**Wedge Meters with Low Reynolds Number Flow**

G Melendez1, D Myers2, R Steven3, K Lewis4

*1CEESI, Nunn, Colorado, USA*

*2CEESI, Nunn, Colorado, USA*

*3 CEESI, Nunn, Colorado, USA*

*4 DP Diagnostics, Windsor, Colorado, USA*

*E-mail: rsteven@ceesi.com*

A significant amount of the world’s hydrocarbon reserves are held in “heavy oil”, i.e. highly viscous oil which flows at low Reynolds numbers. The performance of many flow meters at low Reynolds number is not well documented. However, it is known that the performances of many flow meters can become particularly sensitive to Reynolds number in the low Reynolds number range. To achieve low uncertainty flow metering at low Reynolds numbers it is therefore important to calibrate the meter across the applications Reynolds number range. Calibration facilities that can calibrate meters at these low Reynolds numbers are rare. This paper describes the calibration of an 8” wedge meter at low Reynolds numbers (Re ≥ 500) at the CEESI oil facility.

Reynolds number is a function of viscosity. Therefore, use of a flow meters calibration data, i.e. the data fit relating the flow coefficient to the Reynolds number, inherently means the operator must supply the viscosity to the calculation from an external source. This is a practical problem. Operators are not always certain of a heavy oil’s viscosity, and changes in composition and temperature can cause significant viscosity changes throughout the day. Hence, a flow meter that is insensitive to Reynolds number / viscosity variations is advantageous in heavy oil applications.

CEESI tested a wedge meter across a low Reynolds number range as wedge meters are long claimed to be insensitive to Reynolds number, even in the low Reynolds number range. Such performance would be highly beneficial, as a high viscosity uncertainty would be irrelevant, having little bearing on the flow rate prediction uncertainty. In this paper, this CEESI wedge meter low Reynolds number data is shown and compared with 3rd party Venturi meter low Reynolds number data, and ISO orifice meter low Reynolds number performance predictions.

In 2014 DP Diagnostics & TUVNEL and showed that the DP meter diagnostic system IP ‘Prognosis’ was capable of operating with, and potentially predicting the flow viscosity of, heavy oil flow through a DP meter. These tests used a Venturi meter. In this paper DP Diagnostics & CEESI show that the same principles are true when using a wedge meter.