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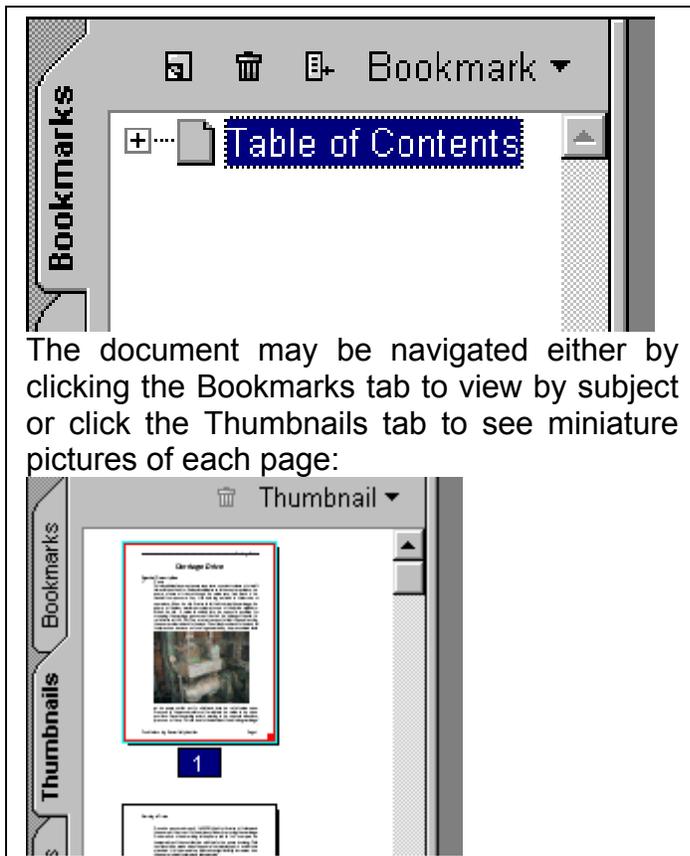
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Indexing Table

Symbol Description

M1 *Gauge*

By moving the selector on the gauge to the M1 position, the pressure downstream of the fixed displacement pumps will be indicated. When the Index Table is operating, the maximum pressure will be limited by the No. 01.45.25 remote relief setting, 45 bar. When the broaching rams are operating, the maximum pressure will be limited by the No. 01.44.24 remote relief valve setting, 115 bar. When the Y01.36.20, Y01.37.20 and Y01.38.20 solenoids are de-energized, all pumps will return back to the tank at low pressure. A lower pressure will be indicated on the selector gauge at that time.

M5 *Gauge*

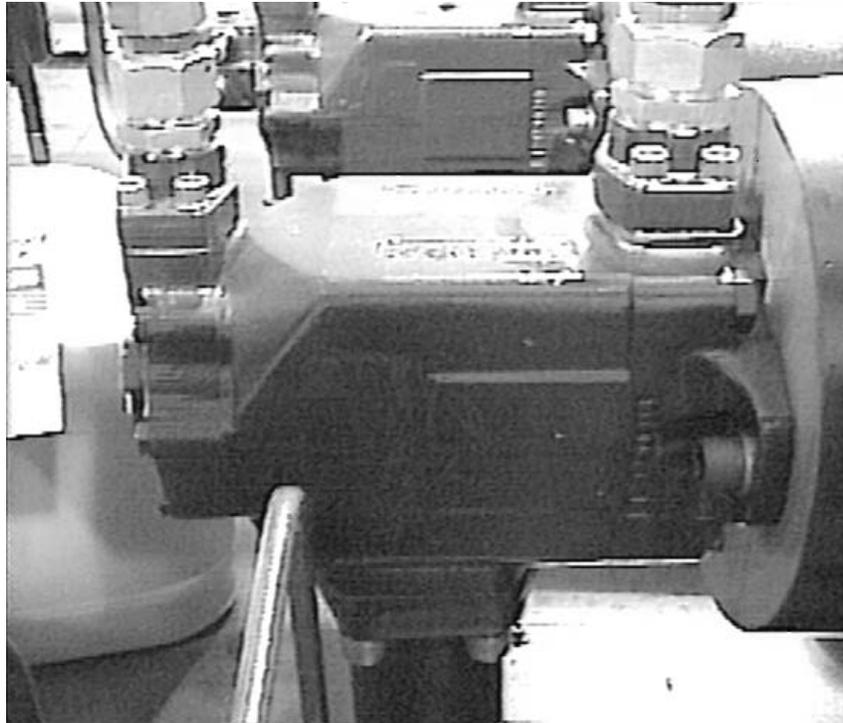
When the selector on the gauge is turned to the M5 position, the setting of the 04.10.09 pressure reducing valve will be read. The recommended setting of this valve is 40 bar.

PF1 *Pump*

This 18 GPM, fixed displacement, pump cartridge will supply a constant volume of oil to the Indexing Table actuators as well as the broaching rams. This pump cartridge is mounted in the same housing as the PF2 pump cartridge. PF1 is located on the back end of the pump assembly.

PF2 *Pump*

This 36.5 GPM, fixed displacement, pump cartridge will supply a constant volume of oil to the Indexing Table actuators as well as the broaching rams. This pump cartridge is located in the same housing as the PF1 pump cartridge. PF2 is located nearest the pump drive shaft.



PF3 ***Pump***

This 18 GPM, fixed displacement, pump cartridge will supply a constant volume of oil to the Indexing Table actuators as well as the broaching rams. This pump cartridge is mounted in the same housing as the PF4 pump cartridge. PF3 is located on the back end of the pump assembly.

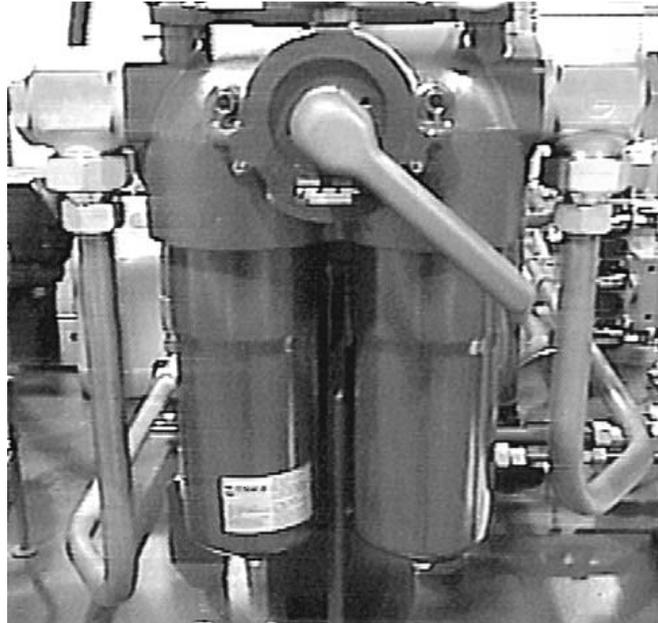
PF4 ***Pump***

This 36.5 GPM, fixed displacement, pump cartridge will supply a constant volume of oil to the Indexing Table actuators as well as the broaching rams. This pump cartridge is located in the same housing as the PF3 pump cartridge. PF4 is located nearest the pump drive shaft.

SO1.18.13 ***Filter Assembly***

The filter assembly contains a three way manual valve, which selects one element or the other for filtering the PF2 pump volume. If the selected element becomes contaminated and the pressure drop

across the element reaches the pressure switch's setting, a signal will be sent indicating the condition. This signal may give the operator an alarm or possibly shut the machine down depending on the electrical programming. The three way valve should be shifted at this time to select the clean element. If this is not done and the pressure drop across the element reaches the



internal check valve's spring setting, the oil will then bypass to the system unfiltered. The filter condition should be checked or changed regularly to prevent contamination from entering the system.

SO1.49.28 ***Pressure Switch***

The switch is used to electrically indicate an extreme high pressure condition. During normal operation, the maximum hydraulic pressure will be determined by the setting of the No. 01.44.24 remote relief valve, 115 bar. Once the setting of the switch is reached, an electrical signal will be sent indicating an over pressure condition. Depending upon the electrical programming, a shut down of the machine may occur. This particular switch is used as an over pressure device for the No. 1 broaching ram.

SO1.52.28 ***Pressure Switch***

The switch is used to electrically indicate an extreme high pressure condition. During normal operation, the maximum hydraulic pressure will be determined by the setting of the No. 01.44.24 remote relief valve, 115 bar. Once the setting of the switch is reached, an electrical signal will be sent indicating an over pressure condition. Depending upon the electrical programming, a shut down of the

machine may occur. This particular switch is used as an over pressure device for the No. 2 broaching ram.

SO4.06.06 **Pressure Switch**

This switch will actuate when the Indexing Table fully lowers. An electrical signal will be sent once the pressure reaches a setting of 30 bar. This pressure switch is used to energize the Y04.09.08 “B” solenoid to return the table cylinders to the home position.

Y01.36.20 **Directional Valve**

When the PF1 pump volume is required to operate the Indexing Table and/or Broaching Rams, the valve solenoid is energized. This permits the No. 01.21.23 logic valve to operate as a high pressure relief. The pressure that the logic valve opens will be at either 45 bar (when Y01.43.20 is de-energized) or 115 bar (when the same solenoid is energized). The solenoid is energized when necessary to broach the part at the following speeds; 5, 15, 20, and 30 m/minute..

When the PF1 volume is not required to operate the Table or Broaching Rams, the valve solenoid is de-energized. This permits the No. 01.21.23 logic valve to open at low pressure (100 PSI or less). This permits the pump volume to return back to the tank at low pressure. Very little heat is created in this mode of operation. The valve is a two position, four way (with the “A” port plugged), single solenoid, spring return, directional valve.

Y01.37.20 **Directional Valve**

When the PF2 pump volume is required to operate the Indexing Table and/or Broaching Rams, the valve solenoid is energized. This permits the No. 01.23.23 logic valve to operate as a high pressure relief. The pressure that the logic valve opens will be at either 45 bar (when Y01.43.20 is de-energized) or 115 bar (when the same solenoid is energized). The solenoid is energized when necessary to broach the part at the following speeds; 10, 15, 25, and 30 m/minute.

When the PF2 volume is not required to operate the Table or Broaching Rams, the valve solenoid is de-energized. This permits the No. 01.23.23 logic valve to open at low pressure (100 PSI or less). This permits the pump volume to return back to the tank at low pressure. Very little heat is created in this mode of operation. The valve is a two position, four way (with the "A" port plugged), single solenoid, spring return, directional valve.

Y01.38.20 ***Directional Valve***

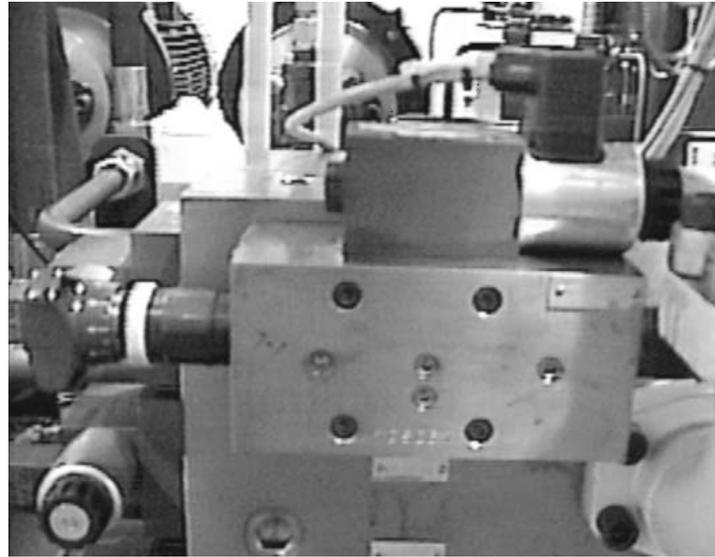
When the PF3 and PF4 pump volumes required to operate the Indexing Table and/or Broaching Rams, the valve solenoid is energized. This permits the No. 01.25.23 logic valve to operate as a high pressure relief. The pressure that the logic valve opens will be at either 45 bar (when Y01.43.20 is de-energized) or 115 bar (when the same solenoid is energized). The solenoid is energized when necessary to broach the part at the following speeds; 15, 20, 25, and 30 m/minute.

When the PF3 pump volumes are not required to operate the Table or Broaching Rams, the valve solenoid is de-energized. This permits the No. 01.25.23 logic valve to open at low pressure (100 PSI or less). This permits the pump volume to return back to the tank at low pressure. Very little heat is created in this mode of operation. The valve is a two position, four way (with the "A" port plugged), single solenoid, spring return, directional valve.

Y01.43.20 ***Directional Valve***

When operating the Indexing Table or the entire machine in the manual mode of operation, the valve solenoid is de-energized. The spool directs pilot pressure on the top of the three logic valves to the 45 bar remote relief valve. Once the pilot pressure reaches the 45 bar setting, the selected logic valves will open permitting the excess pump's volume to return back to tank through the specific logic valve.

When the broaching rams are commanded to operate, the valve solenoid energizes. The solenoid will shift the spool into the “B” position. Pilot pressure is now blocked through the valve because of the pipe plug in the “B” port. Pilot pressure on top of the logic valves can now build to the



setting of the 115 bar remote relief valve. If this pressure is reached while the broaching rams are operating, then the specific logic valve would open dumping the specific pump back to tank at high pressure. Y01.43.20 is a two position, four way (with the “B” port plugged), single solenoid, spring return, directional valve.

Y01.48.20 ***Directional Valve***

When the solenoid is de-energized, pressure in the line is ported to the No. S01.49.28 pressure switch. If the setting of this switch is reached 120 bar, then an over pressure condition will be indicated. Depending on the electrical programming, a shut down of the machine may occur. When the valve solenoid energizes, the system pressure is blocked to the pressure switch. At the same time the pressure in the switch is ported to tank through the valve spool. This valve is used for high pressure protection when the No. 1 broaching ram is machining apart. Y01.48.20 is a two position, four way (with the “B” port plugged), single solenoid, spring return, directional valve.

Y01.51.20 ***Directional Valve***

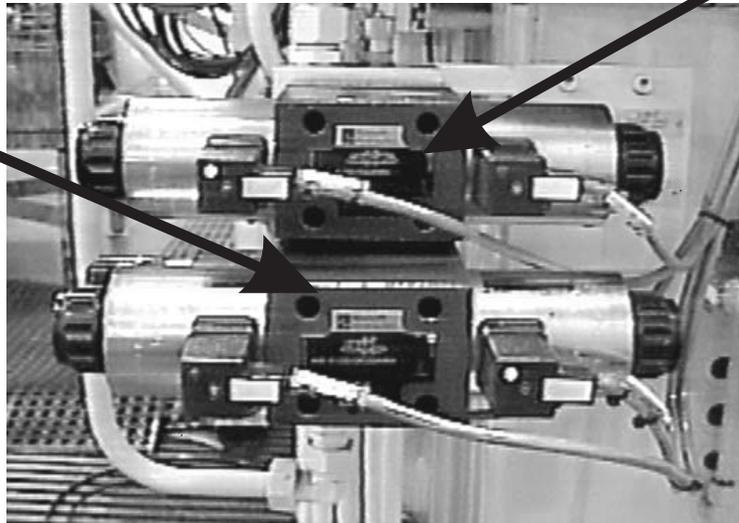
When the solenoid is de-energized, pressure in the line is ported to the No. S01.52.28 pressure switch. If the setting of this switch is reached, 120 bar, then an over pressure condition will be indicated. Depending on the electrical programming, a shut down of the

machine may occur. When the valve solenoid energizes, the system pressure is blocked to the pressure switch. At the same time the pressure in the switch is ported to tank through the valve spool. This valve is used for high pressure protection when the No. 2 broaching ram is machining apart. Y01.51.20 is a two position, four way (with the "B" port plugged), single solenoid, spring return, directional valve.

Y04.03.03 *Directional Valve*

When necessary to lower the Index Table, a voltage is applied to the "A" solenoid on this valve. Pressurized Y04.09.08

Y04.03.03



fluid is then directed through the spool to the top side of the actuator. As the table lowers, the oil that is forced out of the bottom side of the actuator will return back to the tank through the valve spool. The valve is detented which means that if the voltage were removed, then the spool would remain in the "A" position.

When the command is given to raise the table, a voltage is applied to the "B" solenoid. The solenoid will shift the spool into the "B" position directing oil to raise the table. The oil that is forced out of the top side of the cylinder will return to the tank through the valve spool. The spool will remain in the "B" position because of the valve detent until the "A" solenoid is energized. The valve is a two position, four way, double solenoid, detented, directional valve.

Y04.09.08 **Directional Valve**

To rotate the table clockwise, a voltage is applied to the “A” solenoid. Flow from the pumps is then ported to extend the top cylinder (as shown on the schematic) and at the same time retract the bottom cylinder.

Once the table is lowered and the No. S04.06.06 switch setting (30 bar) is reached, the “B” solenoid of this directional valve is energized. Volume is then directed to the bottom cylinder, which after it extends forces the top cylinder to retract to the home position. The turntable is now ready for the next rotation cycle.

01.21.23 **Logic Valve**

This valve is controlled by the Y01.36.20 directional valve. When the PF1 pump volume is not required to operate the Indexing Table or Broaching Rams, the valve solenoid is de-energized. This permits any pressure on top of the logic valve to bleed back to the tank. The logic valve will then open at low pressure (100 PSI or less) directing the pump volume back to the tank at low pressure. When the pump volume is required to operate the Index Table or Broaching Rams, the valve solenoid is energized. Pilot pressure is then ported to the top of the logic valve piston. This pressure will be limited to 45 bar when operating the table and 115 bar when operating the broaching rams. If either of these two pressures are reached during the specific operation, the logic valve will shift open. The pump volume will then return to the tank at high pressure. Heat will be created when this occurs. The logic valve is located inside the valve manifold.

01.22.16 **Logic Valve**

This logic valve will operate as a check valve in this circuit. As long as the pressure at the valve inlet can build higher than the pressure at the outlet, oil can flow from the pump to the system. Once the pressures nearly equalize on both sides of the valve, the piston will shift closed because of the force of the spring. The logic valve is located inside the valve manifold.

01.23.23 Logic Valve

This valve is controlled by the Y01.37.20 directional valve. When the PF2 pump volume is not required to operate the Indexing Table or Broaching Rams, the valve solenoid is de-energized. This permits any pressure on top of the logic valve to bleed back to the tank. The logic valve will then open at low pressure (100 PSI or less) directing the pump volume back to the tank at low pressure. When the pump volume is required to operate the Index Table or Broaching Rams, the valve solenoid is energized. Pilot pressure is then ported to the top of the logic valve piston. This pressure will be limited to 45 bar when operating the table and 115 bar when operating the broaching rams. If either of these two pressures are reached during the specific operation, the logic valve will shift open. The pump volume will then return to the tank at high pressure. Heat will be created when this occurs. The logic valve is located inside the valve manifold.

01.24.16 Logic Valve

This logic valve will operate as a check valve in this circuit. As long as the pressure at the valve inlet can build higher than the pressure at the outlet, oil can flow from the pump to the system. Once the pressures nearly equalize on both sides of the valve, the piston will shift closed because of the force of the spring. The logic valve is located inside the valve manifold.

01.25.23 Logic Valve

This valve is controlled by the Y01.38.20 directional valve. When the PF3 and PF4 pumps volumes are not required to operate the Indexing Table or Broaching Rams, the valve solenoid is de-energized. This permits any pressure on top of the logic valve to bleed back to the tank. The logic valve will then open at low pressure (100 PSI or less) directing the pump volume back to the tank at low pressure. When the pump volume is required to operate the Index Table or Broaching Rams, the valve solenoid is energized. Pilot pressure is then ported to the top of the logic valve piston. This pressure will be limited to 45 bar when operating the table and 115 bar when operating the broaching rams. If either of these two pressures are reached during the specific operation, the logic valve

will shift open. The pump volume will then return to the tank at high pressure. Heat will be created when this occurs. The logic valve is located inside the valve manifold.

01.26.16 **Logic Valve**

This logic valve will operate as a check valve in this circuit. As long as the pressure at the valve inlet can build higher than the pressure at the outlet, oil can flow from the pump to the system. Once the pressures nearly equalize on both sides of the valve, the piston will shift closed because of the force of the spring. The logic valve is located inside the valve manifold.

01.27.17 **Fixed Orifice**

This orifice will control the rate that the logic valve shifts open and closed.

01.28.17 **Fixed Orifice**

This orifice will control the rate that the logic valve shifts open and closed.

01.29.17 **Fixed Orifice**

This orifice will control the rate that the logic valve shifts open and closed.

01.30.18 **Fixed Orifices**

These orifices are located in a single block and are used to reduce the flow rate in and out of the directional valve.

01.31.18 **Fixed Orifices**

These orifices are located in a single block and are used to reduce the flow rate in and out of the directional valve.

01.32.18 **Fixed Orifices**

These orifices are located in a single block and are used to reduce the flow rate in and out of the directional valve.

01.33.19 Fixed Orifice

The size of the orifice determines the flow rate to the Y01.43.20 directional valve and 01.44.24 and 01.45.25 remote relief valves.

01.34.19 Fixed Orifice

The size of the orifice determines the flow rate to the Y01.43.20 directional valve and 01.44.24 and 01.45.25 remote relief valves.

01.35.19 Fixed Orifice

The size of the orifice determines the flow rate to the Y01.43.20 directional valve and 01.44.24 and 01.45.25 remote relief valves.

01.39.21 Check Valve

The check valve will permit free flow from the top of the logic valve piston to the pilot pressure circuit. The check valve will block flow in the opposite direction.

01.40.21 Check Valve

The check valve will permit free flow from the top of the logic valve piston to the pilot pressure circuit. The check valve will block flow in the opposite direction.

01.41.21 Check Valve

The check valve will permit free flow from the top of the logic valve piston to the pilot pressure circuit. The check valve will block flow in the opposite direction.

01.44.24 Remote Relief Valve

When the broaching rams are machining a part, the Y01.43.20 directional valve solenoid is energized. Pilot pressure through the directional valve is now blocked. This permits the maximum pressure on top of the 01.21.23, 01.23.23 and 01.25.23 logic valves to build to the setting of this relief, 115 bar. If the pressure at the outlet port of any of the three pump circuits builds to the setting, the valve will shift open also allowing the specific logic valve to open as well.

Flow from the pump will then return back to tank through the specific logic valve at high pressure. Heat will be created when this occurs.

01.45.25 **Remote Relief**

When the Indexing Table is operating, the Y01.43.20 valve solenoid is de-energized. Pilot pressure from the 01.21.23, 01.23.23 and 01.25.23 logic valves is directed to this remote relief valve. If the pressure downstream of the pumps were to reach the valve setting, 45 bar, the logic valves would shift open dumping the pumps' volumes back to the tank at high pressure. Heat will be created when this occurs.

04.02.02 **Check Valve**

The check valve will permit free flow from the pumps to raise and lower the Indexing Table cylinder. Once the table is raised the command is given to rotate in a clockwise direction. This check valve will lock oil in the bottom of the raise and lower cylinder. This check will prevent the table from dropping as it rotates.

04.07.07 **Check Valve**

When raising the table, oil will free flow through this check valve and into the bottom of the cylinder. There is another connection at the bottom of the cylinder that will also allow oil in and out of the cylinder. With dual flow paths, more volume can be ported into the cylinder for raising. The check valve will block the flow in one line as the cylinder lowers. This limits the amount of oil that flows out of the bottom side back to the tank.

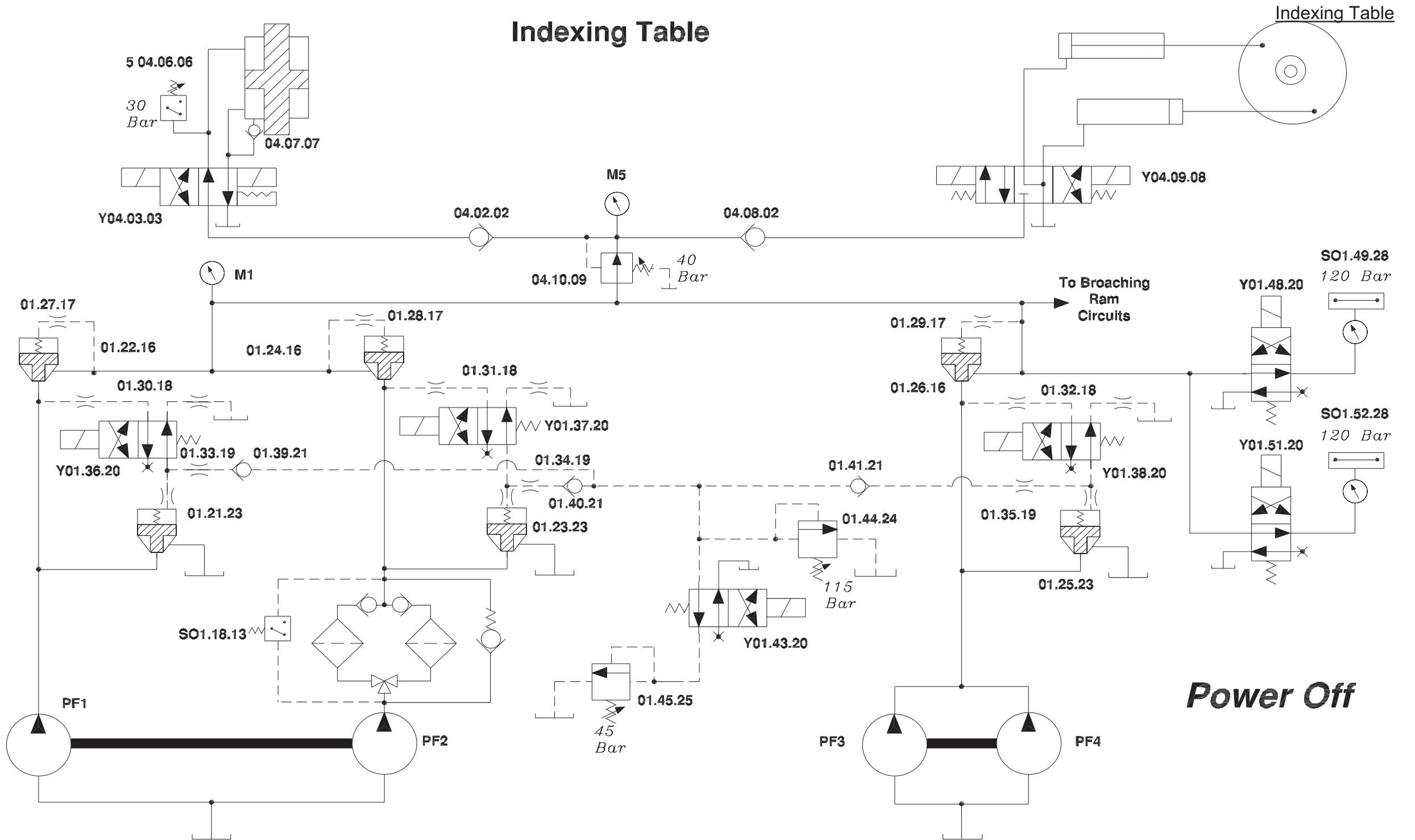
04.08.02 **Check Valve**

The check valve will allow flow from the pumps into the Indexing Table cylinders. After the table is rotated, the table is commanded to lower. This check valve will lock oil in the Indexing Table cylinders when this occurs.

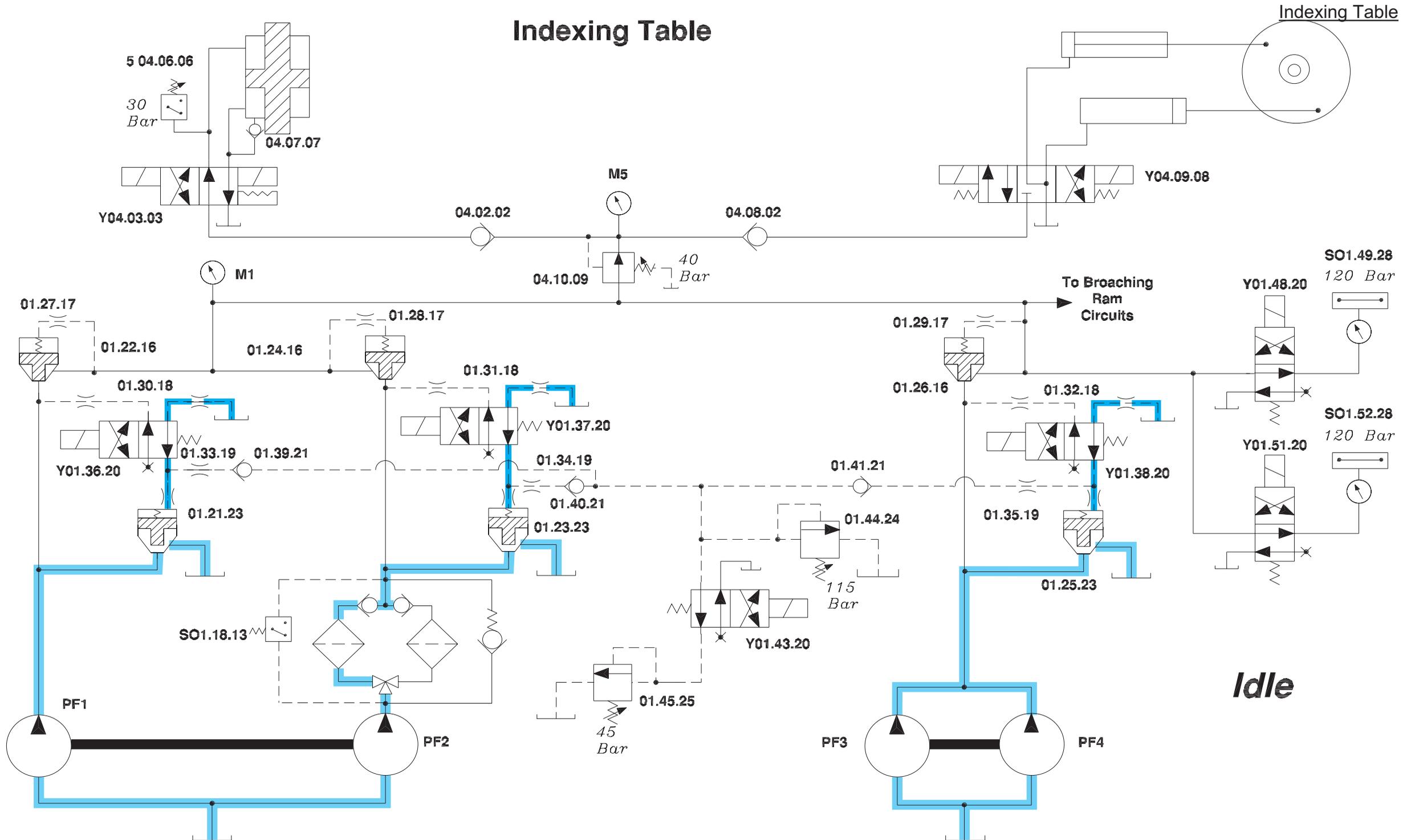
04.10.09 ***Pressure Reducing Valve***

This valve will reduce the system pressure down to 40 bar for operating the Indexing Table. The valve spool will shift between the fully open and fully closed positions permitting only enough oil through to maintain the setting of the 40 bar spring. This valve is of the cartridge type and is screwed into the side of the block.

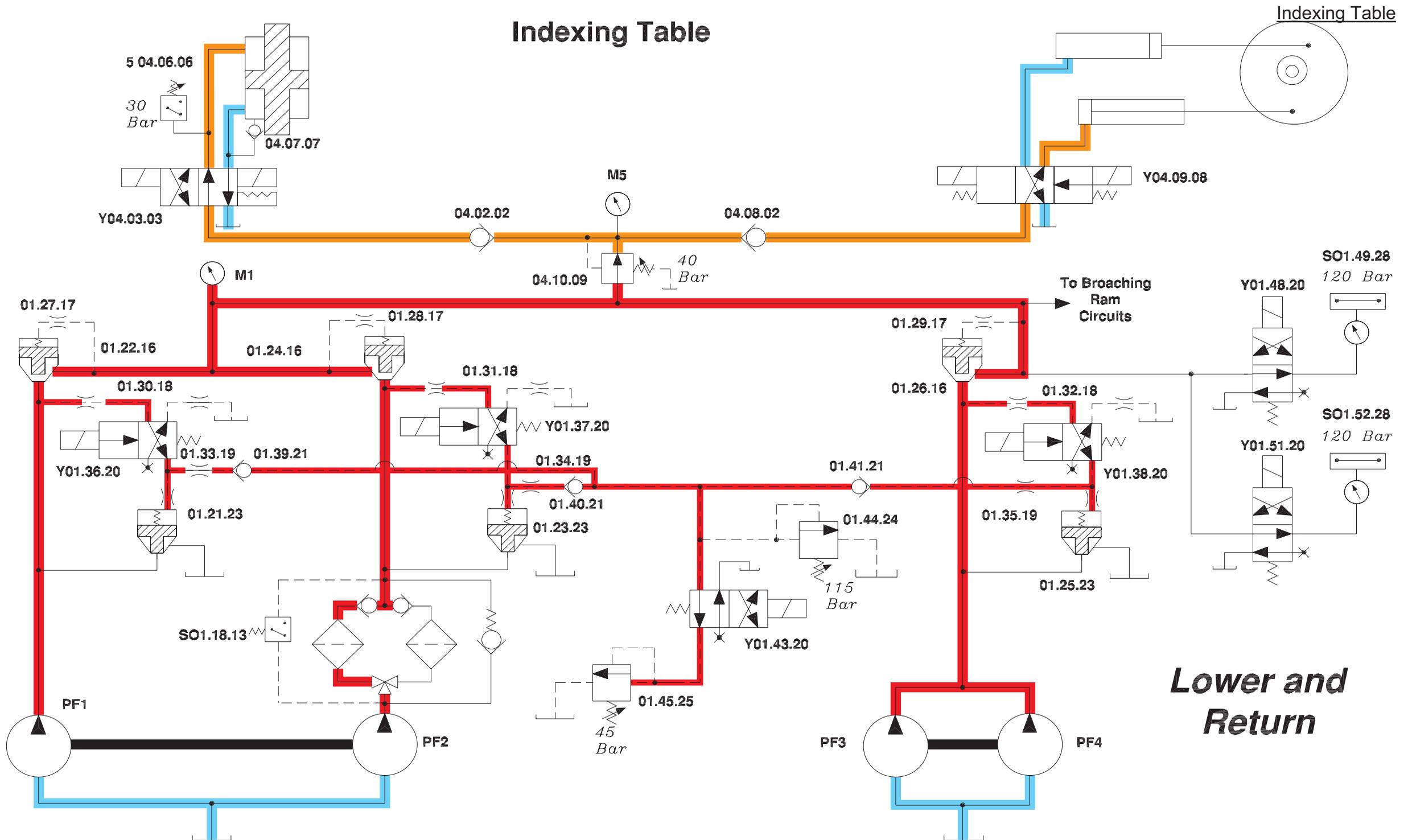
Indexing Table



Indexing Table



Indexing Table



Indexing Table

