SP Valves and Coil Operating Parameters

INTRODUCTION TO SP VALVES AND COIL OPERATION

For proportional valves, performance depends on the current in the coil. Coil current is a function of the applied voltage and the resistance in the coil. Increasing voltage will increase the current level while increasing resistance will decrease the current level. In most mobile equipment electrical systems the applied voltage is not controlled; instead it varies around the nominal battery voltage. In the case of battery-operated vehicles the voltage decreases continually until the battery is recharged. The internal resistance of the coil is a function of the material used in the coil winding, and the ambient temperature around the coil. As the temperature of the coil winding increases, the electrical resistance increases. This results in a decrease of the current in the coil, which can decrease the output of a proportional valve. To assure that constant current is delivered to the coil regardless of this change in resistance, a closed-loop current controller should be used.

In order to maintain maximum flow at high temperatures, it is important to know the actual applied voltage to the coil including any voltage drop across the controller. Generally, on engine-driven equipment where alternator voltage is several volts above battery voltage, a coil rated at nominal voltage may work well. On battery-operated equipment, a coil rated at several volts below nominal voltage works best.

In general, it is expected that in actual application, the current applied to the SP valve will vary. Sometimes the current applied may be close to maximum, while at other times it may be close to the threshold current. Therefore, the increase in coil resistance resulting from the power applied will typically stabilize around a nominal or average value. This stabilized, average current value is defined as:

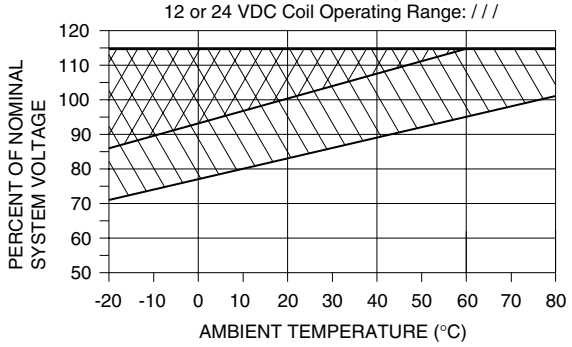
I-Average = (I-Threshold + I-Maximum) ÷ 2

The graphs illustrate the operating range of HydraForce standard coils on the SP valves. The graphs show the voltage required to continuously maintain average current. The voltage supplies sufficient power to reach maximum current on an intermittent basis. Since it is recommended to use the SP valve with a closed-loop current controller, a voltage drop of 1.5V across the controller has been taken into consideration in these graphs.

For example, the graph for the 08 size 10 VDC coil shows that at an ambient temperature of 20°C, maximum current is available with only 83% of nominal system voltage. If ambient temperature rises to 80°C, maximum output is achieved only if 102% of nominal voltage is available to the coil. However, with the 12 VDC coil, 102% of nominal voltage is required at 20°C. Notice that the voltage required at 80°C is above the maximum 115% of nominal voltage line. This indicates that the 12 VDC coil is not suitable for this ambient condition regardless of the system voltage available.

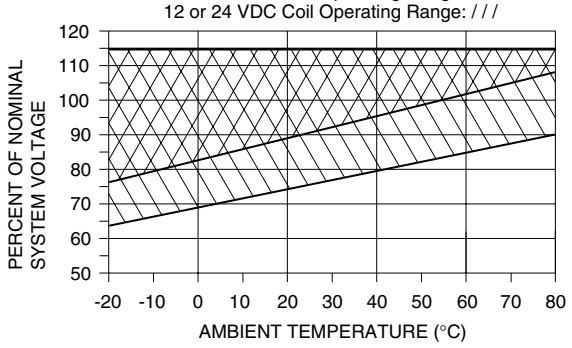
08 SIZE COIL

Percent of system voltage required to maintain average current (I-ave.) at various ambient temperatures
10 or 20 VDC Coil Operating Range: \ \ \
12 or 24 VDC Coil Operating Range: / / /



10 SIZE COIL

Percent of system voltage required to maintain average current (I-ave.) at various ambient temperatures
10 or 20 VDC Coil Operating Range: \ \ \
12 or 24 VDC Coil Operating Range: / / /



Coil Electrical Rating

Valve Size	Coil Voltage	Maximum Control Current
08	10	1170 ±115 mA
08	12	1000 ±100 mA
10	10	1320 ±120 mA
10	12	1100 ±100 mA

Note: I-Threshold varies from product to product. Refer to the Flow vs. Current graph shown for each product. The tolerance is the same as that given for I-Max.