SUCTION

It became obvious when 5-stage dry-sump pumps began showing up on Winston Cup engines, that there was something to be gained from achieving negative crankcase pressure. There was rarely anything written about it in the racing rags and when they did it was usually very vague stuff.

To find out just how beneficial it was we tested it on our HO 350 dyno mule. For suction we started by using a mechanical fuel pump and it didn't produce very much vacuum. Then we tried a smog pump and it was effective far beyond expectations. We used a ball-valve to regulate the amount of suction and had to keep it closed down pretty far to keep from sucking the seals out of the motor. With little effort we were able to pull 20"hg in the crankcase (which is all we had the guts to try). With the engine running at peak horsepower you could pull the hose from the pump and loose twenty horsepower. We were amazed. We asked other engine builders if they had tested it and we were surprised to find they had learned some of the same things that we had (unfortunately we hadn't learned enough).

We observed that oil pressure dropped by a one-to-one ratio with crankcase pressure. That was easy to understand. What wasn't so easy to understand is why airflow into the engine increased when there was a depression in the pan. Is this bad data. Have we had a bogus observation?

We recently tested crankcase depression again on our 460 big block dyno mule with a four stage Weaver pump with 1.45" scavage sections. It would pull around 11 in/hg from idle to 6000 rpm. Our dyno-mule ZZ3 and the late model NASCAR motor we originally tested achieved 20 in/hg. Both were wet-sumped and this one was dry-sumped. We used better test procedures than we had before. Since we could switch between an open crankcase (vented) and a closed crankcase (non-vented) in seconds, we ran about ten back-to-back tests switching between the two systems. We controlled all of the known variables and did steady-state tests so as to get good repeatability.

At this depression (11 in/hg) we saw very little if any gains in the way of horsepower or increased airflow into the engine. The only previous observation that held up was the drop in oil pressure. We didn't think anything of it at first. Then it hit us. How can crankcase pressure effect oil pressure in a dry-sump system? This is very perplexing.

Anyway, perhaps we need more suction before these benefits really show themselves. Maybe this is all just wishful thinking and Jere is right - there are no free lunches.

Whether there is a horsepower increase or not the real benefit of crankcase depression is the way

a fresh engine dries up and stays dry. This has been observed on more than one engine. Not a trace of upper-end oiling after just a short run-in. I know I've never seen engines dry up so quickly and so completely. Maybe we've always oiled the chambers a little and assumed it was gasoline in there. These are observations only a bore-a-scope can allow (unless you pull the heads a lot). It seems reasonable to assume that if you can completely eliminate oil in the combustion chamber then the knock limit is going to be higher because it is felt that oil in the combustion chamber is a major cause of detonation (is this just a theory or is it fact). A less important benefit perhaps is the elimination of oil leaks. The motor looks as clean after the race as it did before. How often have you seen that.

We reasoned that if oil control was this good then maybe we could go back and once again try some of the ring packages that didn't work in the past because of upper-end oiling. I had seen fifteen to twenty horsepower in the past (on the old dyno however) by using a low tension oil ring but had to abandon them because of oiling the combustion chambers. I have to believe that this negative pressure is to one degree or another responsible for Formula 1 engines being able to use two-ring pistons and 15,000 plus rpm.

This testing coincided with the Advanced Engine Technology Conference where I met a Speed-Pro engineer. He asked if I'd heard about the new Pro-Series ring. They weren't in the catalog yet but he suggested I try them. What I tried in the late model motor was the .043" first and second ring and the 3mm oil ring. On the late model motor without the smog pump we had a substantial horsepower edge over the previous combination. So this gain with the added gain from the smog pump we felt we had a competitive horsepower number.

Unfortunately the engine went into the car and went to the first race with no track testing. The motor broke due to loss of oil. The dyno can't duplicate the race track and that is why people like to test before they race. In retrospect we may have gotten to greedy with the vacuum number. To be more fair to ourselves we didn't know what the depression should be but we had observed the more the depression the more the gain. The oil pump was having to compete with the vacuum pump for the oil. Perhaps the "g" forces combined with lifting off the throttle combined to favor the smog pump as the more forceful pump and pumped the oil out of the engine. This is R&D and unfortunately it was done with a customers engine. Therein lies the quandary.

John Shatterfield boasts that he doesn't do R&D on customers engines and maybe he doesn't have to because he also has his own drag car. We however, don't race a circle track car and even though we can do our engine R&D on the dyno, the dyno isn't the race track. That's why one of the major parts of most race teams budgets goes to testing and maybe that is why NASCAR puts a limit on how much testing Winston Cup teams can do. Given enough test time, the most affluent teams would rise to the top, widening the gap between them and the lesser financed teams. A good rule.

Anyway that cost us a customer and from it we learned more about doing business and dealing with amateurs than we did about engines. And we always remember what Mike Ditka said, "*Success isn't permanent and failure isn't fatal."*

They said (after the fact) they didn't want any trick stuff. What they didn't realize is that at the same time many other people across the country were doing the same thing (we didn't know it at the time and thought we were really on to something - which we were) and going through the same learning curve. Most of them had the sense to test and survived the curve. I can just picture Ayrton Senna telling Frank Williams he doesn't want any trick stuff.

When you are right no one remembers; when you are wrong no one forgets.

If you have the new Stef's catalog you may have noticed they now offer a smog pump kit to do the same thing we were doing. Muskrat got into a phone conversation with them a while back and this smog pump issue came up. He was surprised to learn that they had gone through the same teething problems we had - too much suction - with the same results. However they realized that kind of benefit (horsepower and reliability) doesn't come easy and is worth a lot of trouble and money so they stuck with the program. When they did get them (smog-pumps) sorted out a lot of people won a lot of races with them. So many races in fact that smog pumps are now banned at many tracks.

Sometimes there is a fine line between being a hero and a goat - just ask Chris Webber.

I heard that some other engine builder said; "oh yea, I tried that years ago and it don't work." That is a head-in the-sand statement if ever I heard one. I've tried many things in the past that technology (another was of saying my ignorance or lack of understanding) wasn't ready for at that particular time, but a few years later with some different parts and a better understanding of what I'm doing can work fine. That lower than low tension oil ring (3mm) for instance wouldn't have had a prayer without negative crankcase pressure. That makes me wonder now if maybe those zero-gap rings might not be such a bad deal with a crankcase depression. Hummmm.

Getting back to the recent 460 test. We were just about to switch to a five-stage pump in the quest for more depression when we had to take it off because we had a customer engine to test. The four stage pump however did produce more suck than we thought it would based on what Jerry Weaver and Bill Jenkins told us. Jenkins said he had observed more vacuum with smaller gear bodies than the larger ones. I had herd that previously from Jerry Weaver but maybe Jenkins was the source of his information. I guess I don't really care. We are going to do a better test of these pumps when we get the 460 back on the dyno. I'll let you know.

Experience is a strenuous teacher. No graduates, no degrees, some survivors.

Pat Usher