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Maintaining the excellent coverage of centrifugal pumps begun in the First Edition -- called "useful" and "indispensable" by reviewers -- the Second Edition continues to serve as the most complete and up-to-date working guide yet written for plant and design engineers involved with centrifugal pumps. In the critical work of maintaining power plant machinery, operating difficulties with centrifugal pumps will inevitably occur because of the essential requirement for electric power plants to operate at all times throughout the year. The root causes and solutions for pump failure comprise major areas of study for engineers in seeking the highest availability of electricity-generating units, extending time between major machinery overhauls and providing early detection of potential failure modes well in advance of machine degradation. This guide for engineers provides a comprehensive overview of the fundamentals of centrifugal pumps, addressing the range of pump operating problems encountered in both fossil and nuclear power plants. The book is divided into three sequential parts: Part I - Primer on

Centrifugal Pumps, Part II -Power Plant Centrifugal Pump Applications, and Part III - Trouble-Shooting Case Studies. Employing effective research models developed through years of experience, the author draws on an extensive range of scholarship that covers the detrimental impact of power plant pump failures on overall plant performance, as well as the preventative measures that aid in successful pump maintenance. After covering the performance and components of centrifugal pumps, operating failure modes are covered both for fossil and nuclear power plants. This is followed by the presentation of several power plant pump troubleshooting case studies. The text also walks readers through the various other industrial applications of centrifugal pumps, as in their use within petrochemical plants and in ocean vessel propulsion systems. Recognizing the warning signs of specific impending pump failure modes is essential to minimizing the financial costs of dealing with pump operating problems. To this end, the author lays out a range of theoretical models and relevant examples in support of the essential work of power plant pump use and maintenance: Centrifugal pump specification and selection -- a systems approach, centrifugal pump specification and selection -- a systems approach part I & II, hidden dangers in centrifugal pump specification part I & II, the risks of parallel operation, the [B-K] factor in mechanical seal life, the importance of running clearances, when two pumps are cheaper than one, cost factors when considering pumping rate and line size, which is worse, specifying too much head or too much flow, causes of intermittent and chronic cavitation, locating the greatest centrifugal pump energy savings, how centrifugal pump hydraulics affect rolling element bearing life, importance of proper review in pump specification, protecting centrifugal pumps at low flow rates, motor trip! predicting the unforeseen disaster, trimming impeller to save energy and increase flow rate, applying mechanical seals to centrifugal pumps, understanding the essentials of centrifugal pump reliability, application of rolling element bearings ... This long-awaited new edition is the complete reference for engineers and designers working on pump design and development or using centrifugal pumps in the field. This authoritative guide has been developed with access to the technical expertise of the leading centrifugal pump developer, Sulzer Pumps. In addition to providing the most comprehensive centrifugal pump theory and design reference with detailed material on cavitation, erosion, selection of materials, rotor vibration behavior and forces acting on pumps, the handbook also covers key pumping applications topics and operational issues, including operating performance in various types of circuitry, drives and acceptance testing. Enables readers to understand, specify and utilise centrifugal pumps more effectively, drawing on the industry-leading experience of Sulzer Pumps, one of the world's major centrifugal pump developers Covers theory, design and operation, with an emphasis on providing first class quality and efficiency solutions for high capital outlay pump plant users Updated to cover the latest design and technology developments, including applications, test and reliability procedures, cavitation, erosion,

selection of materials, rotor vibration behaviour and operating performance in various types of circuitry Basic knowledge about fluid mechanics is required in various areas of water resources engineering such as designing hydraulic structures and turbomachinery. The applied fluid mechanics laboratory course is designed to enhance civil engineering students' understanding and knowledge of experimental methods and the basic principle of fluid mechanics and apply those concepts in practice. The lab manual provides students with an overview of ten different fluid mechanics laboratory experiments and their practical applications. The objective, practical applications, methods, theory, and the equipment required to perform each experiment are presented. The experimental procedure, data collection, and presenting the results are explained in detail. LAB Pumps are commonly encountered in industry and are essential to the smooth running of many industrial complexes. Mechanical engineers entering industry often have little practical experience of pumps and their problems, and need to build up an understanding of the design, operation and appropriate use of pumps, plus how to diagnose faults and put them right. This book tackles all these aspects in a readable manner, drawing on the authors' long experience of lecturing and writing on centrifugal pumps for industrial audiences. This last, the education of pump users, is precisely what this book was intended to do. To what extent we must have achieved our purpose, our readers must decide. My good friend and associate, J. T. (Terry) McGuire, and I have been working very closely together for a long time. Our view of engineering problems and of their solutions coincide to an astonishing degree. When I was asked to prepare a second edition of my book Centrifugal Pumps, it was logical that I turned to Terry and suggested that he be my coauthor on this project. He agreed to do so, and his cooperation has been most valuable, both in improving the resultant work and in easing my burden. It would be presumptuous on my part to pretend that nothing has changed in the technology of centrifugal pumps during the 30 years since I prepared the manuscript for the first edition of this book. Let me, then, speak of some of these changes. Centrifugal Pumps describes the whole range of the centrifugal pump (mixed flow and axial flow pumps are dealt with more briefly), with emphasis on the development of the boiler feed pump. Organized into 46 chapters, this book discusses the general hydrodynamic principles, performance, dimensions, type number, flow, and efficiency of centrifugal pumps. This text also explains the pumps performance; entry conditions and cavitation; speed and dimensions for a given duty; and losses. Some chapters further describe centrifugal pump mechanical design, installation, monitoring, and maintenance. The various types and applications of pumps in the light of the particular design features involved are addressed in other chapters. This book is authoritative, informative, and thought-provoking to an exceptional extent. It establishes a notable advance in the progress of the art of the designer and manufacturer of centrifugal pumps, to the material advantage of the user. Practical Centrifugal Pumps is a comprehensive guide to pump construction,

application, operation, maintenance and management issues. Coverage includes pump classifications, types and criteria for selection, as well as practical information on the use of pumps, such as how to read pump curves and cross reference. Throughout the book the focus is on best practice and developing the skills and knowledge required to recognise and solve pump problems in a structured and confident manner. Case studies provide real-world scenarios covering the design, set up, troubleshooting and maintenance of pumps. · A comprehensive guide to pump construction, design, installation, operation, troubleshooting and maintenance. · Develop real-world knowhow and practical skills through seven real-world case studies · Coverage includes pump classifications, types and criteria for selection, as well as practical information on the use of pumps An engineer's guide to the design, selection, operation and maintenance of centrifugal pumps. Author Moniz Senior Hospital Engineer for the Government of Western Australia. The structure of a hydraulic machine, as a centrifugal pump, is evolved principally to satisfy the requirements of the fluid flow. However taking into account the strong interaction between the pump and the pumping installation, the need to control the operation, the requirement to operate at best efficiency in order to save energy, the provision to improve the operation against cavitation and other more specific but very interesting and important topics, the object of a book on centrifugal pumps must cover a large field. The present book examines a number of these more specific topics, beyond the contents of a textbook, treating not only the pump's design and operation but also strategies to increase energy efficiency, the fluid flow control, the fault diagnosis. This book gives an unparalleled, up-to-date, in-depth treatment of all kinds of flow phenomena encountered in centrifugal pumps including the complex interactions of fluid flow with vibrations and wear of materials. The scope includes all aspects of hydraulic design, 3D-flow phenomena and partload operation, cavitation, numerical flow calculations, hydraulic forces, pressure pulsations, noise, pump vibrations (notably bearing housing vibration diagnostics and remedies), pipe vibrations, pump characteristics and pump operation, design of intake structures, the effects of highly viscous flows, pumping of gas-liquid mixtures, hydraulic transport of solids, fatigue damage to impellers or diffusers, material selection under the aspects of fatigue, corrosion, erosion-corrosion or hydro-abrasive wear, pump selection, and hydraulic quality criteria. As a novelty, the 3rd ed. brings a fully analytical design method for radial impellers, which eliminates the arbitrary choices inherent to former design procedures. The discussions of vibrations, noise, unsteady flow phenomena, stability, hydraulic excitation forces and cavitation have been significantly enhanced. To ease the use of the information, the methods and procedures for the various calculations and failure diagnostics discussed in the text are gathered in about 150 pages of tables which may be considered as almost unique in the open literature. The text focuses on practical application in the industry and is free of mathematical or theoretical ballast. In order to

find viable solutions in practice, the physical mechanisms involved should be thoroughly understood. The book is focused on fostering this understanding which will benefit the pump engineer in industry as well as academia and students. This practical reference describes the occurrence of cavitation in a centrifugal pump, and how unacceptable cavitation can be avoided. It explains cavitation problems such as hydraulic performance loss, hydrodynamically or thermodynamically induced surging, and cavitation erosion. General guidelines for acceptable operation conditions, such as, net positive suction head (NPSH) margins and minimum flowrates, are presented along with evidence and logic for these proposed guidelines. Damage on Pumps and Systems. The Handbook for the Operation of Centrifugal Pumps offers a combination of the theoretical basics and practical experience for the operation of circulation pumps in the engineering industry. Centrifugal pumps and systems are extremely vulnerable to damage from a variety of causes, but the resulting breakdown can be prevented by ensuring that these pumps and systems are operated properly. This book provides a total overview of operating centrifugal pumps, including condition monitoring, preventive maintenance, life cycle costs, energy savings and economic aspects. Extra emphasis is given to the potential damage to these pumps and systems, and what can be done to prevent breakdown. Addresses specific issues about pumping of metal chips, sand, abrasive dust and other solids in fluids Emphasis on economic and efficiency aspects of predictive maintenance and condition monitoring Uses life cycle costs (LCC) to evaluate and calculate the costs of pumping systems The Practical Pumping Handbook is a practical account of pumping, piping and seals starting with basics and providing detailed but accessible information on all aspects of the pumping process and what can go wrong with it. Written by an acknowledged expert with years of teaching experience in the practical understanding of pumps and systems. Aids understanding of pumps to minimize failures and time-out A practical handbook covering the basics of the pumping process Written by an acknowledged expert Most HVAC systems are designed to handle the maximum potential temperature extremes, keeping the building cool on the hottest days and warm on the coldest days. As a result, the HVAC system only needs to work at full capacity on the ten or so hottest and coldest days of the year. On the other 345 days, the system could be operated at reduced capacity. HVAC pumps are generally designed for peak conditions and the output of these systems is controlled by mechanically constricting the flow with throttling valves. This wastes energy. By using a variable speed drives, chilled water flows can be matched to actual heating and cooling demands. This 5-hour Quick Book course provides the students with a firm understanding of the basic principles that centrifugal pumps operate under. Topics covered include the performance curve, series operation, parallel operation, the affinity laws, friction, specific gravity & viscosity, suction lift, and NPSH. Learning Objective At the conclusion of this course, the student will: 1. Understand the basic types of pumps used in HVAC applications. 2. Understand

the key fluid properties such as viscosity, density, temperature, specific weight, concentration and vapor pressure. 3. Understand why pump performance is typically rated feet of head and not pressure. 4. Understand the various head terms such as suction lift, static head, discharge head, friction head, velocity head and pressure head. 5. Understand the laws of affinity and illustrate them with a pump operating under VFD control. 6. Understand the pump curve, system curve, operating point and the best efficiency point for the pump operation. 7. Understand the flat, smooth and drooping characteristic curve for the centrifugal pump and the applications for which it is best suited. 8. Understand the importance of specific speed and their relationship to the shape of impeller (radial, mixed or axial). 9. Understand pump cavitation and its relationship to net positive suction head (NPSH) available and required. 10. Understand the various techniques for flow control including throttling, speed adjustment and multi-pump installation considerations in parallel or series arrangement. 11. Learn by example the method to compute the frictional head through the HVAC chilled water system. 12. Define the pumping system efficiency and the tips to achieve the same.

Maintaining the excellent coverage of centrifugal pumps begun in the First Edition -- called "useful" and "indispensable" by reviewers -- the Second Edition continues to serve as the most complete and up-to-date working guide yet written for plant and design engineers involved with centrifugal pumps. All the experience of the research team from one of the world's foremost pump manufacturers - Sulzer, featuring the latest in pump design and construction. Centrifugal and Rotary Pumps offers both professionals and students a concise reference detailing the design, performance, and principles of operation of the different pumps types defined by the Hydraulic Institute. From historical background to the latest trends and technological developments, the author focuses on information with real-world practice.

Troubleshooting Centrifugal Pumps and Their Systems, Second Edition, begins by discussing pump characteristics that can be reconfigured to suit changing conditions. Next, it provides guidance on when to withdraw a pump from service for repair and how it should be subsequently treated. It is an ideal resource for those who feel ill-equipped to analyze unsatisfactory pump system behavior, and is also a great reference for pump engineers, pump hydraulic designers, and graduate students who need systemic knowledge on centrifugal pumps and their systems. Presents the basic mechanisms of abrasive wear in centrifugal pumps, including different wear patterns and their causes. Discusses performance improvements to help readers meet the new requirements of a pumping system. Describes repair and life improvement techniques. Includes real-world examples of troubleshooting in centrifugal pumps and systems.

Pump Wisdom: Essential Centrifugal Pump Knowledge for Operators and Specialists delivers a concise explanation of how pumps function, the design specifications that must be considered before purchasing a pump,

and current best practices in lubrication and mechanical seals. Readers will encounter new startup and surveillance tips for pump operators, as well as repair versus replacement or upgrade considerations for maintenance decision makers, new condition monitoring guidance for centrifugal pumps, and expanded coverage of operator best practices. This latest edition of *Pump Wisdom: Essential Centrifugal Pump Knowledge for Operators and Specialists* includes expanded coverage of areas critical to achieving best-in-class pump reliability, including commonly encountered issues and easy-to-follow instructions for getting centrifugal pumps to operate safely and reliably. This book also provides: Comprehensible and accessible explanations of pump hydraulics Simple explorations of the mechanical aspects of pumps with coverage of bearings, seals, impeller trimming, lubricant application, and more Safety tips and instructions for centrifugal pumps Perfect for chemical, petroleum, and mechanical engineers, *Pump Wisdom: Essential Centrifugal Pump Knowledge for Operators and Specialists* is also an ideal resource for operators, managers, purchasing agents, machinists, reliability technicians, and maintenance workers in water and wastewater plants. Maintaining the excellent coverage of centrifugal pumps begun in the First Edition -- called "useful" and "indispensable" by reviewers -- the Second Edition continues to serve as the most complete and up-to-date working guide yet written for plant and design engineers involved with centrifugal pumps. A survey of leak-free centrifugal and positive displacement pumps -- Properties and design criteria for magnetic drives on pumps -- Zero-leakage pumps equipped with permanent magnetic drive -- Leak-free centrifugal pumps in plastic -- Canned-motor pumps : an important contribution to leakage-free operation -- Standardized chemical pump with canned motor in flameproof enclosures -- Canned motor and magnetic drive systems : a comparison -- Reciprocating metering pumps in leak-free design -- Leakage-free metering of fluids in fully automated processes -- Process diaphragm pumps -- Diaphragm compressors -- Liquid ring vacuum pumps and compressors with magnetic drive -- Leak-proof Roots vacuum pumps. *Pumping Machinery Theory and Practice* comprehensively covers the theoretical foundation and applications of pumping machinery. Key features: Covers characteristics of centrifugal pumps, axial flow pumps and displacement pumps Considers pumping machinery performance and operational-type problems Covers advanced topics in pumping machinery including multiphase flow principles, and two and three-phase flow pumping systems Covers different methods of flow rate control and relevance to machine efficiency and energy consumption Covers different methods of flow rate control and relevance to machine efficiency and energy consumption Specifically for the pump user, this book concentrates on the identification and solution of problems associated with existing centrifugal pumps. It gives specific examples on how to modify pump performance for increased efficiency and better quality control, which turn into long-term cost savings. Some basic theory is included to give the reader greater understanding of the problems

being encountered and attacked. Numerous developments have taken place in centrifugal pumps to transfer liquids for different applications in efficient manner. A safe, cost effective & efficient operation at rated capacity, efficiency and high reliability is the basic requirement of pumps. To meet the objective, the book deals with basic concept of theory added working principle, different type of pump & their application, constructional features, design guide lines & rotor dynamics, selection, erection, trouble diagnosis & remedial actions in abnormal situations. The metallurgical requirements and developments for pump components had been discussed briefly for acquaintance of plant engineers to help in selection &, procurement. Concept of NPSH, specific speed, sealing system and Characteristic curves of pump with the help of graphs, theoretical formulae, sketches and examples may promote understanding in field applications. Operation and Maintenance philosophy is presented to cover wide domain of pumping system The systematic and predictive maintenance programs & their applications are discussed related to centrifugal pumps. A brief out line discussions are presented on electric system involved in pump installation and maintenance. Since, alignment of pump, especially the multi stage pumps with driver (motor or steam turbine) plays a vital role in smooth operation and machine life, author has dealt separately the alignment methods and practices with illustrative practical examples. The book is formatted in the form of Work Book to help the working engineers as reference at any stage of their task performance. Rely on the #1 Guide to Pump Design and Application-- Now Updated with the Latest Technological Breakthroughs Long-established as the leading guide to pump design and application, the Pump Handbook has been fully revised and updated with the latest developments in pump technology. Packed with 1,150 detailed illustrations and written by a team of over 100 internationally renowned pump experts, this vital tool shows you how to select, purchase, install, operate, maintain, and troubleshoot cutting-edge pumps for all types of uses. The Fourth Edition of the Pump Handbook features: State-of-the-art guidance on every aspect of pump theory, design, application, and technology Over 100 internationally renowned contributors SI units used throughout the book New sections on centrifugal pump mechanical performance, flow analysis, bearings, adjustable-speed drives, and application to cryogenic LNG services; completely revised sections on pump theory, mechanical seals, intakes and suction piping, gears, and waterhammer; application to pulp and paper mills Inside This Updated Guide to Pump Technology • Classification and Selection of Pumps • Centrifugal Pumps • Displacement Pumps • Solids Pumping • Pump Sealing • Pump Bearings • Jet Pumps • Materials of Construction • Pump Drivers and Power Transmission • Pump Noise • Pump Systems • Pump Services • Intakes and Suction Piping • Selecting and Purchasing Pumps • Installation, Operation, and Maintenance • Pump Testing • Technical Data Centrifugal Pumps: Design and Application, Second Edition focuses on the design of chemical pumps, composite materials, manufacturing techniques employed in nonmetallic pump

applications, mechanical seals, and hydraulic design. The publication first offers information on the elements of pump design, specific speed and modeling laws, and impeller design. Discussions focus on shape of head capacity curve, pump speed, viscosity, specific gravity, correction for impeller trim, model law, and design suggestions. The book then takes a look at general pump design, volute design, and design of multi-stage casing. The manuscript examines double-suction pumps and side-suction design, net positive suction head, and vertical pumps. Topics include configurations, design features, pump vibration, effect of viscosity, suction piping, high speed pumps, and side suction and suction nozzle layout. The publication also ponders on high speed pumps, double-case pumps, hydraulic power recovery turbines, and shaft design and axial thrust. The book is a valuable source of data for pump designers, students, and rotating equipment engineers. All the experience of the research team from one of the world's foremost pump manufacturers - Sulzer, featuring the latest in pump design and construction.

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