

TITLE: FACILITY DESCRIPTION AND CALIBRATION PROCEDURE FOR GAS METERS IN LACAP (BC10)

1. AIM

This document contains a description of the facilities and calibration capability, as well as an overview of the operating procedure, of the test bench for gas meters calibration at high pressure (LACAP), sited in the Central Laboratory facilities of Enagás in Zaragoza, Spain.



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2. TECHNICAL DETAILS

- Site:


Enagás Central Laboratory (LCE)
Autovía A-2, Km. 306,4 – 50012. Zaragoza (Spain)
- Test bench type: Closed loop, operating independent from the gas transmission pipeline.
- Fluid: natural gas, proceeding from near gas transmission pipeline.
- Fluid flow: with an axial blower, actuated by an electrical motor with a frequency variator.
- Gas temperature control: heat exchangers gas/cool water.
- Calibration runs: Two (not working at the same time).

Calibration Capability

- Gas Meters tested (DUT): Turbine, Ultrasonic (USM), Rotary Pistons, Vortex and Coriolis (under special study).

Measured signals:

 - 2 x High frequency pulses (HF NAMUR), 0 – 5 kHz
 - 1 x Low frequency pulses (LF), REED contact
 - 1 x Current output: 4 – 20 mA
 - 1 x Serial RS485/232 (optional if manufacturer software available, mainly for USM)
- Test Pressure range: 3 to 50 barg (accredited range: 16 to 50 barg).
- Gas temperature range: 18 to 32 °C.
- Flowrate range: 10 to 10.000 m³/h (actual conditions).
- Nominal diameters (inches): 2, 3, 4, 6, 8, 10, 12, 16, 20 and 24 (DN50 to DN600).
- Flanges (ANSI): 150, 300, 600.
- Spools: available with minimum lengths of 5D and 10D for all the nominal diameters.
- Length of calibration runs: 5D+ DUT (3D)+10D.
- Gas composition: continuous on-line measurement at process conditions (gas chromatography).

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- Reference measurement system, working standards (WS):
 - 4 Turbine G-1600 DN250 ANSI300
 - 1 Turbine G-400 DN150 ANSI300
 - 1 Turbine G-160 DN80 ANSI300
- Trazability to International standards, PIGSAR/PTB - Germany, through transfer standards (TS):
 - 1 Turbine G-1600 DN250 ANSI300
 - 1 Turbine G-400 DN150 ANSI300
 - 1 Turbine G-160 DN80 ANSI300
- Best Measurement Capacity (BMC), uncertainty range on meter error (%) depending on flow rates and pressures: 0,23% - 0,26% (www.enac.es).
- The Enagás Central Laboratory is supported by a Quality Control System accredited by ENAC (EN ISO/IEC 17025).
- CEM (Spanish National Metrology Institute) associated Laboratory since October 2014.

3. GENERAL ISSUES

- The meters, spools and accessories must be delivered at LCE with appropriate packaging, free of fees, at least two working days before date of calibration.
- The customer must deliver in LCE, before date of calibration, pressure test certificates according to EN 10204, for all meters, spools and accessories.
- The meters, spools and accessories will be available at the LCE warehouse, to be collected by the customer, two working days after date of calibration (special requirements under agreement).
- Optionally, customers can visit LCE and witness the calibrations. Visitors room with TV screen (showing calibration data) and Internet (WI-FI) are available.
- Deliveries address:

ENAGÁS, S.A.
Laboratorio de Contadores de Gas (Warehouse)
Autovía A-2, Km. 306,4 – 50012. Zaragoza (Spain)
- Customer assistance contact: Mr Luis San Vicente
phone +34 976 469835
e-mail: lsanvicente@enagas.es

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- Laboratories Technical Manager: Mr Carlos Sebastián
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e-mail: csebastian@enagas.es

4. OPERATING AND CALIBRATION PROCEDURE IN LACAP (Overview)

- Delivery of meters, spools and accessories in the LCE warehouse (shipping arranged by customer).
- Upon arrival: as received inspection for external damage and checking of technical characteristics and documents. In case of damages, pictures are taken and a report is sent to the customer. Later, the meter is transferred to the LACAP building for temperature assimilation purposes.
- Perform visual check of meter (and customer spools if any) for internal damage or special dirt that could affect the calibration or any part of the test bench. If necessary, customer may be contacted and eventual problems reported.
- Install DUT and spools in the suitable calibration run. If delivered by customer, flow conditioner can be installed upstream the DUT (minimum at 10D).
- Connect the pressure and temperature transmitters. Absolute pressure is measured at DUT pr-connection. Gas temperature is measured with RTD at 3D downstream the MUT. Optionally, pressure loss across the DUT is measured.
- Pressurize the loop at setup value (or at the higher if more than one pressure required). Later, pressurize and leak-test the calibration run.
- Connect and check the DUT signal outputs to be used: HF, LF, analogue current. Optionally, RS322/485 serial communication if proprietary software is available at the calibration computer (for USM is absolutely necessary for reading, modification and storage of configuration parameter list).
- After checking the required signals, the ball valves in the calibration run are opened and maximum flowrate is reached. After that, wait for flowrate and gas temperature stabilization in the loop (following actual ambient temperature in the calibration room).

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- Start calibration at $Q_{max} \pm 5\%$. The calibration computer records all the signals from the PLC: pulses, mA, pressures and temperatures. Gas volume passed through WS and DUT and error % at the flowrate are calculated. Normal measurement time is 108 s, or 5.000 DUT pulses or 10.000 WS pulses. Three repetitions of the error calculation are recorded.
- Stabilization, measurements, repetitions and error calculation are performed in the same way for the consecutive flowrates until Q_{min} is reached. Standard calibration is for 6 flowrates: 100%, 70%, 40%, 25%, 10% and 5% of Q_{max} .
- Other flowrates and number of repetitions can be performed under request.
- If another pressure has been required, the loop and calibration run pressure is decreased. All the process is repeated in the same way until the minimum calibration pressure is achieved.
- After each calibration the Weighted Mean Error (WME) is calculated, following OIML R137. If necessary, meter adjustment is performed to reach the WME as near to zero as possible. In case of an USM, Adjustment Factor following ISO/CD 17089-1 is calculated and modified in the configuration parameter list.
- If more than one calibration pressure have been required, the adjustment is performed at the pressure indicated by customer (usually the nearest to the pressure in field operation).
- Verify the adjustment at one flowrate (check point: usually 70% Q_{max}); more check points can be tested under request.
- Depressurize the calibration run, inertize with nitrogen and remove DUT, spool pieces and accessories. Seal the DUT and stick LACAP label.
- Issue the Calibration Certificate following EN ISO/IEC 17025. In Annex 1, a plot of error curve at each pressure calibration is included, as well as the corresponding to as found and as left if DUT has been adjusted. In case of USM, in Annex 2 the as left parameter list record is included.
- Box up DUT and accessories, using the same packaging, boxes, etc. the goods arrived with; storage in the LCE warehouse until collection (shipping arranged by customer).