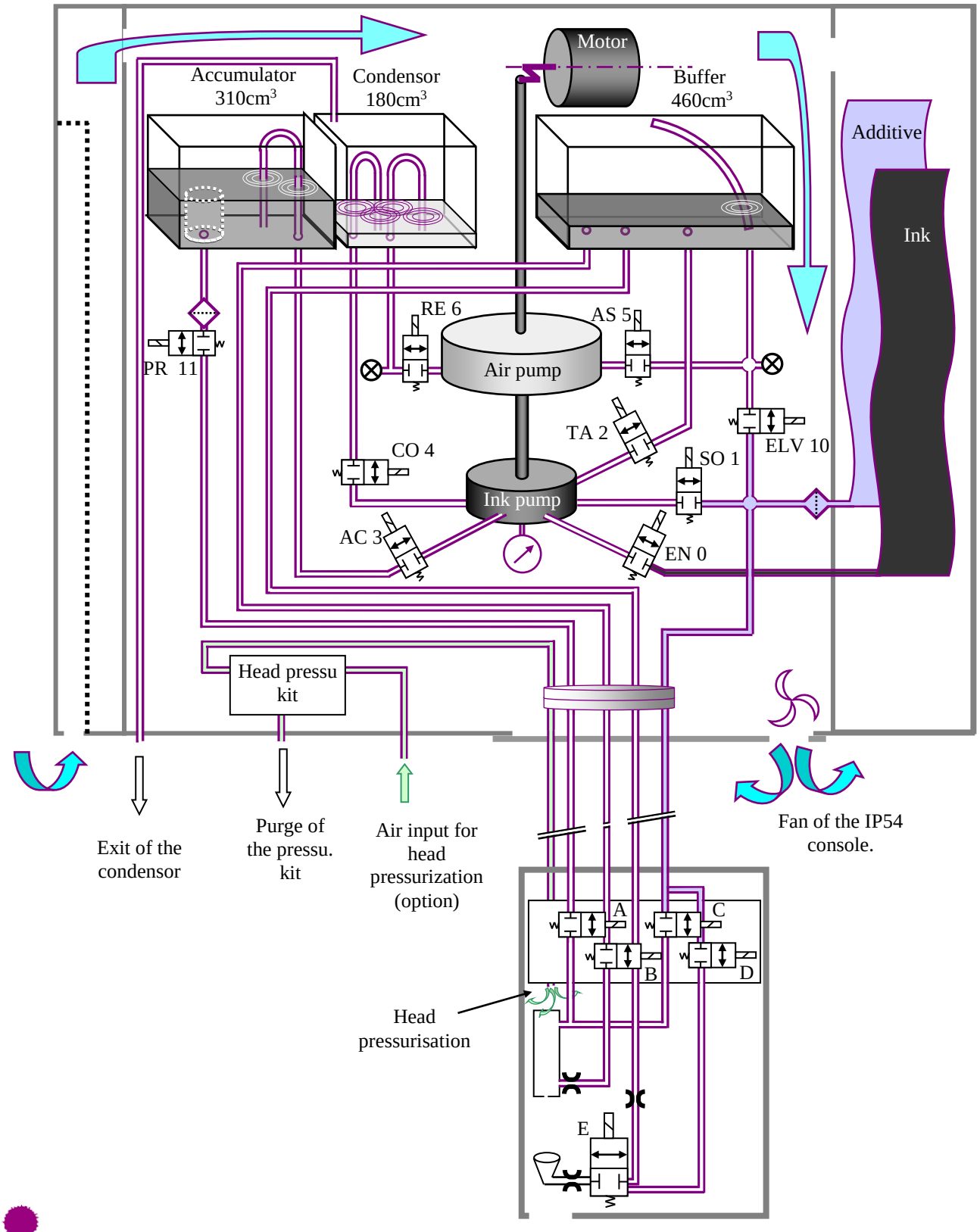
■ Solenoid valve hydraulic circuit (Printer stopped)

This circuit is equipped with solenoid valves on the air pump (U 5 and U 6).

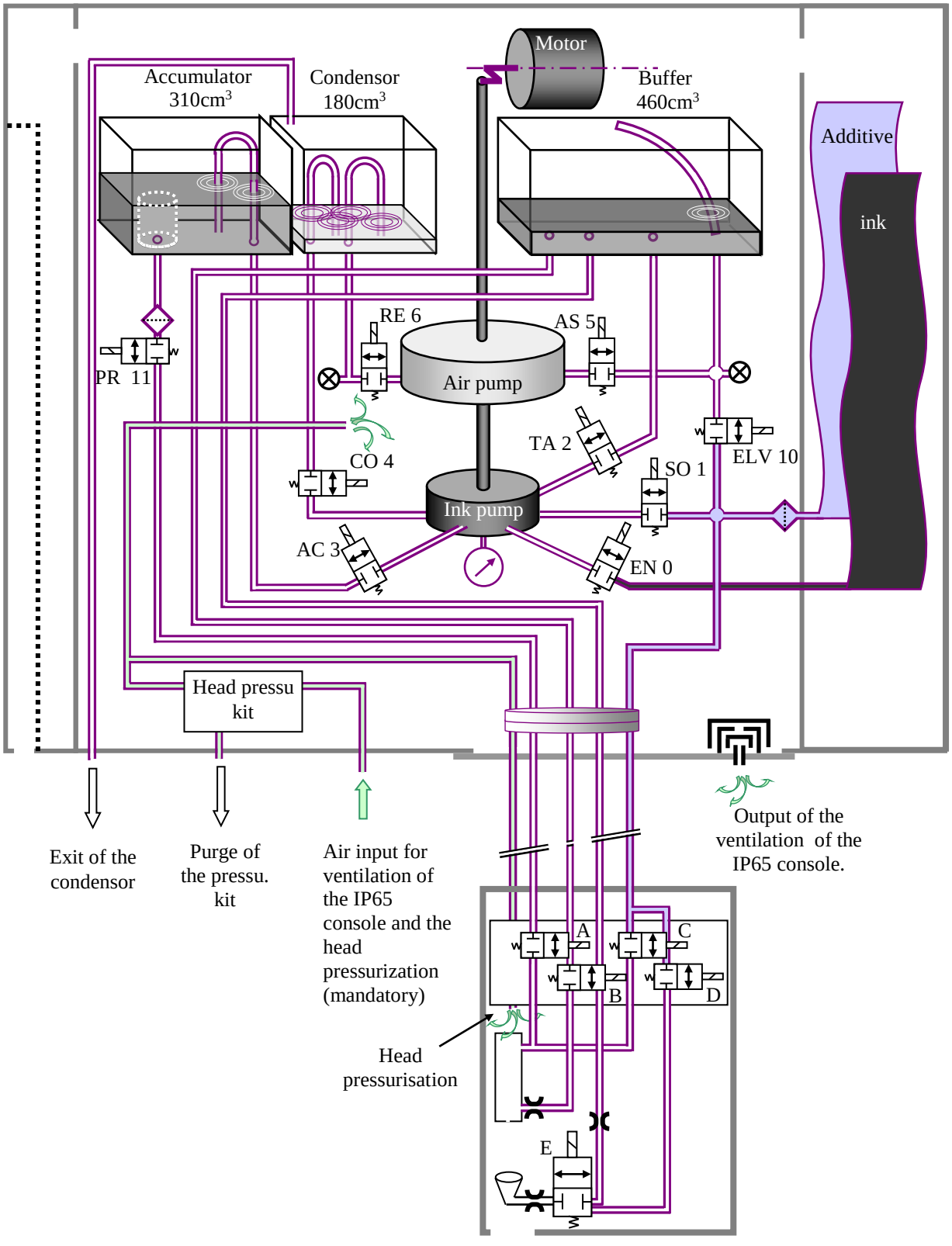
This ink circuit can be installed in a IP54 console (figure on this page) or in a IP65 console (figure on the next page).



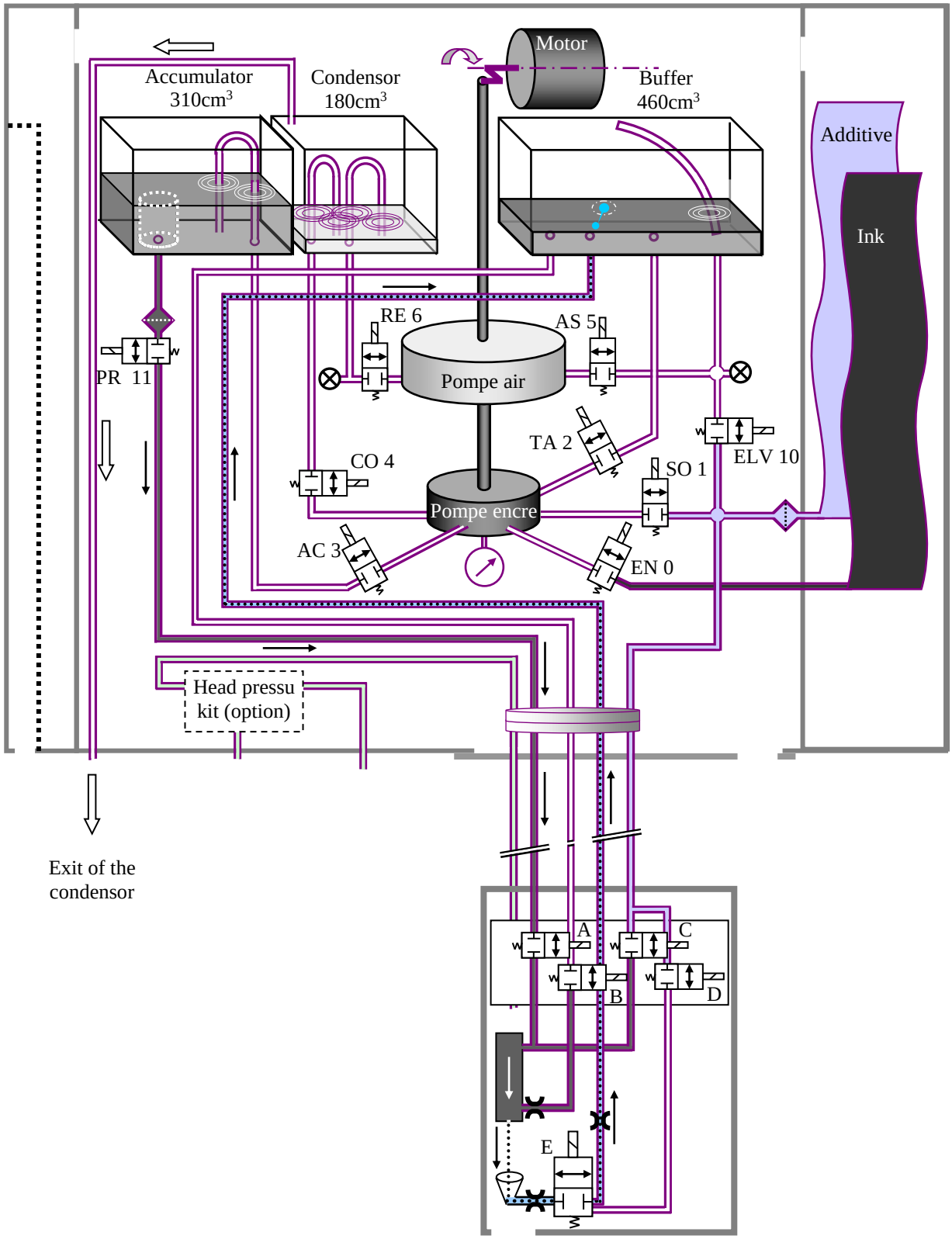
■ No return valve hydraulic circuit (Printer stopped)

This circuit is equipped with no return valves on the air pump (U 5 and U 6).

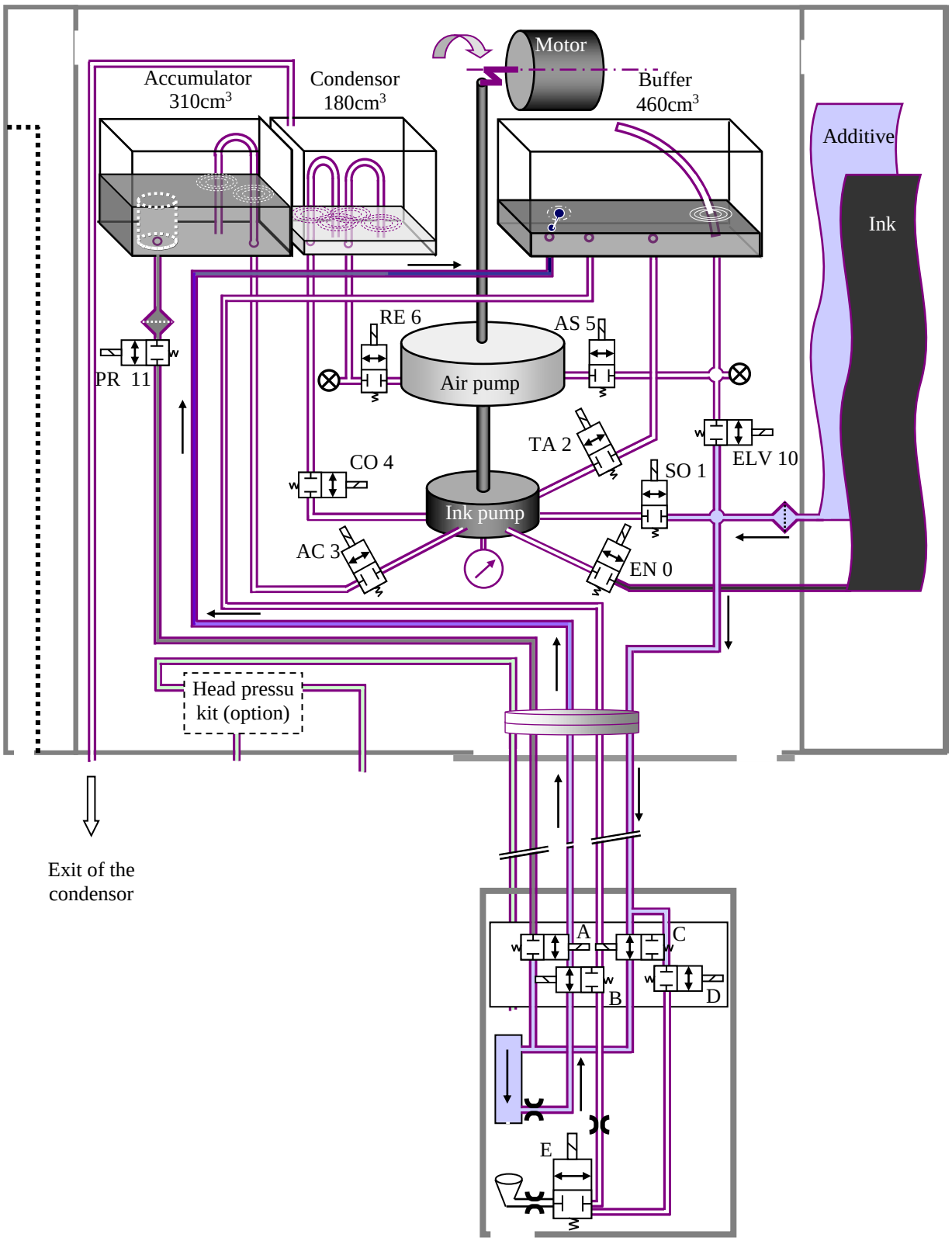
This ink circuit can be installed in a IP54 console (figure on previous page) or in a IP65 console (figure on this page).



■ Diagram of the hydraulic circuit (Normal operation)



■ Diagram of the hydraulic circuit (Jet stopped with additive)



■ Ink circuit: principle of operation

The core of this ink circuit comprises two separate reciprocating pumps operated by a single motor. Nine solenoid valves located around these pumps and controlled by software transfer fluids between the various tanks.

The "air pump" is primarily used to generate a negative pressure in the buffer tank. This negative pressure generates suction in the recovery gutter and is also used to draw up additive when starting and stopping the jet in order to rinse the resonator block and the head solenoid valves.

The "ink pump" pressurizes the ink in the accumulator and handles all transfers of fluid between the various tanks.

As the two pumps use a single motor, the software changes the positive or negative pressure of one pump or the other by opening and closing the solenoid valves in order to correct one value without changing the other.

EXAMPLE: *If the negative pressure needs to be increased but the pressure value is correct:*

- during the common intake movement of the pumps

- open solenoid valve AS 5 (air intake in buffer tank)

- open solenoid valve TA 2 (ink intake in buffer tank)

- during the common discharge movement of the pumps

- close AS 5 and open RE 6 (discharge air into condenser)

- leave TA 2 open (discharge ink in buffer tank)

NOTE: *A pump cannot operate if all the solenoid valves connected to it are closed.*

NOTE: *All the solenoid valves may be tested manually.*

■ Head

The print head on Imaje 9020 and Imaje 9030 printers comprises five solenoid valves. Four of them are grouped in a "solenoid valve block" (solenoid valves A, B, C and D) and the fifth stands alone (solenoid valve E).

Name and role of each solenoid valve:

- solenoid valve A: pressure solenoid valve, used to allow ink into the resonator block.
- solenoid valve B: purge solenoid valve, used to allow ink to circulate quickly through the resonator block.
- solenoid valve C: gun rinse solenoid valve, used to rinse the resonator block with additive.
- solenoid valve D: gutter rinsing solenoid valve, used to run additive through the suction pipe and gutter solenoid valve.
- solenoid valve E: gutter solenoid valve, used to automatically open and close the gutter.

Specific feature of solenoid valve E:

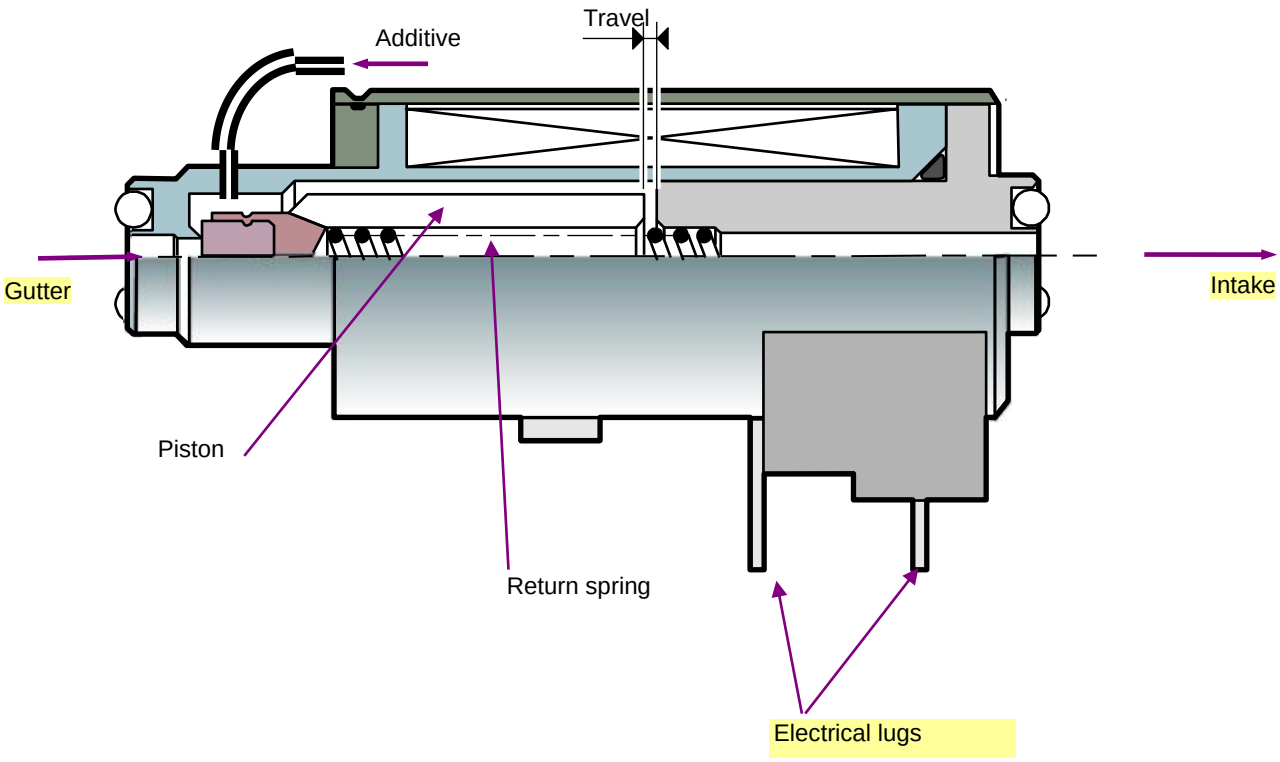
This solenoid valve (two ports, one channel) can take in additive through a third port in order to rinse its seat and core. Additive can only be drawn in to rinse solenoid valve E if solenoid valve D is opened.

Solenoid valve E may be open, closed or "swinging" while additive flows.

See diagram below.

NOTE: *All the solenoid valves may be tested manually.*

■ Diagram of recovery gutter solenoid valve E.



■ Recovery gutter

The recovery gutter is open when solenoid valve E is activated (powered) and closed when it is idle (unpowered). During maintenance procedures the software automatically changes the gutter status (open or closed) depending on the command.

EXAMPLE: *During solvent feed the gutter is closed (solenoid valve idle).*

During a stability check the gutter is open (solenoid valve powered).

■ Principle of transfers

Each transfer can be broken down schematically into six phases:

- Phase 1:

With the motor stopped, one solenoid valve on each pump is opened.

- Phase 2:

The motor rotates by half a turn, pulling the double piston and generating suction (intake) through the open solenoid valves, then stops.

- Phase 3:

With the motor stopped, the intake solenoid valves are closed.

- Phase 4:

With the motor still stopped, the discharge solenoid valves are opened.

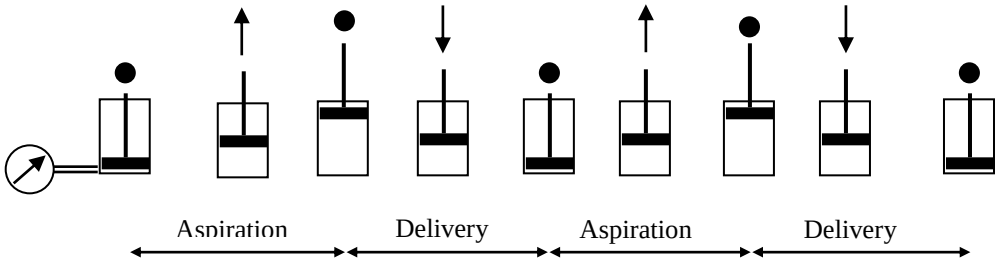
- Phase 5:

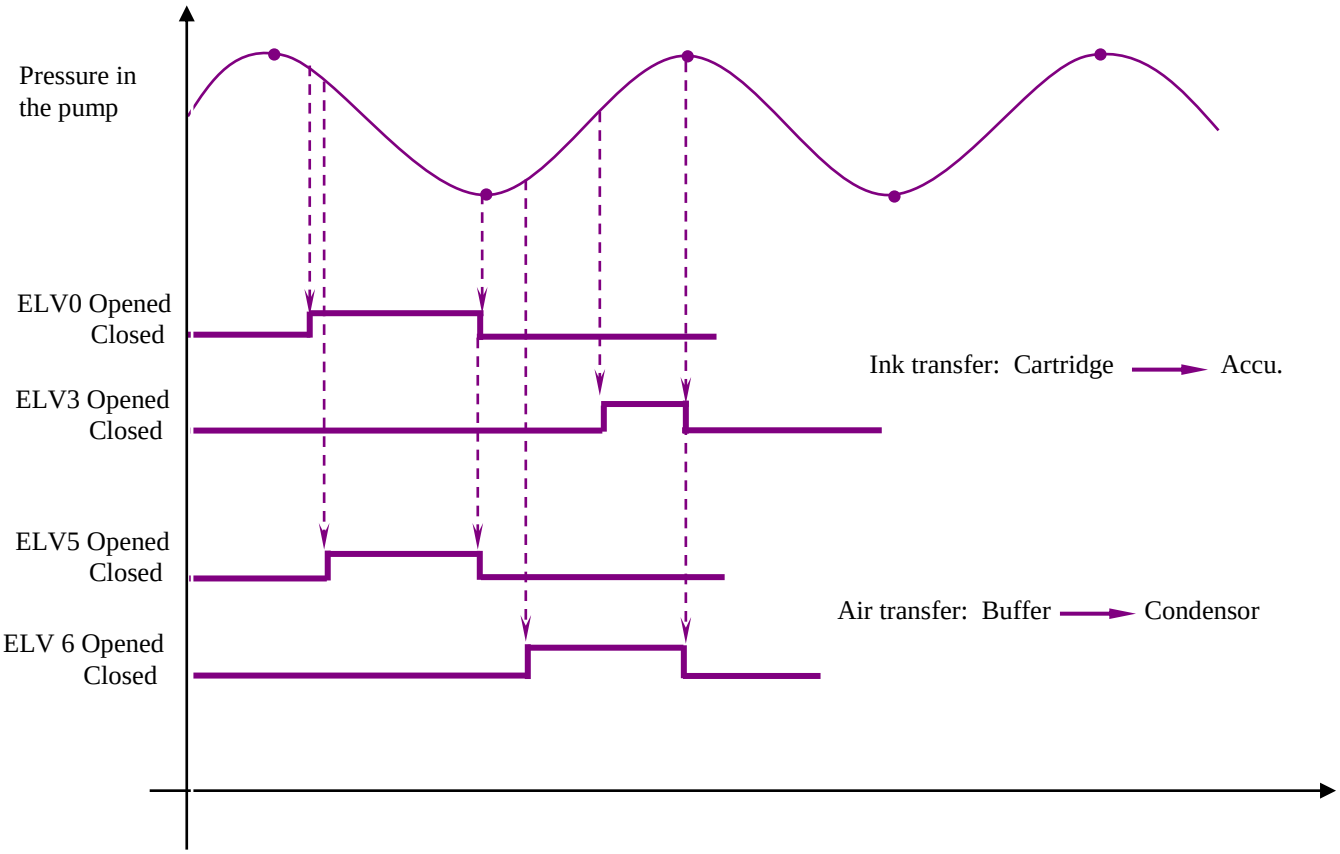
The motor rotates by half a turn, pushing the double piston and generating a pressure (discharge) through the open solenoid valves, then stops,

- Phase 6:

The solenoid valves are closed.

In reality, depending on the transfer, phases 1 and 2 may be combined, as may phases 4 and 5. In order to avoid perturbing the pressures (or negative pressures) in the tanks, the pressures on each side of a solenoid valve must be identical before the valve is opened. See diagram below.


Aspiration
Delivery
Aspiration
Delivery


Pressure in the pump
ELV0 Opened
Closed
ELV3 Opened
Closed
ELV5 Opened
Closed
ELV 6 Opened
Closed
Ink transfer: Cartridge → Accu.
Air transfer: Buffer → Condensor

■ Ink filters

The primary filter is inside the accumulator on the ink circuit. It is not interchangeable.

To reach the 14 µ filter screen on the SV 11 inlet, remove the solenoid valve's support bell. Removing the filter is not recommended (risk of ink circuit contamination).

■ Additive filter

A 5 µ filter screen is located between the additive tip holder additive and the ink circuit. To reach the filter screen, remove the tip holder.

■ Calibrated leaks

The hydraulic system has three calibrated passages (leaks) located in the print head.

The first is in the hose exiting the recovery gutter solenoid valve. This “leak” optimizes the recovery signal. It is reachable and interchangeable.

WARNING: *The leak has a diameter of:*
- 0.7 mm for 1.1G, 1.2G and 1.2M printers
- 0.5 mm for 1.1M printers

A second calibrated passage measuring 0.6 mm is built in to the gutter in order to reduce the air intake and thereby optimize additive consumption. The entire gutter is interchangeable.

The third calibrated passage, a drain port, is built into the modulation chamber. Its diameter depends on the modulation chamber type. The modulation chamber is interchangeable.

■ Constant ink concentration principle

The printer uses the "constant concentration" principle.

The ink temperature is measured continuously in the print head, using a temperature sensor on the ADP board. The jet speed is also measured continuously.

Depending on the temperatures measured, the ink type, and head type, a theoretical pressure is defined to obtain the correct jet ejection speed.

If the pressure required to obtain this speed is different from the theoretical pressure, the ink concentration must be incorrect.

The computer corrects the ink concentration by injecting additive.

■ Jet speed calculation and adjustment

For high quality printing, the jet must be ejected at a constant speed. The software continuously calculates the speed and adjusts it if necessary.

■ Jet speed calculation

Speed = Distance / Time

The principle used to measure the speed is as follows: A sequence of seven consecutive drops is charged to a specific, precise value when it passes through the charge electrode. The speed is measured in the detection electrode placed immediately after the charge electrode. The software measures the elapsed time between the point when the detection electrode detects the specific electrical charge and the point when it disappears from the detection electrode. As the distance traveled within the detection electrode is known the software can deduce the jet speed.

The speed measured is then compared to the speed set point.

■ Automatic jet speed adjustment

Three cases can arise:

□ Speed measured > Speed set point

In this case the pressure in the accumulator must be reduced. The software controls the opening and closing of solenoid valves AC3 and TA2 so as to reduce this pressure and very quickly return to the speed set point.

□ Speed measured < Speed set point

In this case the pressure in the accumulator must be increased. The software causes ink to be taken from the buffer tank or the cartridge and added to the accumulator.

□ Speed measured = Speed set point

Nothing needs to be changed, the printer is ready to print.

■ Measuring the negative pressure

The negative pressure is measured with the pressure and temperature sensor underneath the ink pump, when transferring ink into the buffer tank. This measured value is compared to a set point value.

■ Adjusting the negative pressure

Three cases can arise:

Measured value < Set point value (weak suction and a risk of the gutter overflowing)

Air pumping is reactivated to increase the negative pressure in the buffer tank (suction in buffer tank, backflow in condenser).

Measured value > Set point value (strong suction but excess additive consumption)

Vacuum pumping (suction and backflow in buffer tank)

Value measured = Set point value

Air pumping to maintain negative pressure without exceeding the set point value. Vacuum pumping if value exceeded.

■ Gutter solenoid valve rinsing

At the end of the “Stop jet” procedure the recovery solenoid valve is rinsed. Solenoid valve D delivers additive to clean the seat, core and spring in solenoid valve E. During this phase the solenoid valve is opened and closed in turn in order to properly clean it and the pipe leading back to the buffer tank.

See diagram on the following page.

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■ Diagram of hydraulic circuit (gutter solenoid valve rinsing)