

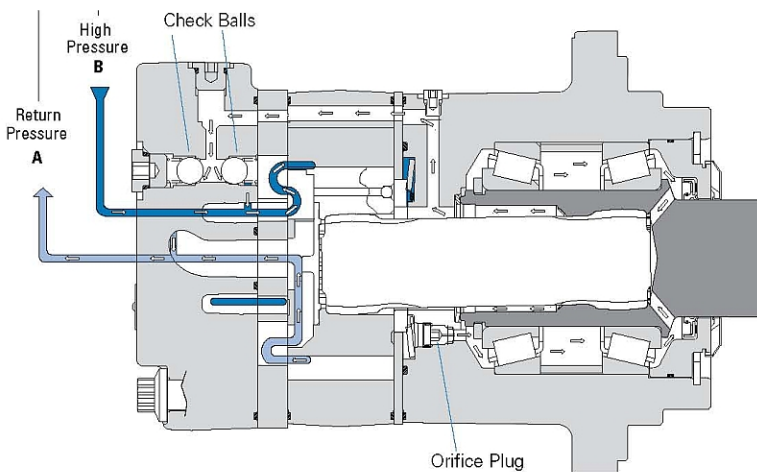
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The Eaton VIS motor is commonly used in grapple rotate applications. The open loop version of the VIS in this application allows rotation drift do to the method used in providing lubrication oil for the inboard shaft bearing and drive splines. The method of lubrication relies on two check valves that seat inside of the valve star. The port with the highest pressure provides the lubrication for the inboard bearing. The highest pressure unseats it's ball in the star, and feeds the lubrication passage. The other check valve prevents flow from bypassing through both check valves.

There are two drawbacks to using the highest pressure port to provide the lubrication for the bearing: 1) the high pressure drop creates heat, and 2) When the control valve (in it's neutral position) is used to hold a load, this load induced pressure is allowed to flow through the check, allowing the load to rotate.

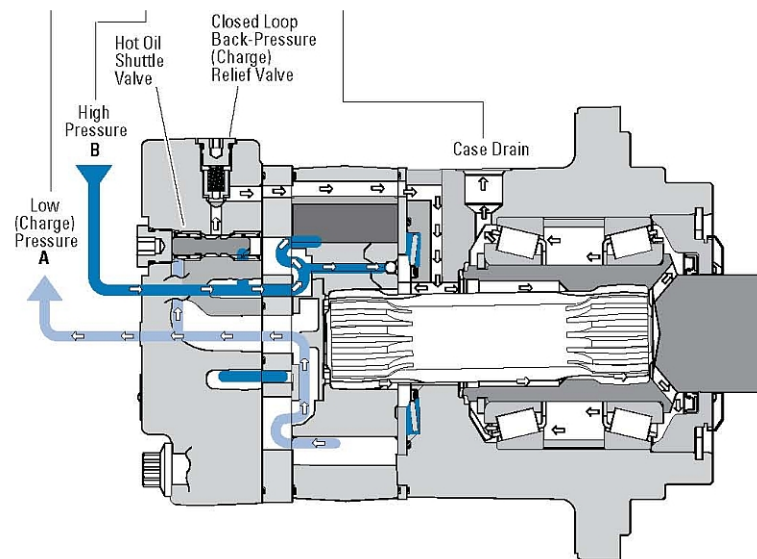
These motors can be converted to closed loops operation which will reduce the amount of drift experienced. At this time this idea is theoretical and has not been tried in this application. Modifications of an OEM system may void warranties and must be done at the users own risk.

Open Loops VIS 45 motor—standard on Grapple Rotate



The high pressure in the B port flows past the check valve in the valve star, through the orifice plug, flushes through the bearings (only the inboard in the VIS 45), through the shaft, into the case drain passage and out the case drain line as the A port back pressure is too high. The lubrication, because of the check valves in the star valve, will always come from the highest port pressure. When load holding, this creates constant leakage and motor drifting.

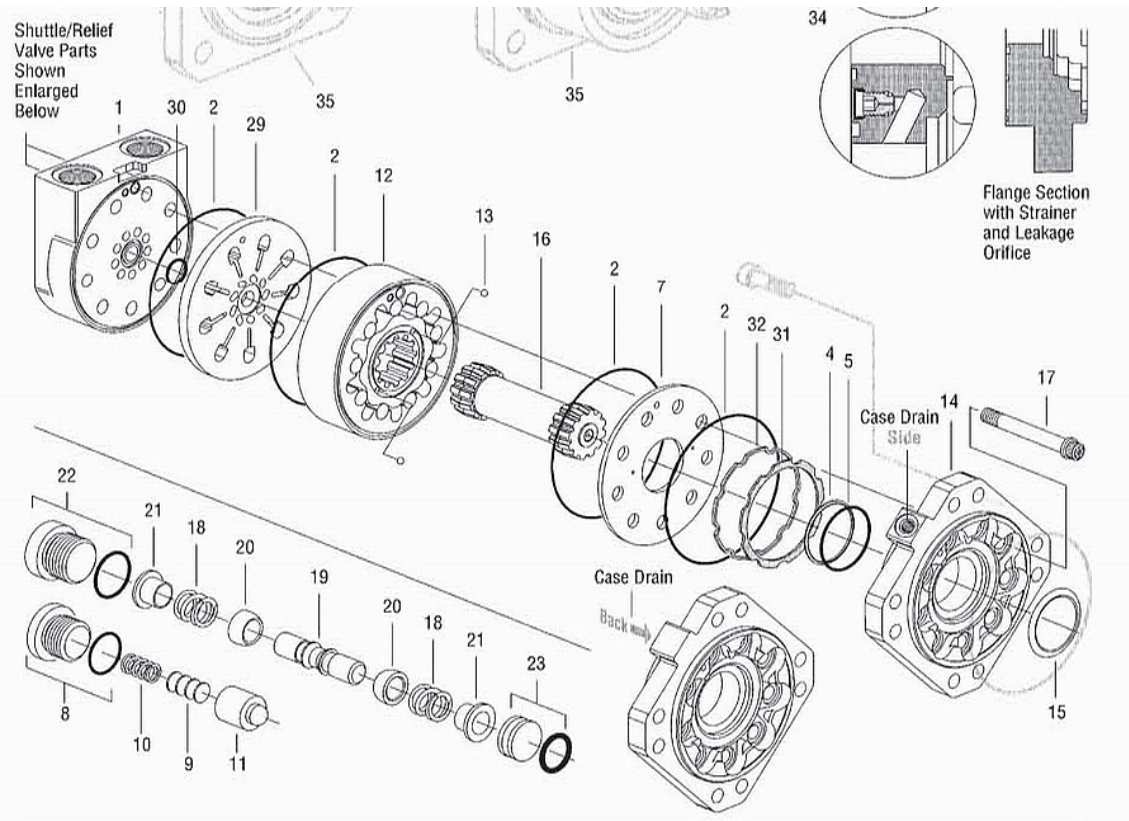
Closed Loop VIS 45 motor—lube comes from the low



The closed loop version of the VIS uses a hot oil shuttle valve in the end cap to supply lubrication oil through the shuttle passage, past the back-pressure relief valve, through the shaft, through the bearings (inboard bearing only on the VIS 45), and out the case drain port. This method prevents oil loss from the high pressure port, reducing the amount of drift in a load holding condition. In order to provide enough lubrication however, the back pressure on the return port must be higher than the sum of the HOS relief valve and case drain line pressure.

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Load holding ability can be increased and drifting reduced by converting the existing motors from open loop to closed loop functioning and adding a back pressure valve to the return line of the control valve.



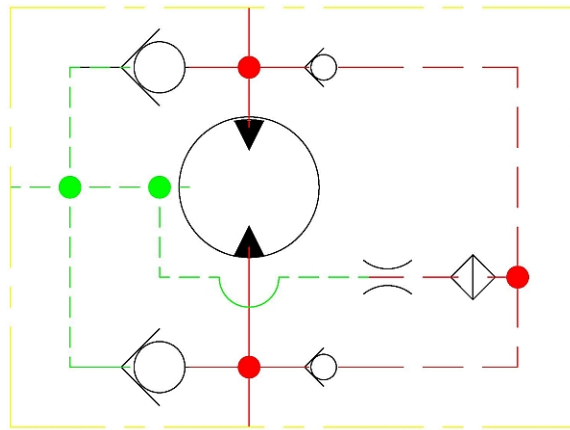
Referring to the open loop diagram on the first page, the two balls and two check springs in the end cap get replaced with the hot oil assembly shown in the parts diagram above. So for a 155-0168-003 motor you will require items:

- 18 Spring 230079-000 x2
- 19 Shuttle Piston 201494-001 x1
- 20 Poppet 8567-000 x2
- 21 Sleeve, Dash Pot 8755-000 x2

The following items get installed into the relief bore which will be empty on the open loops version:

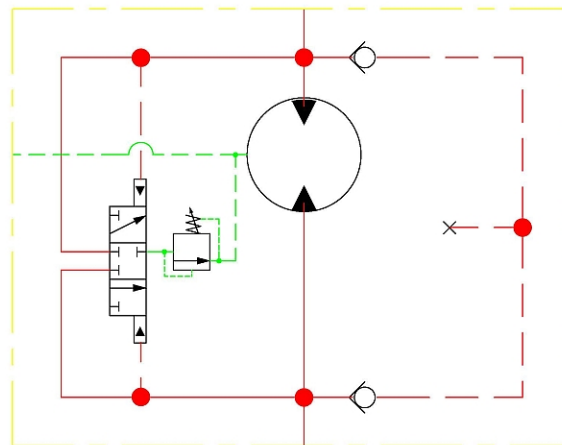
- 9 16048-500 Shim x1
- 10 17024-024 Spring x1
- 11 201495-004 Poppet x1

It is imperative that the mounting flange has a case drain port in it. If there is no port, the mounting flange must be replaced with a 2413-022 flange (for 003 design) or be modified by drilling and tapping the port in the flange.



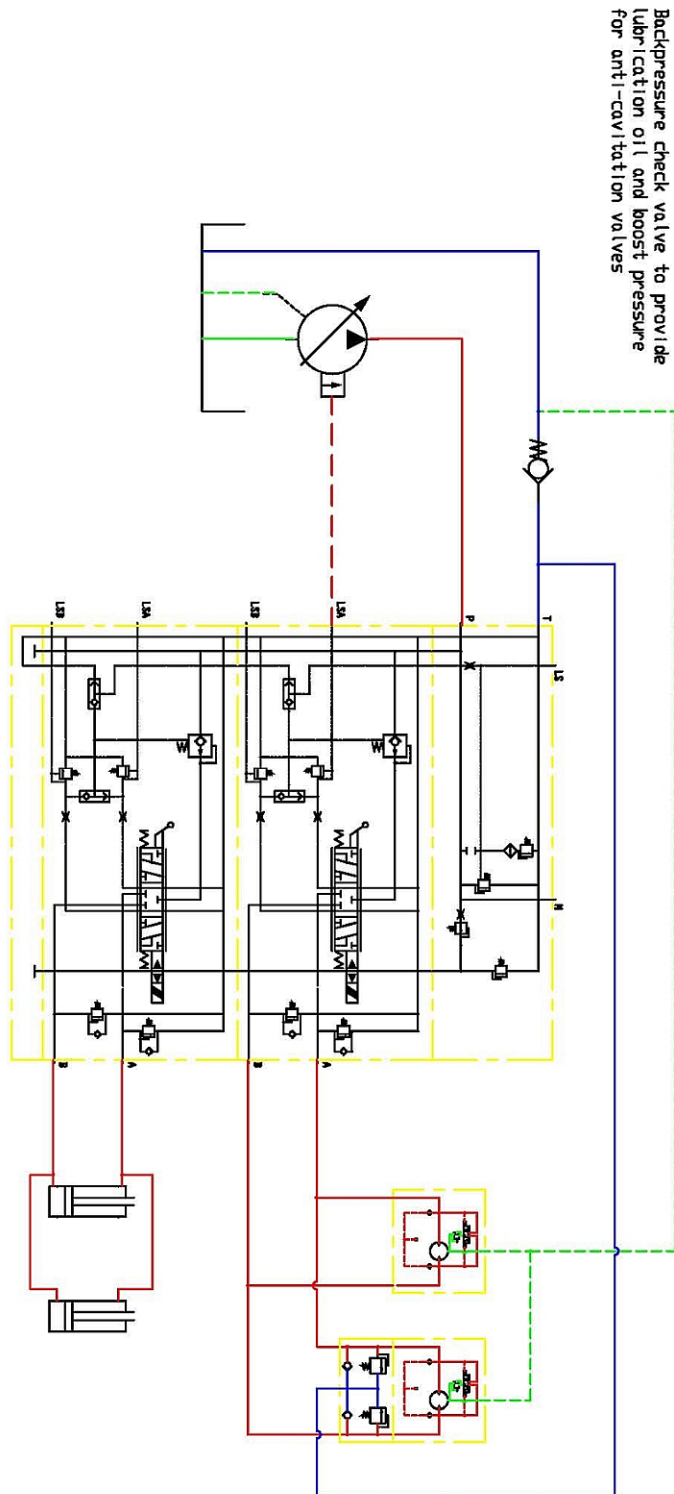
Schematic representation of the open loop VIS motor

The above schematic of the open loop version of the VIS motor shows the connection between the high pressure port and the bearing flushing oil. It does not show the actual flushing of the bearing. The oil from the port with the highest pressure flows through its small check ball in the star valve, through a filter and orifice in the flange, through the bearing and either exits through an external case drain, or flows through one of the case checks if no case drain line is used.



Schematic representation of the closed loop VIS motor

The above schematic of the closed loop version of the VIS motor shows the connection between the low pressure port and the bearing flushing oil. It does not show the actual flushing of the bearing. The hot oil shuttle connects the low side pressure side to a relief valve. The outlet flow from this relief valve flows through the shuttle oil passage, through the bearing and out the case drain port. There is no orifice or filter in the flange. The orifice needs to be replaced by a plug.



Backpressure check valve to provide lubrication oil and boost pressure for anti-cavitation valves

The schematic on the previous page is for a Weldco grapple. It is drawn with the back pressure valve and closed loop VIS motors. Note that Weldco does not produce a grapple with this arrangement. In this application, the check valves in the cross port relief block can be replaced with valves that have a lower cracking pressure. This is desirable in reducing the amount of cavitation the motor will experience and will also result in better braking and load holding capability.

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References:

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