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To: Scott Wick, Wicks Aircraft and Motorsports

From: Chris Huskamp, Huskamp Motorsports Engineering

Date: November 10th, 2009

RE: Evaluation of ARE manometer.

Scott,
On Saturday the 11th I set up the ARE manometer for testing and performed a carburetor balance on a Scorpion F500 with a Rotax 493 engine and Mikuni VM38 carburetors. The time from removing the parts from the box to being set-up to test took approximately 15 minutes. The only caveat to this was that I had procured a 2" rubber coupling (included two hose clamps for ~$2.00) and two 0.75" rubber stoppers (at $0.97 each) from Lowes prior to starting. The instructions were clear and concise for both setup and operation. The installation was clean and effective (see Figure 1.)

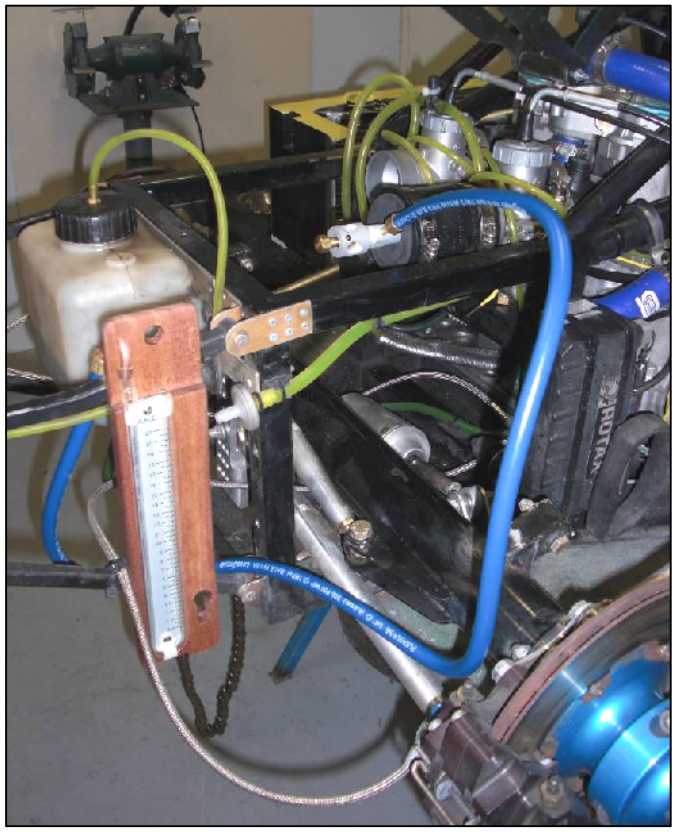

Figure 1: ARE Manometer Set-up for use on Scorpion F500 (493 Rotax powered)

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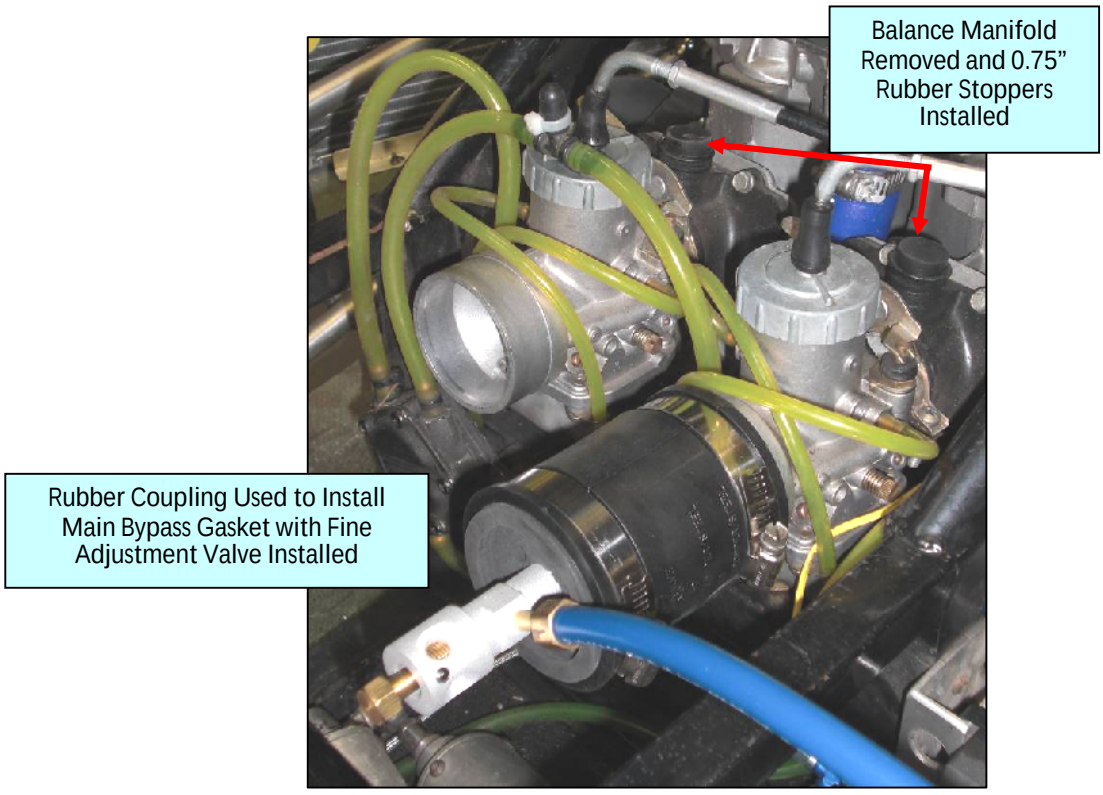

Figure 2: Close up of installation on the VM38 carburetor.

The engine was started and warmed to operating temperature. The engine was then idled to 2010 rpm (2000 rpm target) and held with a friction brake applied to the throttle cable at the pedal. The fine adjuster as used to calibrate the fluid's lower meniscus level to a line on the manometer. The number of the line on the gauge should be documented on a pad of paper. It should be noted that the numbers on the gauge are irrelevant and simply for memory when comparing other carburetors, since we are performing a differential as opposed to an absolute pressure measurement. Additionally, the numbers should not be expected as a baseline for the engine as the fluid level can be adjusted up and down the scale with the fine adjuster.

After the baseline is developed for the first carburetor, the adjuster should not be changed and all care should be taken not to bump the setup and potentially create an air leak. The hose clamp connecting the coupler and the carburetor should be loosened and the assembly moved to the next carburetor. After installing the bypass gasket and tightening the coupling hose clamp to create and airtight seal. The difference between observed fluid heights for carburetor 2 should be compared to the number noted in the notebook for carburetor 1. In my particular case the reading was off by two lines (high) on the gauge. The cable length adjuster was used to correct the throttle slide opening to within better than 1/3rd of a line.

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No performance data will be available until the car is on track for the 2010 season. However, having balanced power output throughout the rpm range is critical for making top power and a top finish.

Here are the benefits and drawbacks of ARE's system:

The benefits:

- Simple and reliable technique is easy to use, and setup will be significantly reduced on the next trial.
- The fine adjuster works quite well.
- Easy to carry and use anywhere.
- No mercury, only a light mineral oil.
- No worries about a pressure sensor going out, causing you to misread.. the worst case is that you need to go to Wal-Mart for baby oil and all they have is fragranced!
- One is able to be very precise with the kit and adjuster configuration.

The drawbacks:

- Did not fit my carburetors, though George assures me they will fit Rotax aviation engines
- A slight coloration of the oil would make reading easier
- The manometer must be isolated from engine vibration, which could create an issue while tuning adjacent to a propeller.
- I am not sure about standing behind a prop and doing this with the revs pulled up even a little bit. That would make me nervous.
- I had to provide rubber stopper plugs to block off the balance tube, the rotax aircraft engines have the same configuration.
- The quality of components is a bit lacking. Specifically, the wood backing is a little hokey for the high tech aircraft and auto racing sectors.. but it is effective. It just gives a weird impression for the money.

This is a good system with its simplicity being the key while George is very interactive and willing to support his product. I can see that your customers would like this product.

Best Regards,

Chris Huskamp
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