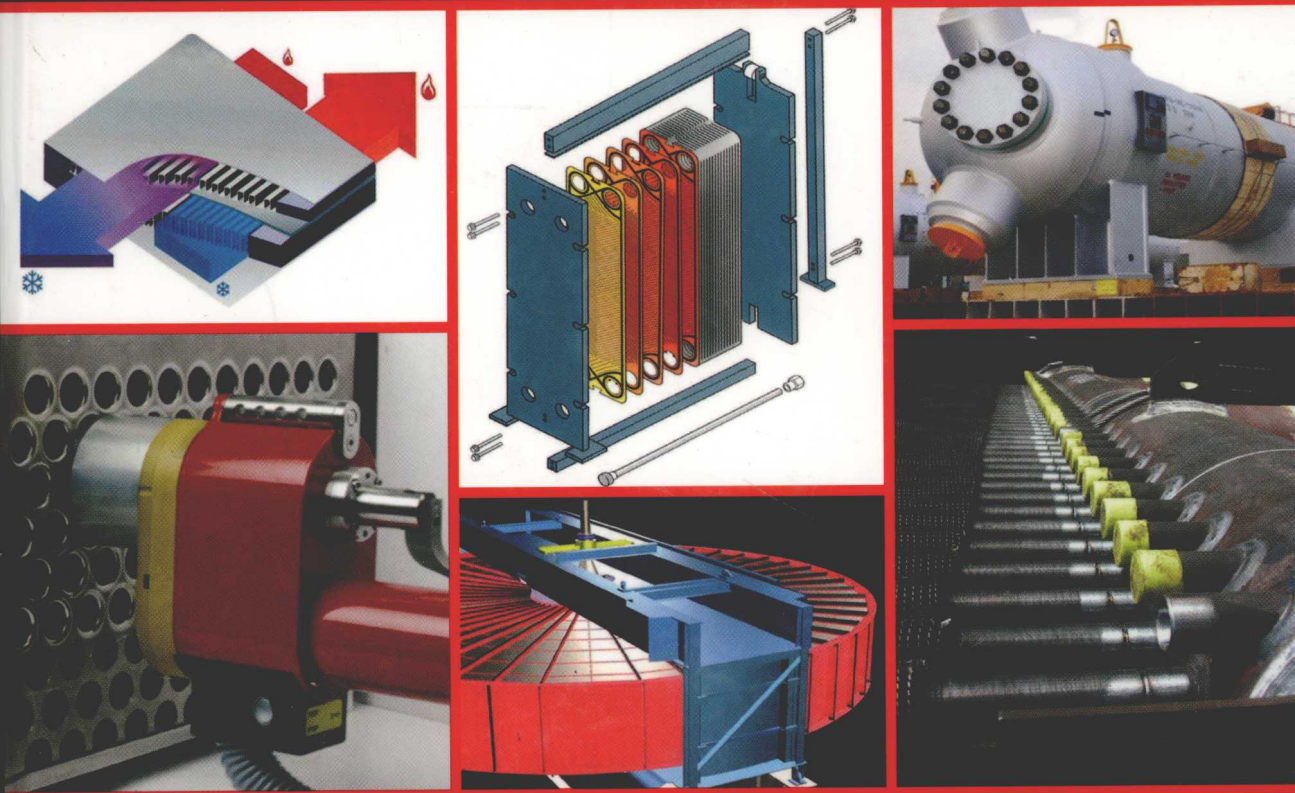


Heat Exchanger Design Handbook

SECOND EDITION



Kuppan Thulukkanam



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Heat Exchanger Design Handbook

S E C O N D E D I T I O N

Kuppan Thulukkanam



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Heat Exchanger Design Handbook

SECOND EDITION

MECHANICAL ENGINEERING
A Series of Textbooks and Reference Books

Founding Editor

L. L. Faulkner

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and Department of Mechanical Engineering
The Ohio State University
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Dedicated to

*my parents, S. Thulukkanam and T. Senthamarai,
my wife, Tamizselvi Kuppan,
and my mentor, Dr. Ramesh K. Shah*

Preface

INTRODUCTION

The advances in heat exchanger technology since the publication of the first edition and the topics that had been missed have necessitated a second edition of this book. This edition showcases recent advances in the selection, design, construction, operation, and maintenance of heat exchangers. The errors in the previous edition have been corrected, and the quality of figures including thermal effectiveness charts has been improved. This book provides up-to-date information on the single-phase heat transfer problems encountered by engineers in their daily work. It will continue to be a centerpiece of information for practicing engineers, research engineers, academicians, designers, and manufacturers involved in heat exchange between two or more fluids. Permission was sought from leading heat exchanger manufacturers and research organizations to include figures of practical importance, and these have been added in this edition. Care has been taken to minimize errors.

COVERAGE

In the chapter on the classification of heat exchangers, topics such as scrapped surface heat exchanger, graphite heat exchanger, coil wound heat exchanger, microscale heat exchanger, and printed circuit heat exchanger have been included. The construction and performance features of various types of heat exchangers have been compared.

Concepts like ALEX core for PFHE, radial flow heat exchanger for waste heat recovery, and rotary regenerator for HVAC applications have been added. Breach-Lock™ and Taper-Lok™ end closures have also been included.

Construction details and performance features of nonsegmental baffles heat exchangers such as EMBaffle®, Helixchanger®, and Twisted Tube® heat exchangers have been added. Design features of feedwater heater, steam surface condenser, and tantalum heat exchanger for pharmaceutical applications have also been included.

Information on pressure vessel codes, manufacturer's association standards, and ASME codes has been updated. ALPEMA standards for PFHE have been dealt with in depth.

Performance features of coil wound heat exchangers have been compared with brazed aluminum heat exchangers. The construction, selection, design, and concepts of manufacture of ACHE have been updated.

Recent advances in PHE concepts such as all welded, shell type, wide gap, free flow, semi-welded, and double-wall have been discussed and their construction and performance features compared.

The chapter on heat transfer augmentation has been thoroughly revised. Underlying the principle of heat transfer enhancement, devices such as hiTRAN thermal system and wire matrix turbulators have been described.

Fouling control concepts, such as back flushing, heat exchangers, such as self-cleaning, and liquid fluidized bed technology, fluidized bed units, and fouling control devices, such as Spirelf®, Fixotal®, and Turbototal®, have been added.

A new chapter on heat exchanger installation, operation, and maintenance covers the commissioning of new units, operation, their maintenance, repair practices, tube bundle removal, handling and cleaning, leak testing and plugging of tubes, condition monitoring, quality audit, and residual life assessment by NDT methods.

The tubesheet design procedure as per the latest ASME code, CODAP, PD 5000, and UPV has been discussed and compared with TEMA standards. The software program structure for design

of ACHE and STHE has been updated. Recent trends in NDT methods such as ECT, UT, and leak testing have been included.

The chapter on fabrication of heat exchangers has now been revised, covering the recent advances in tube expansion and tube-to-tubesheet welding practices, rolling equipment, accessories, adequacy of rolling, cold working principle, configuration of tube-to-tubesheet joints for welding, modern equipment for tube hole preparation, and internal bore welding tubes. The section on heat exchanger heads has now been updated by incorporating various hot/cold working methods, and manufacturing procedures and PWHT have been discussed. New topics like CAB brazing of compact heat exchanger, cupro-braze radiators, and flat tube versus round tube concept for radiator tubings have also been added.

Due to their content and coverage, chapters 2, 5, 13 and 15 can be treated as individually self-contained units, as they do not require other chapters to be understood. This edition is abundantly illustrated with over 600 drawings, diagrams, photos, and tables. The *Heat Exchanger Design Handbook*, Second Edition is an excellent resource for mechanical, chemical, and petrochemical engineers; process equipment and pressure vessel designers, consultants, and heat exchanger manufacturers; and upper-level undergraduate and graduate students in these disciplines.

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