Flow of Hydraulic Pumps Using Displacement Value

At some point while browsing the internet for hydraulic pumps, be it a gear, piston, or vane, you probably have come across the term “Displacement” combined with a numerical value in either cu/in/rev or cm3 /rev. (Examples and values will be in Imperial units for this article.) The goal of the information below is to help you understand and learn what to do with this value.

Put simply, pump displacement is the amount of oil that is moved from the inlet side of a pump to the outlet side of a pump during one full rotation of a pump’s internal components.

To set the basis for figuring out how to find the flow rate of a pump, we will begin with three important figures. The first being the number “231”. This is how many cubic inches are in 1 gallon. The second is RPM “rotation per minute” of our primary driver (gas/diesel engine or electric motor) which the pump will be coupled to. The third being the displacement value of the pump.

Example:

Let’s say we have an electric motor that has an RPM rating of 1750 and gear pump with a 1.7 cubic inch displacement. We know the RPM the pump will spin at, we know the displacement value of the pump and we know there are 231 cubic inches in 1 gallon. We are ready to create our equation!

1750 RPM X 1.7 cu/in / 231 cu/in =

1750 * 1.7 / 231 =

2975 cubic inch per minute / 231 cubic inch per gallon=

12.88 Gallon per minute flow rate (GPM)

Pretty simple once you know how all the numbers are operating. Now let’s implement a gasoline engine. Gasoline engines can typically achieve an RPM up to 3600 RPM. Let’s see what would happen if we used the pump from the previous example on our higher revving primary driver and we will go to the max RPM of 3600.

3600 RPM X 1.7 cu/in / 231 cu/in =

3600 * 1.7 / 231 =

6120 cubic inch per minute / 231 cubic inch per gallon =

26.5 Gallon per minute flow rate (GPM)

As you can see, our fluid output increased significantly. It is important to match your pump to its application under all working conditions or you can go well beyond the maximum rated output a pump manufacture sets for their product or under/overpower another component in your system.

All the forementioned examples are of a fixed displacement pump. There are variable displacement pumps available and require additional steps to correctly calculate proper flow rates.