

costs, effects of fuel price increase and labour charges are incorporated into the analysis. Interestingly, there is a comparison between the theory and measurements made on an existing district heating network that gives reasonable agreement.

- *Bernauer/Buchner: Metal hydrides for heat storage of combustion and reaction processes.* Contains a very useful summary and review of the applicability of metal hydrides over the full range of both industrial and domestic waste heat sources for both open and closed hydrogen cycles, with a full compilation of physical, chemical and

thermal properties. Possible applications are discussed in power plants, automobile air conditioners together with a range of heat pump uses.

The book finishes with two detailed listings of the thermal energy storage programmes in the EEC and in the USA.

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Flow Measurement Engineering Handbook

R. W. Miller

When asked by the Foxboro Company to write a new edition to bring L. K. Spink's book on the Principles and Practice of Flowmeter Engineering up to date, R. W. Miller took up the rather daunting challenge. Spink's book, first published in 1930 was of a very different era and so Dick Miller has produced not a series of visible transplants onto an old framework but a completely fresh and highly commendable *tour de force*.

The book can be considered roughly to comprise four main sections. The first is a comprehensive review of the information on fluid properties and on the flow phenomena which the user needs to assess before even considering which flowmetering device to use. The author is concerned only with measurements in pipelines and with industrial situations, open channel devices and research equipment are excluded. This section ends with an extremely useful chapter on flowmeter selection.

The second and third groups of chapters deal with the metering devices themselves while the fourth part of the book is a series of nine appendices listing mainly liquid and gas properties. In this, the book is like the 1964 version of BS 1042; it gives the reader virtually all the information he needs in a single volume.

This is a practical book copiously sprinkled with worked examples—an outlet for the author's experience with technical teaching. These are of great value to the user who can learn so much more by seeing how to calculate the answers. Indeed, once grasped, the author's concept of sizing factors makes computation straightforward.

A 'Handbook' originally meant a small treatise which could be held in the hand and by 1836 had come to be used to describe a book with concise information as a guide for the tourist. Similarly the word compendium was originally used to describe an abridgement of a larger work. This Handbook of Dick Miller's, weighing 1.5 kg, would more justifiably be called a treatise in its own right on the subject of differential producers, the name which the author uses to describe the genus of pressure difference devices such as the orifice plate, nozzle, etc.

The author concentrates on these devices, classifying the rest of the flowmeters commonly used

in process measurement and control as the genus of linear flowmeters. Thus turbine, vortex, electromagnetic, ultrasonic and the rest are dealt with in a fifth of the space which the author requires to deal adequately with differential producers. This balance is his critical assessment of the present day and how far we have really come since the 1930's. Associated developments in pressure transducers, computers, etc, make the task easier, or more difficult depending on attitudes, but I agree that fundamentally we still have a long way to go before we can assure the user the reliability and predictability which have been established for the pressure difference devices such as the ubiquitous orifice plate. Improvements are on the way with major research investigations in Europe and the USA into orifice plate coefficients.

The warning which the reader must take to heart though, from the size of this book if from nothing else, is that 'good' measurements are only achieved by the observance of great care and honesty. I would have liked to see a more detailed examination of the assessment of uncertainty than given in the 18-page chapter on accuracy. Loy Upp's comment that accurate measurement needs equal measures of good instruments, good installation and good maintenance coupled with an element of faith is a sound maxim to which the reviewer would add only that there is invariably some unsuspected source of error which makes the overall estimate of uncertainty an under- rather than an over-estimate.

This Handbook, however, is a most worthwhile acquisition for the instrument engineer who may find the page numbering by chapters difficult to use at first and the quaint transference of the chapter/page numbers from top corner to bottom corner for pages of Tables unnerving, but who will be rewarded by his perseverance with the wealth of material contained within its covers.

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