BPR's with Proportional Electric Displacement Control

Introduction

Displacement control on the open loop, bent-axis model BPR pump is regulated by means of sensing and manipulating system pressure. The use of this pump in applications that require direct operator control of the displacement and subsequent resultant flow from the BPR pump has not been possible in the past. The nearest thing to direct displacement control for the BFR, is the incorporation of a load sensing circuit with the proper directional control valves. But, this is not always practical or desired.

LINDE HYDRAULICS has addressed this problem in the development of the BPR 140, 186, and 260 with electric displacement control. By introducing a variable electrical signal into a proportional solenoid, pilot pressure is controlled thus the displacement of the BPR is controlled. The pump displacement is precisely proportional to the electrical input current.

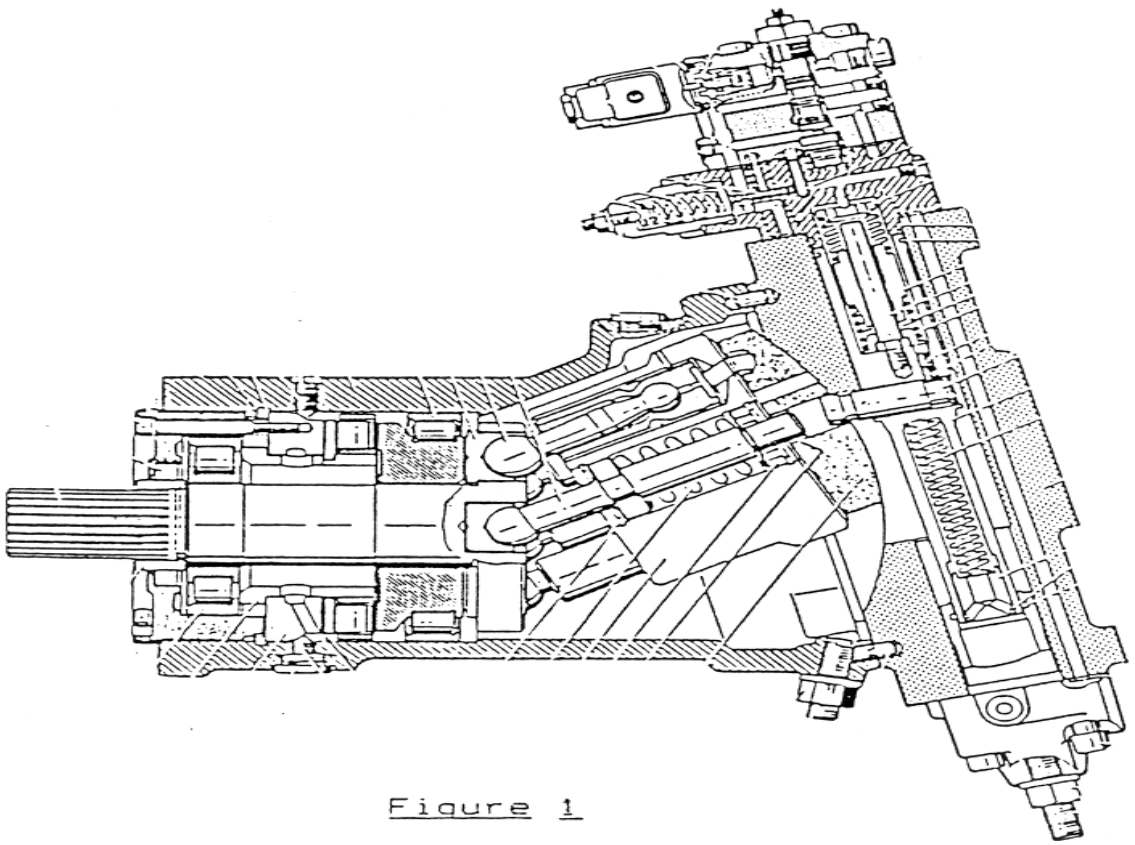


Figure 1

How it works (see figure 2).

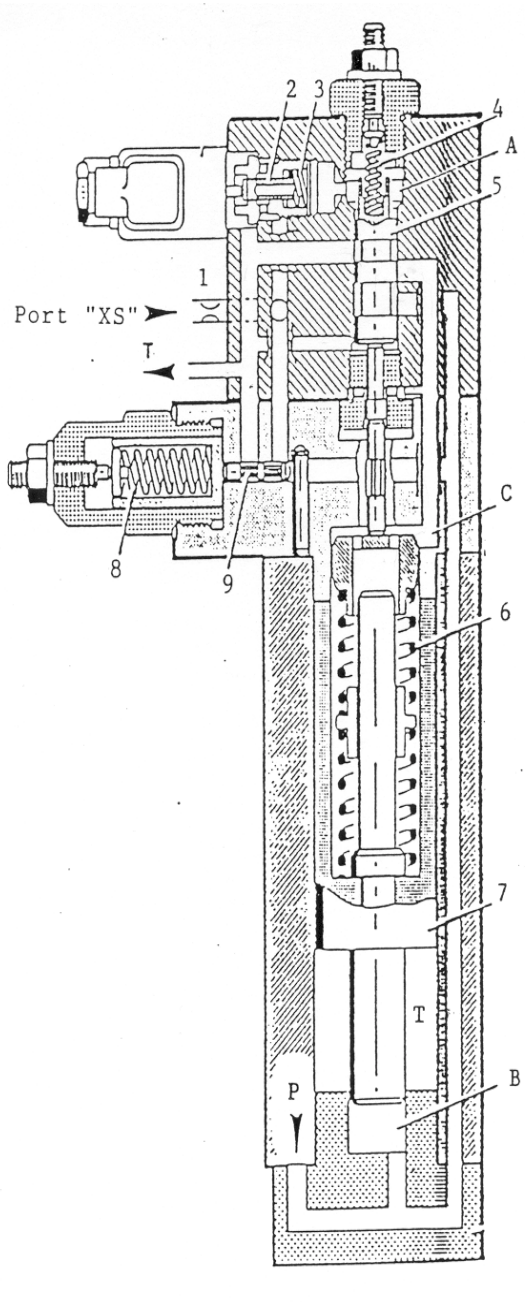


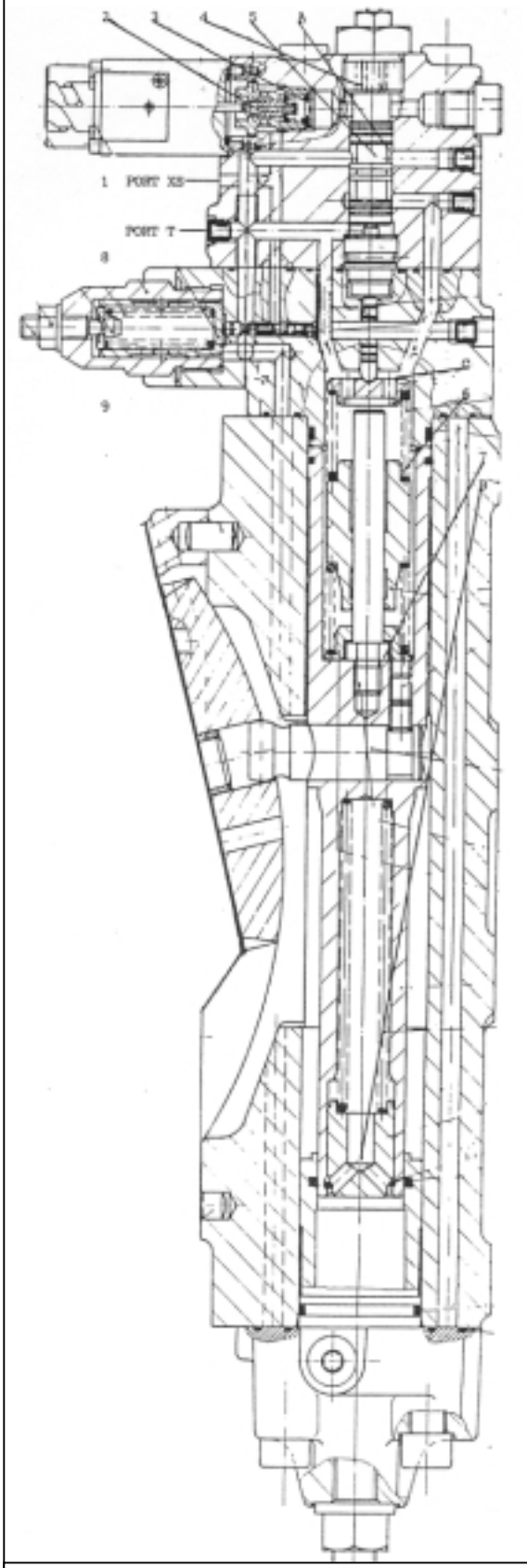
Figure 2

With no current applied to the electric solenoid, pilot pressure introduced into port " XS ", through a flow limiting orifice 1, is blocked by hollow spool valve 2, which is biased in a position to vent chamber A to tank by spring 3. Metering spool valve 5 is pushed upward against the pilot regulation pressure adjustment spring 4 in chamber A (now vented) by the greater force of the follow-up spring 6. This position of spool valve 5 allows system pressure oil (P) to flow from the small diameter side of the displacement control piston 7, area B, to the large diameter side, area C, regulating the pump to minimum displacement.

Electric current applied to the solenoid valve will move the hollow spool valve 2 against spring 3, closing the vent and metering pilot pressure to the top of spool valve 5. When the pilot control pressure, plus the force of spring 4, is slightly greater than the force of spring 6, spool 5 moves down, blocking the flow of system pressure oil (P) to the large diameter side of piston 7, area C. A further increase in electrical current to the solenoid valve vents the large diameter side of piston 7, area C, to tank, allowing the pump to go on stroke.

The limit of pump stroke is governed by the mechanical force applied by spring 6, balancing spool valve 5 in a metering position, against the forces applied by the pilot pressure and spring 4. Pilot pressure is metered by balancing the hydraulic force of the pilot pressure, plus the force of spring 3, with the magnetic force applied by the solenoid valve. In this manner, the displacement of the BPR is controlled proportionally to the input current to the solenoid.

As an added feature to the electric displacement control, pressure cut-off has been incorporated. If the system pressure increases beyond the force imposed by spring B, piston 9 is shifted to the left, opening a passage for the pilot pressure oil to flow to tank. Pressure in chamber A drops, allowing spool 5 to shift upward. This opens the passage for system pressure oil (P) to flow to the large diameter of piston 7, area C. Piston 7 is shifted downward and the pump returns toward a minimum displacement.



Specifications

Constant Pilot Pressure Req'd	220-435 psi
Control Pressure Range	Rb = 60 psi Re = 145 psi
24 Vdc Solenoid Data	
Resistance	25.2 Ohms
Current @ min Displ.	0 mA
@ max. Displ.	390 mA
Cont. Limit	650 mA
Dither Signal	35 Hz rectangle pulse ratio 1:1 (square wave)