Further notes for the suspension oil test published on www.thesuspensionlab.nz 1/2/2021

Glossary

Viscosity - The 'thickness' of a fluid which dictates how easily it will flow. Thicker oil (eg maple syrup) resists flowing more than a thinner oil (eg water) This is measured (unit: centistokes) at 40*c and also 100*c. The 40*c is usually quoted as it is close to the normal operating temp of a bicycle shock. The 100*c value is important though as it helps indicate how the oil will behave as the temperature changes. These are then used to calculate the Viscosity Index.
Typical shock fluids have a Viscosity of 14-18 cSt @ 40*c

Viscosity Index - A fluid will always change viscosity with temperature but how much can vary between products. Viscosity (VI) is a rating of how much thinner the oil gets as it is heated up. A higher VI means it doesn't thin out as much so damping will be more consistent. Likewise a high VI won't get as thick in the cold. Most suspension damper oils have a VI between 250 and 400. A VI below 200 is usually a lower leg lubricant or used in applications like open bath fork dampers where temperature is less important but lubricity is.

Test Equipment

The test was run on a Carolina Test Works RD-2 Damper Dynamometer

Data Processing

The output data was exported from the CTW Probe software and analysed using the Python programming language. Calculations were performed using the NumPy package and plotted using Matplotlib.

The raw force data from the dyno is offset by the spring force generated by the IFP. Usually a rod force test is performed during a test run but seeing as the IFP pressure would change during the run it wouldn't be accurate. Since we are aware of this effect, an adjustment was made in the calculations using a Combined Gas Law equation and the result subtracted from the data. This was also used to generate the air spring curves.
Gay-Lussac's Law is used if you are only calculating the change in pressure with temperature. You can see what changes you will experience yourself (in a rigid container!) with one of the many online calculators out there such as - https://www.omnicalculator.com/physics/gay-lussacs-law

Other Observations

- The force values do vary between oils, due to a few factors - the Maxima oil was the factory fill and tested "as-is" to represent a real world situation. Therefore there was likely a small amount of air in the oil from the factory bleed or through use. Due to the common bleed main piston design of the shock this also created less compression damping force.
- The shock only had rebound adjustment and this was not kept the same, but changed when needed to give the most similar rebound curve. In the case of the Redline oil this was so thin that the rebound adjuster was set more closed and the most similar curve was slightly firmer than the others despite the thinner oil.
- The "hot oil pink" is the most representative of the "correct" damping for the shock.