

The Facts about Performance Pulley's

We've all seen the ads that promise "8 – 15 Horse Power" by just replacing your stock pulleys with a new set of aluminum performance under drive pulleys. Easy horsepower for only a couple of hundred dollars - and you don't even have to crack the engine open for surgery! Wait a minute... someone also said, "there's no such thing as a free lunch," so what's the catch? Let's talk about it and I'll relate the effect under drive pulleys had on my car and how I corrected it.

Let's take a simple example of an engine with only one belt driving the water pump, alternator and the crank pulley - three pulleys total to deal with. Engineers spend years (ok maybe days) calculating the proper speed in which the pulley for the water pump and alternator must turn to ensure proper water flow and charging at all engine speeds. On regular daily drivers this means it must be optimal at idle and at freeway speeds. The car must be able to sit in traffic for hours in hot weather, staying cool, all while the stereo and air conditioning are on.

The easiest way to look at this is as a relationship between the pulleys, described as the pulley ratio. On my 351 Cleveland, the stock pulley's worked out as below – note: you can use pulley diameter, circumference or radius. Any will yield a ratio as long as you use the same technique for all pulleys.

Stock Pulley System	Crank	Water Pump	Alternator
Diameter	7.0	5	2.5
Ratio (to crank)	---	1.15	2.8

Simply said, for every revolution of the crank pulley, the water pumps goes around 1.15 times and the Alternator 2.8 times.



Now of course these are the stock steel pulleys which had 3 grooves on the crank and drove the water pump off of the power steering pulley instead of with the Alternator - a problem all by itself. I wanted to go to a serpentine belt and run the alternator off the same belt as the water pump while having a second position on the crank for an eventual air conditioning. The only way to get this done was to use a Ford small block kit by March Performance Pulleys - which utilized an under drive

crank pulley. Definitely looks cool on the engine as the smaller crank pulley has a much more pleasing perspective, along with the added “8 – 15 more horsepower” I got!

I’m running a high flow Edelbrock water pump and an Accel race alternator (smaller size fits better) so didn’t expect any problems but as we all know kit cars are never simple – especially in our quest for horsepower and performance.

Within the first 100 miles on the car, I noticed that at idle I was dropping the charge – I was only getting about 12.2 volts out of the alternator instead of the 14.4 volts I should have been getting. It would bounce right back up as soon as I fed some RPM’s to the engine so I wasn’t terribly worried. It became more apparent at night when the headlights would dim at stop lights and then brighten as I pulled away. I also saw the water temperature drift up if I was in stop and go on a hot day for any period of time longer than about 10 minutes. Since it’s a Cobra, and a new motor, I assumed it was due to break in and the curse of the Cobra. It wasn’t until I started thinking about the charging problem that it occurred to me they might be connected. At idle, cooling is provided by a 16” electric fan so with only 12.2 volts being supplied instead of the normal 14.4 volts I was getting about 15% less voltage to the fan and consequently 15% less cooling air thru the radiator.

If I now look at the ratios of the March under drive pulley set I see:

March Pulley System	Crank	Water Pump	Alternator
Diameter	5.38	5.38	2.38
Ratio (to crank)	---	1	2.26

The pulley ratio for the alternator was lower than stock by about 20% so is was definitely contributing to the lack of charging at idle. One way to fix it would be to find a new crank pulley in the stock diameter which would then put the ratio’s back to original. But since I’ve converted to serpentine belts, and the rarity of 351 Cleveland parts, none were to be found. With a little searching on EBay I found a series of different alternator pulleys. Everything from a 1.68” to a 2.75” were available so for about \$20 I bought a 2.24” and a 1.89” to try out.

Crank Pulley	7.0 (stock)	5.38	5.38	5.38
Alternator Pulley	2.5	2.38	2.24	1.89
Ratio (to crank)	2.8	2.26	2.4	2.8

I installed the 1.89” pulley as that will give me the same ratio as stock, and should restore my charging system to normal operation. After restart of the engine and measuring at idle, I had a consistent 14.4v output.

The water pump ratio, although also off, is probably compensated by the Edelbrock high flow water pump so I’m going to run it and see if the increased voltage to the cooling fan does the trick before messing with the water pump pulley.

This is another reminder that Detroit spends a lot of money designing and testing their vehicles so when we think a modification is a good thing, we should always look at the tradeoffs – some may affect you the wrong way.