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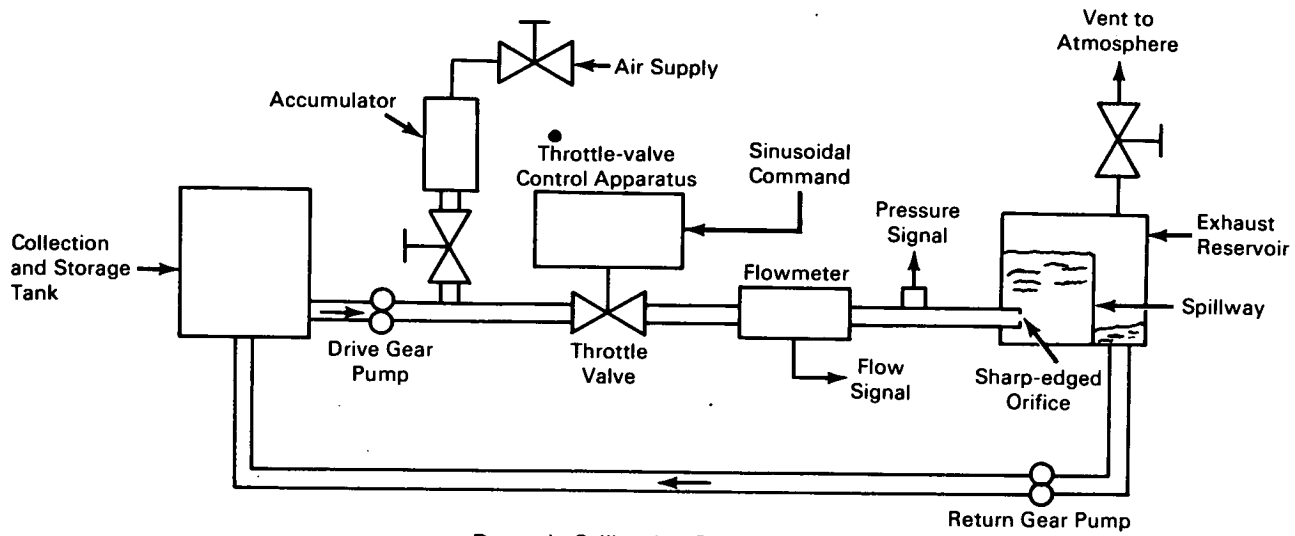
NASA TECH BRIEF

Dynamic Calibration of Turbine Flowmeters



Dynamic Calibration Schematic

It has been found that turbine flowmeters can be calibrated dynamically by means of frequency-response tests, provided small perturbations are used. The indicated flow is related to the actual flow by a first-order lag function:

$$W_i' = \frac{W'}{1 + j\frac{f'}{f_o}}$$

where W_i' is the perturbation mass flow indicated by the flowmeter, W' is the perturbation actual mass flow, f is the perturbation frequency and f_o is the breakpoint frequency of the flowmeter. This lag function is completely defined by the breakpoint frequency which is directly proportional to mean flow rate

$$f_o = C\overline{W}$$

where $\overline{W}$ is the mean value of actual mass flow and C is an experimentally determined constant.

Knowledge of the value of C is sufficient for completely specifying the flowmeter dynamics over the range of mean flows investigated.

Turbine flowmeters are occasionally used to measure dynamic flow rates of liquids. The accuracy of such dynamic measurements is questionable without a dynamic calibration of the flowmeter and indicating apparatus.

Techniques for evaluating this performance that have been proposed determine the flowmeter response to large step changes in flow rate. Unfortunately, step changes in flow rate having short rise times are difficult to realize. An alternate technique for obtaining a flowmeter calibration was investigated. The calibration was obtained for a 3/8-inch flowmeter

(continued overleaf)

by sinusoidally perturbing the liquid flow rate through a line terminated with an orifice. The flow indicated by the flowmeter was compared with that obtained from the orifice-pressure-drop measurements. This technique has the advantages that it employs easily obtained sinusoidal perturbation, and it provides repeatable results.

Note:

The following documentation may be obtained from:

Clearinghouse for Federal Scientific
and Technical Information
Springfield, Virginia 22151
Single document price $3.00
(or microfiche $0.65)

Reference: NASA TMX-1736 (N69-17702), Dynamic Calibration of Turbine Flowmeters by Means of Frequency Response Tests

Patent status:

No patent action is contemplated by NASA.

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