Belgorod Calibration Facility

Ultrasonic Meter Calibration

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Large Bi-Directional Pipe Ball Prover

Application

Metering & Technology's (M&T) DFX meters are being installed on a mobile calibration facility being designed and manufactured by Oil & Gas Systems Limited, which will be utilised as a master meter system for the regular calibration of ultrasonic meters installed on 13 production sites in Iraq. Oil & Gas Measurement Limited (OGM) carried out the calibration of the first four Liquid Ultrasonic Meters being supplied, at Oil & Gas Metrology's calibration facility in Russia.

Description

This facility located in Belgorod in the south of Russia opened in 2014 and was the first commercial calibration centre for liquid flow meters in Russia that uses a diversity of hydrocarbon liquids. The facility can calibrate liquid flow meters at varying fluid viscosities up to a maximum diameter of 20 inch and with a maximum flow rate of 3000 m3/h. This makes it possible to simulate or get close to the conditions at which most flow meters operate in the field. The calibration of modern flow meters requires a high quality low uncertainty value and, in this case, the meters had to be calibrated to just ±0.1% uncertainty and comply with 'Calibration standard, API MPMS Chapter 4.5 Master Meter Provers'. Representatives from a third party independent auditor (SGS) along with a representative from the Operator's team carried out the witnessed inspection during the testing of these four meters to ensure it met the stringent requirements of the standard. The final two meters will be calibrated later in the year in the presence of Iraqi inspectors.

The testing involved the calibration of two off each 8 and 12 inch DFX MM 32 beam Ultrasonic Meters (USMs). These are part of a set of six meters to be used in the project. Two meters (8 and 12 inch) will be installed on the mobile facility, with a set of two remaining in stores as calibrated spares, while the third set is in transit for recalibration. Each pair of meters will be recalibrated at agreed intervals.

Calibration is based on Reynolds number, ensuring the coverage of all the range of viscosities currently encountered in the Operator's Oil Field. The full flow range was calibrated against the calibration facilities' large bi-directional pipe prover. The calibration method used for the pipe provers is the master method as described in API MPMS 4.5.

Challenges

The required linearity of ±0.1%, combined with the API MPMS Ch 4.5 requirements is a very difficult and stringent specification and so required the best and most representative calibration possible. The low uncertainty of the Belgorod calibration facility combined with its wide range of temperature controlled viscosities made this possible. To represent the meter operation in the field the 32 Beam DFX meters were calibrated with a viscosity of 6 and 20cSt, ensuring that the meters covered the viscosity and Reynolds number range of 4.4 to 22.9cSt specified for the 13 operational sites on which the mobile calibration facility will be used. To further ensure that the calibration of the meters is representative of site conditions the meters were calibrated with the same upstream, downstream pipe spools and flow conditioners that are to be used on site. Once the sections were bolted together they remained in place for transport back, to eliminate any possible change in upstream flow conditions.

A calibration report, certified by the Russian weight and measures organisation VNIIM, was produced at the end of the testing showing the final calibration results and the CBM data recorded during the calibration will be loaded into the CBM database on the mobile prover control system for total traceability.

The final calibrations on these first four meters were well within the stringent requirements specified by the client. This showed not only the quality of the meter performance, but more specifically it showed the stability and overall fine performance of the calibration facility, and these results show clearly that the Belgorod centre can be considered as a reliable standard for both Russian and worldwide calibration.

Meter Under Test

Quality Skid