

BOOK REVIEWS

H. D. BAEHR, *Thermodynamik* (An introduction to basic concepts and their technical applications) 3rd rev. edn. Springer, Berlin (1973). 440 pp. DM 42,00.

THIS book is characterized by especially clear explanation, concept and application of basic thermodynamic notations (e.g. change of state-thermodynamic processes) most of all in the introductory chapter. Subsequently a treatment of the First Law is presented with detailed discussion of the notion of work, while heat is merely defined as the change of internal energy of a system reduced by the energy transferred as work. In Chapter 3 the Second Law is given in conjunction with the deduction of Entropy and the introduction of the notions of Exergy and Anergy. In the entire book energy conversion from the point of view of exergy consumption is given great attention, exhibiting the usefulness of this property as well as of the exergetic efficiency. Criticism appears appropriate for the use of notions as "empiric" or "metric" entropy in treating the Second Law, if the book will stand up to the desire of the author, mentioned in the preface, to help the *Engineer* in understanding the bases of thermodynamics.

After the two Laws, consecutively thermodynamic properties of pure substances, gas-vapour mixtures, flow-processes, refrigeration, combustion and—in a well-done

chapter—thermal power plants are presented. The advantage of exergy for this last chapter is emphasized.

In the devising of material the author often deviates from conventional text-books, so when the ideal gas law is consequently treated as the boundary case for $p \rightarrow 0$ of the general thermal equation of state. Thus the ideal gas is not found in the first pages as usual but in Chapter 5 where it is treated in a few pages. The deduction of the simple changes of state are completely omitted. Hints, for their application, however are found in the numerous examples distributed within the text.

Examples and tables are given in SI-units. In contrast to former editions and the notation commonly used in technical thermodynamics the sign of work was altered such that the entire energy added to a system is to be introduced as positive, while all energy dissipated is negative.

Mention should be given also to the fact that the revision of the book brought forward a reduction in volume compared to the 2nd edition.

For every expert the book is a gain and recommended for its clearness and closed conception.

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Recent Developments in Compact High Duty Heat Exchangers. The Institution of Mechanical Engineers, London (1972) £7.

THIS paper-bound volume contains 11 papers (plus discussion, corrigenda, etc.) given at a conference at the Institution Headquarters on 12 October 1972. As is usually the case, the title of the volume does not manage to encompass the contents, as the brief descriptions below will demonstrate. The contents of any given paper offer little more for the practitioner than a starting point for further inquiry. Taken together, however, the papers give a useful survey of several unconventional heat exchanger types and applications. Most of the papers are descriptive and qualitative and emphasize mechanical and operational features, but this is, after all, the level at which the really critical decisions in heat exchanger selection and design are made.

The first two papers consider the steam generators for nuclear plants, the first considering sodium-to-water exchangers and the second including water-to-water and gas-to-water also. These papers are primarily useful to alert the engineer in non-nuclear industries to some of the technology that has been developed to meet the very special criteria of the nuclear plant. While the fabrication aspects of this technology may have more obvious application to high pressure-high temperature chemical processing, the thermal-hydraulic problems are closely related to those in cryogenic plants.

The third and tenth papers in the volume both deal with plate heat exchangers. Plate heat exchangers undoubtedly deserve more widespread process application than they have received; the gap is due, at least in part, to the unwillingness of the manufacturers to divulge sufficient design data and methods to allow plates to be independently compared

to tubular designs. This situation is changing, but it cannot be said that these papers contribute much to that event. The first does call attention to ongoing mechanical developments which are improving the pressure, temperature, and size ranges to which the units can be built, and the other paper discusses qualitatively the application of the transfer unit concept to the analysis and configuring of plate exchanger thermal profiles.

The fourth paper reports on the development of what can be described as a "shell and plate" configuration, which seeks to combine the best features of each with special application to high pressure. Conceptually, the design is close to the familiar Ramén lamellar bundle, but there are differences which may justify separate technical consideration and are probably intended to establish an independent patent position.

The next paper deals with flow and heat transfer in elliptical ducts. It is fundamental and analytical and rather out of context but does relate to the tube side phenomena in finned elliptical tube exchangers in widespread use. The important conclusion is that the predicted average turbulent heat-transfer coefficient and wall shear stress are in close agreement with experiment; however, the local agreement is poor since the turbulence model employed neglects secondary flow.

The sixth paper compares plain and corrugated high fin tubes for air-cooled exchangers. While the correlations actually used lack generality, the author presents a useful procedure for comparison of finned surface performance and for guiding fin development efforts.

The seventh paper is an experimental study of the round tube and continuous plate fin configuration frequently found in engine coolers and air conditioning systems. The range and accuracy of the experiments appear to be quite good and the data useful for design.

The eighth paper, which needs to be read in connection with the figures in the Discussion, is a purely qualitative survey of plate fin heat exchangers and applications. Both in the paper and in the discussion the author avoids mention of the flow maldistribution problem, which is the most critical problem in the design and operation of large plate fin configurations in services requiring high thermal effectiveness (close temperature approaches). The only practical solution to this problem at this time seems to be a substantial derating of the ideal mean temperature difference (or NTU's).

The ninth paper is also purely qualitative, describing the historical development of the graphite heat exchanger from the shell-and-tube configuration (very widely used today, though one would not learn that from this paper) to the modular drilled blocks. There are a few numbers in the paper to allow the process designer to estimate the possible attractiveness of these units vis-a-vis other designs.

The last paper is devoted to tubular aerospace heat exchangers. The treatment is at best superficial, and such details as are given relate to fabrication, which does not translate very far into fields with different objective functions for design.

In sum, it is always healthy to learn what is going on in fields peripheral to one's own. In this context, this volume has value even now, but it would have been much better to be at the Conference. Only one or two papers have permanent reference value.

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