

ULTRASONIC FLOWMETER 'WET' GAS TESTS AT NEL

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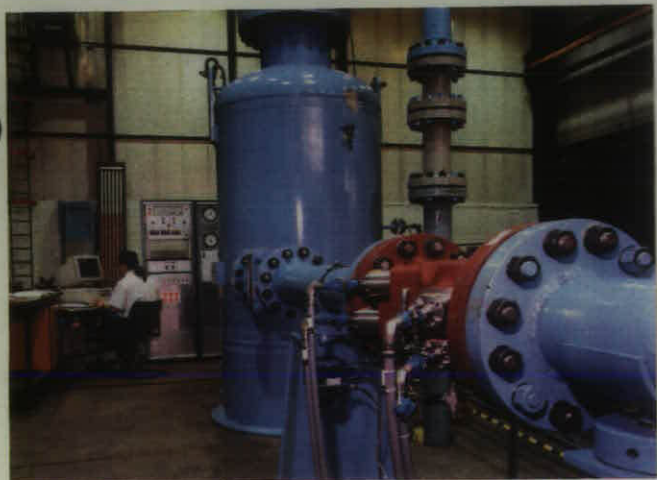
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## Introduction

As part of the "Ultraflow" Joint Industry Project to develop a "wet" gas flowmeter<sup>(1)</sup>, the British Gas/Daniel multipath ultrasonic flowmeter is currently being tested at NEL. The High-Pressure Gas Recirculating Loop<sup>(2)</sup>, capable of the required gas flowrates and pressures, has been specially converted for the purpose. This brief note details the technical changes to the facility to accommodate liquid addition, separation and handling, as well as elements of the current test programme.



Close-up view of test meter with gas/liquid separator in background

## Modifications to the NEL flow loop

The NEL High-Pressure Gas Recirculating Loop is a continuous-running facility with a nominal bore of 150mm (6"), a pressure range of 1-7 MPa (10-70 bar) and a maximum gas velocity of approx. 20 m/s. Although other gases can theoretically be accommodated, the working fluid presently is air.

New technical features resulting from the conversion to wet gas include a liquid injection section, a gas/liquid separator, and various ancillary liquid-side items such as a heavy duty pump and reservoir.

The liquid injection head is installed between the reference turbine meter and the test meter (its axial position is actually variable from between 10 and 50 pipe diameters upstream of the test meter). It is fitted with 200 spray nozzles (Bete impingement type, PJ series) which inject the liquid in fine-mist form (droplets of 100 microns or less) over a wide flow range (0.2 l/m to 200 l/m). The flowrate is controlled by switching nozzles on or off incrementally as opposed to varying the pressure difference across them. This maintains a constant droplet size over the flow range.

At the end of the test-section, in order to protect the compressor and to avoid any deleterious effect on the performance of the reference meter, the liquid is removed in a gas/liquid separator. This has been custom built to match the particular flow conditions (ie to optimise catch efficiency and minimise pressure

drop). Inside the separator vessel is a meshpad demister (Knit-mesh Ltd) of a type developed specially for similar applications offshore.

From the separator, the liquid drains down to a storage reservoir while the dried gas continues around the loop. The liquid is fed back to the injection point by a positive-displacement pump (Wheatley T365M triple plunger type with variable-speed drive) capable of coping with the high suction pressure of up to 70 bar and of boosting this by the pressure differential required across the nozzles (25 bar).



General view of facility showing injection head and controls trolley

## Current tests

In consultation with the regulatory authorities, the Ultraflow consortium has drawn up a representative test programme intended to yield sufficient information to allow official assessment of the ultrasonic meter for fiscal and allocation duties. The programme is summarised as follows;

- ☐ Pressures: 10 barg and 70 barg
- ☐ Gas velocities: 5 levels up to 20 m/s
- ☐ Liquid concentrations: 5 levels up to 1% by volume
- ☐ Liquid types: Water, Glycol, Water/Glycol
- ☐ Injection types: "Fine-mist" spray, Free liquid along bottom of pipe
- ☐ Injection locations: 10d and 50d upstream of test meter

The tests are currently underway and are expected to run until early next year.

## Refs.

- 1 Wilson, M, Ultraflow Project information sheet, October 1992.
- 2 Watt, R M, & Reid, J, "The NEL High-Pressure Gas Recirculating Loop", Int. Conf. on Flow Measurement in Industry & Science, London, May 1991.

## References

[1] Paper presented at the North Sea Flow Measurement Workshop, a workshop arranged by NFOGM & TUV-NEL

Note that this reference was not part of the original paper, but has been added subsequently to make the paper searchable in Google Scholar.