## Simultaneous measurement of fluids density and viscosity using HP/HT capillary devices

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Although not talked in the article, there is minor experimental variability in pressure drop due to heat transfer that occurs between the surroundings and the non-capillary components and other losses associated with switching the fluid flow and entrance/exit effects. This variability is present in the reference fluid and in the actual fluid evaluated. In order to reduce the majority of those deviations, two methods were adopted:

1. The use of a large tube diameter surrounding the capillary and in the bypass, which means that a micro flowrate (max. 250  $\mu$ L/min) has almost negligible pressure losses (9E5 times smaller than the capillary) and high contact time in the heat transfer zone (2 minutes). So, the physical properties in the temperature "transition" zone (laboratory to experimental temperature) will have a very small impact.

2. The bypass tube was used with exactly the same diameter, length, roughness and heated area as the capillary surrounding tube. So, the fluid (in the tube surrounding the capillary and in the bypass) will have the same temperature "transition" length and the same "transition" properties. The previous contributions were taken in account and they are present inside the experimental parameters  $\beta$  (eq.10) and  $\alpha$  (eq.11), for density and viscosity, respectively.

A.



**Figure 1S:** *Regression* according to Eq. 2. for a CO<sub>2</sub>/CYC mixture (90:10 mol:mol) at 130°C and 139 bar flowing inside two different length capillaries.