

Contents

Preface xi

Chapter 1. Design	1
Attention to Detail	2
Design Activities	3
Engineers/Designers	5
Engineering/Design	5
Unification of Process and Environmental Objectives	6
Origins of This Book	9
Understanding This Book	12
Chapter 2. Quality (and Productivity)	15
Introduction	15
The Deming Way	18
Deming's 14 Points	19
Importance of Engineering/Design	23
Realities	24
Control	25
Leadership	27
Leader or Lackey?	33
Knowledge	34
Cause of Lack of Knowledge	38
Chapter 3. For Company Executives	39
Reinvestment of Earnings	39
Early Executive Tasks	40
Overstepping Bounds	41
Owner's Project Team	- 41
Early Funding	42
Policy regarding Vendors	•43
Funds for Vendors	43
Economic Evaluation Criteria	44
Flexible Bid Analyses More Duties	45 46
More Duties	40
Chapter 4. Priorities	47
Chapter 5. Cost and Schedule	51
Schedule—Some Introductory Ideas	51
Basic Concepts	53
Sequence	55
Resources	57
Cash Flow	59
Reasonable Things	60
Methods	61
Estimates	66
Estimate Accuracy	69
Contingency	71
Economics	71
Chapter 6. Project Organization	77

Chapter 7. Problem Solving	85
Background	85
Break into Parts	85
Find Governing Rules	85
Acquire Data	86
Compute	86
Check the Results	86
Helpful Hints	87
Why Problems Persist	87
Chapter 8. The Mass Balance	89
Background	89
Product Specification and Process Result	92
Physical Reality	92
Problem-Solving Aids	94
A Crystallizer-Centrifuge Combination	98 100
Disciplined Approach	100
Chapter 9. Preparation for Understanding Equipment	103
Required Capacity	107
Seals	109
Dynamic Seals	112
Bearings	115 120
Electric Motors and Electric Controls	120
The Bernoulli Equation Granular Solids	130
Granular Solids	134
Chapter 10. Equipment Examples	147
Centrifugal Pumps	147
Hoods. Ducts, and Fans	157
Bins	166
A Final Example concerning Solids	171
Valves	173
Chapter 11. P&IDs	177
Overview	177
P&ID Symbols	185
Conventions	193
Development	197
Information on P&IDs	210
Construction-Grade P&ID	212
Chapter 12. Procurement	223
Introduction	223
Subcontracts	224
Specifications	226
The Procurement Process	229
Bid Analysis	230
A Final Reminder	234
Chapter 13. Hiring the Engineers	235
Job Definition	235
Scope and Basis	236
Obtaining Engineering Services	238
-	

viii Contents

я

Chapter 14. Paper	243
Files and Filing	243
Information Flow	246
Document Schedule	253
The Need for Vendor Data	255
Acquisition of Vendor Data	259
Handling of Vendor Data	260
Last Comments	263

References 265

- Appendix A. Sample Proposal Letter, Scope of Work, and Basic Data 267
- Appendix B. Procedure for Handling Vendor Documents 279
- Appendix C. Forms Used during Project Work 293
- Appendix D. Instrument Society of America Symbols 319
- Appendix E. Useful Dimensional Formulas 323
- Appendix F. Flow Sheet Symbols 327
- Appendix G. Phosphoric Acid Data Sheet (Product Specification) 331
- Appendix H. Sample of Equipment Specification 335
- Appendix I. Text of Article Published in Engineering Times 349
- Appendix J. Personal Files 353
- Appendix K. Definition of ±10 Percent Estimate according to One Major Chemical Company **359**
- Index 361