

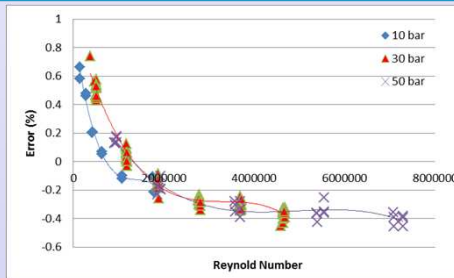
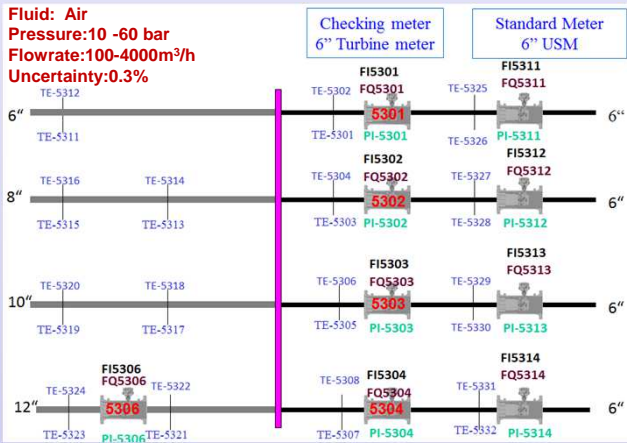
Quality assurance and stability of high pressure calibration facility

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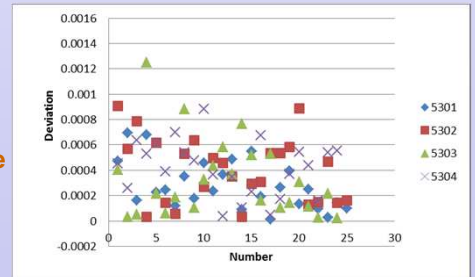
Abstract

Chinese Petroleum Corporation Company (CPC) is the primary supplier of Nature Gas (NG) in Taiwan, and the amount of NG in 2015 is about 17 billion cubic meters, and 80% is used as power plant's fuel to replace traditional coal fuel and nuclear power. To improve the accuracy and stability of NG measurement, the measurement flowmeter is replaced from traditional orifice flowmeter to multi path ultrasonic flowmeter (USM), and these business meter is calibrated at RMRI gas flowmeter calibration laboratory which use air as working flow, the calibration system is a close loop system with pressure from 10-60 bar and flowrate is from 100-4000m³/h. To ensure the high accuracy and excellent long terms stability of system, the uncertainty is necessary to be calculated. We use USM meter calibrated at Taiwan NMI as standard meter and use turbine meter as checking meter to ensure the result. This paper describes the uncertainty calculation including N_s, N_m, C_p, C_t, C_z. The uncertainty error is most come from meter factor which including traceability, repeatability, pressure effect , equation regression, and long term stability.



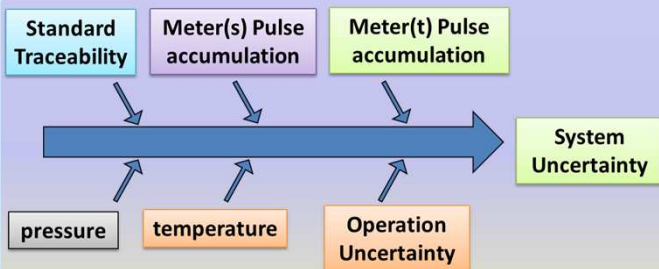
- ◆ Pressure effect
- ◆ Standard meter: 6 inch USM
- ◆ Checking meter: 6 inch turbine
- ◆ Influence: equation regression, gas density, and Reynold number

- ◆ 25 groups in 1year
- ◆ Flowrate: 100m³/h
- ◆ Max deviation is 0.1%
- ◆ Temperature and pressure stability



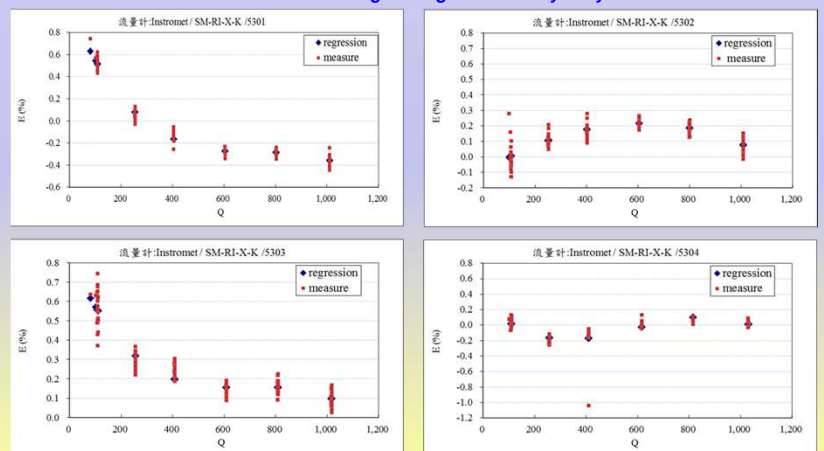
$$m_s = \sum_{i=1}^n m_{s,i}$$

$$\frac{P_m V_m}{Z_m R T_m} = \sum_{i=1}^n \frac{P_{s,i} V_{s,i}}{Z_{s,i} R T_{s,i}}$$



$$u_c(E_R) = \sqrt{[c_1 u(N_m)]^2 + [c_2 u(N_s)]^2 + [c_3 u(K_r)]^2 + [c_4 u(C_p)]^2 + [c_5 u(C_T)]^2 + [c_6 u(C_Z)]^2}$$

(uncertainty)



CPC RMRI gas flow calibration laboratory is the largest air flow calibration laboratory in Taiwan and the capacity is 4000 m³/h with pressure 10-60bar. The uncertainty is 0.3%. We calibrate nature gas business meters for power plant. We use four ultrasonic flowmeters as standard meter and trace the standard from Taiwan national measurement laboratory (NMI). Turbine meters are used as the checking meter to ensure the stability and quality. The stability of system can keep in 0.1% during 1 years