

# Richardson Process Plant Estimating Standards Table of Contents

D	h	_	$\sim$	νc
к	П	()	()	кч

Volume Index

Alphabetical Index

# **General Conditions**

- 1-1 General Notes and Instructions
- 1-2 Estimating Direct and Indirect Costs
- 1-6 Schedule Preparation
- 1-10 Square Foot and Parametric Estimating
- 1-20 Cranes and Hoisting Equipment
- 1-30 Rental Equipment
- 1-40 Scaffolding and Shoring
- 1-50 Testing and Quality Assurance
- 1-60 Architectural & Engineering Services
- 1-70 Weather and Seismic Maps
- 1-80 Mensuration
- 1-90 Metrication, The International System of Units (SI)
- 1-100 Abbreviations
- 1-110 Glossary of Cost Estimating Terms
- 1-120 Technical Directory

## Site Work

# Site Clearing

- 2-1 Clearing and Grubbing
- 2-2 Topsoil Stripping, Stock Piling and Replacing

# Site Grading, Filling And Compacting

- 2-3 Calculating Quantities for Site Grading
- 2-4 Site Grading, Filling and Compacting Cat D4E Series 111 Bulldozers
- 2-5 Site Grading, Filling and Compacting Elevating Scrapers
- 2-6 Site Grading, Filling and Compacting Cat 631E & 651E Standard Scrapers
- 2-7 Elevated Fills for Buildings
- 2-9 Dewatering And Shoring

# Structural Excavation And Backfill

- 2-12 Calculating Quantities of Structural Excavations
- 2-13 Structural Excavation and Backfill by Hand
- 2-14 Structural Excavation Case 580 Loader-Backhoe
- 2-15 Structural Excavation Cat 225 Backhoe
- 2-16 Structural Excavation Cat 235 Backhoe
- 2-17 Structural Excavation Cleveland 7036 Trencher
- 2-18 Structural Excavation Using Cat Wheel Loaders

2-19 Structural Excavation - Rock 2-20 Loading Loose Materials - Cat Wheel Loaders 2-21 Structural Backfill and Compaction 2-22 Trench Excavation - Case 30+4 Trencher 2-23 Dump Truck Hauling and Dump Charges 2-24 Slope Protection and Brow Ditches Using Air Blown Mortar **Foundation Piling** 2-25 Wood Piling 2-27 Steel "H" Piling 2-28 Precast Concrete Piling 2-29 Drilled Foundations Site Drainage 2-30 Polyvinyl Chloride Gravity Sewer Pipe 2-32 Cast Iron Soil Pipe 2-33 Concrete Drainage Pipe 2-34 Corrugated Metal Pipe 2-35 Vitrified Clay Pipe 2-36 Concrete Drainage Structures Site Water Supply 2-37 Polyvinyl Chloride Pressure Pipe 2-38 High Density Polyethylene Pressure Pipe (HDPE) 2-39 Ductile Iron Pressure Pipe 2-40 A W W A Waterworks Valves and Hydrants 2-41 Flexible Transition Couplings 2-42 Cement Mortar Lining of Pipelines in Place Site Improvements 2-43 Asphalt Concrete Paving and Base Materials 2-44 Portland Cement Concrete Paving 2-45 Curbs, Curbs and Gutters, and Cross Gutters 2-46 Portland Cement Concrete Walks, Steps and Pads 2-47 Chain Link Fencing 2-48 Landscaping 2-49 Railroad Sidings 2-51 Flagpoles, Pipe Bumpers and Metal Guard Railing 2-60 Dike Construction 2-62 Gabions and Reno Mattresses 2-65 High Density Polyethylene (HDPE) Liners 2-100 Demolition and Removals 2-101 Asbestos Abatement

#### Concrete

# **Footings**

3-1 Continuous Wall Footings and Grade Beams

3-2 Continuous Footings with Integral Stem Walls 3-3 Square Footings Slabs On Grade 3-5 Slabs on Grade 3-6 Structural Mats on Grade Columns 3-7 Round Columns and Piers Using Regular Sonoco Sonotubes 3-8 Round Columns and Piers Using Light Sonoco Sonotubes 3-9 Square Columns and Piers Walls 3-10 Concrete Walls - Gang Formed 3-11 Curved Concrete Walls - Gang Formed 3-12 Concrete Walls - Single Waler System 3-13 Curved Concrete Walls - Single Waler System Slabs, Elevated 3-15 One and Two Way Solid Slabs and Beams 3-16 One Way Pan-Joist 3-17 Two Way Pan-Joist Waffle Slabs 3-18 Flat Plates and Flat Slabs 3-19 Domed Concrete Tank Covers Decks 3-20 Concrete Fills on Floor and Roof Decks 3-21 Insulating Fills on Floor and Roof Decks 3-22 Concrete Stairways 3-24 Tilt-Up Concrete Walls **Prestressed Concrete** 3-25 Post-Tensioned Prestressed Concrete 3-27 Plant Produced Pretensioned Prestressed Concrete 3-29 Pile Caps and Tie Beams 3-30 Grouting Structural Steel Column Base Plates 3-50 Process Equipment Foundations 3-100 Miscellaneous Concrete Items 3-101 Concrete Embossing Masonry 4-1 Concrete Block Masonry 4-2 Brick Masonry 4-3 Concrete Block Masonry - IMSI® Insulated Block Wall 4-4 Natural Stone Masonry 4-5 Acid Brick Tile Floors 4-6 Brick floors And Stairways

Masonry

Richardson Rapid System Estimates

- 4-61 Hollow Unit Masonry Walls
- 4-62 Solid Unit Masonry Walls
- 4-70 Veneer and Composite Brick-Block Walls Rapid Estimating System
- 4-100 Miscellaneous Masonry Items

#### Structural Steel

#### Structural And Miscellaneous Steel

- 5-1 Ledger Angles
- 5-2 Round And Square Structural Steel Tube Columns
- 5-3 Structural Steel For Buildings And Structures
- 5-4 Open Web Steel Joists
- 5-5 Steel Trusses
- 5-6 Tapered Steel Girders
- 5-7 Steel Floor And Roof Decks
- 5-8 Miscellaneous Metals For Buildings
- 5-9 Gratings And Stair Treads, (Aluminum, Fiberglass And Steel)
- 5-10 Miscellaneous Steel Items, (Anchors, Brackets, Inserts And Unistrut Channel And Fittings)
- 5-11 Process Plant Platforms, Ladders And Handrails
- 5-12 Pipe Supports And Pipe Racks
- 5-13 Overhead Condenser Supports
- 5-14 Manhours for Carbon Steel Welding

# Richardson Rapid System Estimates

- 5-50 Structural Steel Framing For Single Story Buildings
- 5-60 Structural Steel Framing For Multistory Buildings
- 5-70 Pre-Engineered Metal Buildings
- 5-71 Modular Relocatable Structures

# Carpentry

# **Rough Carpentry**

- 6-1 Sills And Ledgers
- 6-2 Interior Wood Partitions
- 6-3 Wood Wall And Partition Framing
- 6-4 Columns And Posts
- 6-5 Floor Or Flat Roof Joists
- 6-6 Built Up Girders And Headers
- 6-7 Glued Laminated Beams
- 6-8 Gang Nail Trusses And Pitched Roof Framing
- 6-10 Board Sheathing On Pitched Roofs
- 6-11 Plywood Sheathing
- 6-15 Particle Board And Hardboard Underlayment
- 6-16 Plank Flooring
- 6-17 Laminated Wood Floors On Edge
- 6-18 Roof Decking

# **Finish Carpentry**

- 6-20 Sidings, Wood, Plywood, Hardboard
- 6-21 Solid Wood Paneling
- 6-24 Hardboard Wallboards
- 6-25 Custom Prefinished Paneling
- 6-26 Wood Trim
- 6-28 Prefinished Custom Cabinets and Countertops

# **Richardson Rapid System Estimates**

6-60 Wood Framing Systems - Rapid Estimating Method

#### **Moisture Protection**

# **Moisture Protection**

- 7-1 Building Paper and Vapor Barrier
- 7-2 Moisture Barriers and Pargeting
- 7-3 Building Insulation
- 7-4 Built-Up Roofing
- 7-5 Roll, Shingle, Shake, Tile and Elastomeric Roofing
- 7-6 Single Ply Roofing
- 7-7 Preformed Metal Roofing and Siding
- 7-8 Sheet Metal Roofing on Pitched Roofs
- 7-9 Flashing and Sheet Metal
- 7-11 Roof Hatches and Heat & Smoke Vents
- 7-12 Skylights
- 7-13 Caulks and Sealants
- 7-14 Firestop Compounds

#### **Doors and Windows**

## **Access Doors**

8-1 Steel Access Doors

#### **Door Frames**

- 8-2 Steel Door Frames
- 8-3 Wood Door Frames

# Doors, Swing

- 8-4 Hollow Metal Doors
- 8-5 Wood Doors
- 8-6 Fiberglass Faced Entrance Doors
- 8-7 Entrance Doors
- 8-8 Laminated Plastic Clad Doors
- 8-9 Builders Hardware
- 8-10 Prehung Doors

# Doors, Folding

- 8-11 Wood Folding Doors
- 8-12 Folding and Bypass Closet Doors

# Doors, Sliding

8-14 Aluminum Framed Sliding Glass Doors8-15 Aluminum Framed Mirrored Closet Doors

8-16 Sliding Wood Framed Doors Doors, Overhead 8-17 Roll-Up and Sectional Overhead Doors 8-18 Garage Doors Windows 8-19 Wood Window Units 8-20 Sliding Aluminum Windows 8-30 Fixed Glazing 8-31 Aluminum Framed Entrance Doors and Storefronts 8-32 Aluminum and Steel Window Walls and Curtain Walls **Finishes** Walls 9-1 Non-Bearing Steel Studs and Suspended Furring For Gypsum Wallboard (Drywall) 9-2 Load-Bearing Steel Stud Walls 9-3 Gypsum Wallboard (Drywall) 9-4 Metal Furring, Lath and Plaster Interior and Exterior 9-5 Fireproofing of Structural Steel 9-7 Dryvit® Outsulation® System 9-10 Acoustical and Integrated Ceiling **Flooring** 9-11 Ceramic Tile, Quarry Tile and Terrazzo 9-12 Hardwood Floors 9-13 Seamless Floors and Wainscoting 9-14 Resilient Flooring 9-15 Carpet Floor Covering **Coating And Covering** 9-20 Painting 9-21 Surface Preparation and Protective Coatings for Metal Surfaces 9-22 Vacuum Blasting Surface Preparation for Metal Surfaces 9-30 Wall Coverings **Richardson Rapid System Estimates** 9-60 Steel Framing Systems - Rapid Estimating System **Specialties Partitions** 10-1 Gypsum Partitions and Shaft Walls 10-2 Laminated Partitions 10-3 Toilet Partitions and Toilet Room Accessories 10-4 Wire Mesh Partitions 10-5 Vinyl Fabric and Vinyl-Clad Folding Partitions

- 10-6 Portable Partitions
- 10-7 Operable Walls

# **Specialties**

- 10-10 Access Floor Systems
- 10-15 Metal Lockers
- 10-16 Linen/Trash Chutes and Compactors
- 10-17 Air Curtains

# Lifts, Elevators And Escalators

- 10-18 Hydraulic Dock Levelers, Lifts, Shelters and Bumpers
- 10-20 Dumbwaiters and Elevators
- 10-21 Moving Walkways and Escalators

#### Mechanical

# Air Conditioning, Heating And Ventilating

- 15-1 Water Chillers
- 15-2 Cooling Towers For Water Chillers
- 15-3 Pumps For Water Chillers
- 15-4 Heating And Cooling Units Roof Mounted And Through The Wall

Type

- 15-5 Unit Heaters And Forced Air Furnace/Cooling Units
- 15-6 Boilers, Circulating Booster Pumps And Convectors
- 15-7 Tanks, Tank Heaters And Instantaneous Heaters
- 15-8 Air Handling Units
- 15-9 Ductwork And Accessories
- 15-10 Insulation For HVAC Equipment And Ductwork
- 15-11 Air Conditioning Control Systems
- 15-12 Air Balancing

# **Plumbing Fixtures**

- 15-14 Water Closets
- 15-15 Lavatories
- 15-16 Urinals
- 15-17 Bathtubs
- 15-18 Integral Bathtub/Shower And Wall Surrounds
- 15-19 Kitchen Sinks And Garbage Disposal Units
- 15-20 Service Sinks
- 15-21 Wash Sinks
- 15-22 Wash Fountains
- 15-23 Emergency Showers And Eye-Wash Fountains
- 15-24 Drinking Water Fountains
- 15-25 Floor Drains
- 15-26 Floor Sinks
- 15-27 Interceptors, Separators And Backwater Valves
- 15-28 Water Heaters

- 15-29 Vent Through Roof And Clean Outs
- 15-30 Plumbing Fixtures Rapid Estimating System
- 15-31 Roof Drains And Rain Leaders

#### Service Piping

- 15-34 A120/A53-F-A Carbon Steel Pipe Threaded and Coupled
- 15-35 Copper Piping Systems
- 15-36 Red Brass Piping Systems
- 15-37 Cast Iron Drain, Waste and Vent Piping Systems
- 15-38 Victaulic® Pressfit® Carbon Steel Piping Systems
- 15-39 Victaulic® Pressfit® Type 316 Stainless Steel Piping System
- 15-40 Grooved End A-106 Carbon Steel Piping Systems
- 15-130 CPVC Plastic Piping Systems
- 15-133 Polypropylene Drain, Waste and Vent Piping Systems
- 15-136 PVC Drain, Waste and Vent Piping Systems
- 15-139 ABS Drain, Waste and Vent Piping Systems

#### **Process And Steam Piping**

- 15-41 Flanged Cast Iron Cement Lined Piping Systems
- 15-42 Threaded A106B/A53-S-B Seamless Carbon Steel Pipe
- 15-43 A106B/A53-S-B Seamless Carbon Steel Pipe Field Fabricated
- 15-44 Spooled A106B/A53-S-B Seamless Carbon Steel Pipe Shop
- Fabricated
  15-45 Large Diameter A106B/A53-S-B Seamless Carbon Steel Pipe Field
- 15-46 Aluminum Piping Systems

**Fabricated** 

- 15-47 Stainless Steel Piping Systems
- 15-48 Flanged Plastic Lined Piping Systems
- 15-145 PVDF (Kynar) Plastic Piping Systems
- 15-147 Fiberglass Reinforced Piping Systems (RTRP)
- 15-150 High Density Polyethylene (HDPE) Compressed Air Service Piping
- 15-49 Self Contained Regulating Valves And Back Flow Preventers

# Instruments

- 15-50 Control Valves.
- 15-52 Liquid Level And Pressure Gauges.
- 15-53 Tank Level Gauging Devices.
- 15-54 Measurement Elements.
- 15-55 Safety Relief Valves.
- 15-56 Flow Instruments, Pneumatic And Electronic, Local Mounted.
- 15-57 Liquid Level Instruments, Pneumatic And Electronic, Local Mounted .
- 15-58 Pressure Instruments, Pneumatic And Electronic, Local Mounted.
- 15-59 Temperature Instruments, Pneumatic And Electronic, Local Mounted .
- 15-62 Distributed Control Systems (DCS).

- 15-63 Honeywell Instruments.
- 15-64 Instrument Control Panels And Instruments.
- 15-65 Control Panel Installation.
- 15-66 Instrument Piping.
- 15-67 Piping Assemblies For Liquid Level Instruments.
- 15-68 Stainless Steel Tubing Systems.

# **Piping Specialties**

- 15-69 Expansion Joints And Flexible Pump Connectors.
- 15-70 Steam Tracing.
- 15-71 Steam Traps And Strainers.
- 15-72 Bolts And Gaskets.
- 15-73 Sample Coolers.
- 15-74 Hot Taps.
- 15-75 X-Ray Of Buttwelds.
- 15-76 Pipe Hangers And Supports.
- 15-78 Cement Mortar Lining And Coating Of Carbon Steel Pipe.
- 15-79 Fire Hose Racks, Fire Extinguishers And Accessories.

#### Mechanical Insulation

- 15-80 Fiberglass Insulation On Hot And Cold Service Piping.
- 15-81 Urethane or Polystyrene Insulation On Cold Process Piping And Process Equipment .
- 15-82 Calcium Silicate Insulation On Hot Process Piping And Process Equipment .
- 15-83 FOAMGLAS® Insulation.
- 15-84 KOOLPHEN® K Phenolic Foam Insulation.

# Richardson Rapid Estimating System

15-90 Steam Trap Assemblies.

# **Total Installed Costs - Preliminary Estimates**

- 15-101 Air Conditioning, Heating And Ventilating Systems Installed Costs.
- 15-104 Plumbing Fixtures Total Installed Costs.
- 15-105 Fire Protection Systems Total Installed Costs .

# Electrical

# Conduit, Duct, Cable Trays And Wireway Gutter

- 16-1 Galvanized Rigid Steel Conduit Systems
- 16-2 PVC Coated Galvanized Rigid Steel Conduit Systems
- 16-3 Rigid Aluminum Conduit Systems
- 16-4 Electrical Metallic Tubing (EMT) Thinwall Conduit Systems
- 16-5 PVC Plastic Rigid Conduit Systems
- 16-6 Underground Plastic Utility Duct Systems
- 16-7 Sealtite Conduit Systems
- 16-8 Cable Tray and Accessories
- 16-9 Wireway Gutter and Accessories

16-10 Steel Underfloor Duct Systems

16-11 Service Entrance Caps, Ells, Capped Ells, and Ground Rods Hazardous Area Electrical Fittings 16-15 Hazardous Area Elbows, Pulling Ells, Unions, Flexible Couplings 16-16 Junction Boxes, Sealing Fittings, Drains and Breathers 16-19 Conduit Hangers And Supports Wire And Cable - Terminations - Splices 16-20 Wire and Cable 16-22 Armored/Metal Clad Cable 16-23 Armored Flexible Cable (BX) and Terminations 16-24 Electronic Instrument Wire and Cable 16-25 Armored Electronic Instrument Cable 16-26 Thermocouple Extension Wire and Cable 16-27 Armored Thermocouple Cable 16-28 Non-Metallic Sheathed Cable (ROMEX) and Terminations 16-33 Enclosures And Junction Boxes Bus Duct, Trolley Duct 16-35 Feeder Bus Duct and Accessories 16-36 Plug-In Bus Duct and Accessories 16-37 Trolley Duct and Accessories Transformers, Switchgear, Switchboards 16-40 Metal Clad Switchgear 16-41 Service Entrance and Distribution Switchboards 16-42 Transformers Panelboards, Switches, Circuit Breakers, Motor Starters 16-43 Circuit Breaker Distribution Panelboards 16-44 Panelboards/Loadcenters/Sub-Panels - General Purpose 16-45 Panelboards/Loadcenters/Sub-Panels in Hazardous Areas 16-46 Safety Switches 16-47 Circuit Breakers 16-48 Motor Starters 16-49 Meter Panels Motor Control Centers, Control Stations 16-52 Motor Control Centers 16-53 Control Stations (Pushbuttons and Pilot Lights) 16-54 Terminal Blocks 16-55 Ground Fault Protection System 16-56 Convenience Outlets And Toggle Switches **Lighting Fixtures** 16-60 Lighting Fixtures General Purpose 16-62 Lighting Fixtures Vaportight and Explosion Proof 16-63 Outdoor Floodlights and Floodlight Poles

# Miscellaneous

- 16-70 Audible Signal Devices Explosion Proof
- 16-75 Grounding Systems
- 16-77 Power Line Poles and Power Line Transmission Wire

# **Piping System Protection**

16-80 Electric Heat Tracing Systems

#### Richardson Rapid System Estimates

- 16-90 Circuit Feeders Rapid Estimating System
- 16-91 Branch Circuits With Convenience Outlets Rapid Estimating System
- 16-92 Branch Circuits With Toggle Switches Rapid Estimating System
- 16-93 Branch Circuits For Lighting Rapid Estimating System
- 16-94 480 Volt Motor Feeders Rapid Estimating System
- 16-95 Flexible Conduit Connections At Electric Motors

# **Total Installed Costs - Preliminary Estimates**

- 16-101 Electrical Systems For HVAC Total Installed Costs
- 16-102 Electrical Wiring And Fixtures Total Installed Costs
- 16-103 Radiant Heat Cable Total Installed Costs

# **Process Equipment**

# **Belt Conveyors And Bucket Elevators**

- 100-1 Troughed Belt Conveyors
- 100-2 Bucket Elevators
- 100-3 Screw Conveyors
- 100-4 Tube-Flo Conveyors
- 100-5 Multi-Flo Conveyors

## Size Reduction Equipment

- 100-18 Twin Rotor Impactors
- 100-20 Ring-Type Granulators
- 100-21 Gravity Impact Crushers
- 100-22 Hammermills
- 100-24 Reversible Impactors
- 100-25 Single Roll Crushers
- 100-26 Single Roll Frozen Coal Crackers

# **Dry Material Feeders**

- 100-35 Bin Activators
- 100-40 Vibrating Feeders
- 100-45 Gravimetric Feeders
- 100-50 Volumetric Feeders
- 100-55 Wing-Type And Conveyor-Type Feeders
- 100-60 Pre-Wetting Dry Chemical Feeders

# Screens And Classification Equipment

100-65 Vibrating Screens

100-70 Full-Flow Rectangular Separator

```
100-72 Centrifugal Sifter
                   100-75 Pressure Sifters
                   100-80 Rotary Screens
                   100-85 Turbo-Screen Classifiers
Dry Material Agitators, Blenders, Mixers
                   100-90 Vibrating Packers
                   100-110 Industrial Fans
                   100-111 Positive Displacement Air Blowers
Dust Collection Equipment
                   100-115 Gas Scrubbers
                   100-120 Cyclone Collectors
                   100-121 Centrifugal Scrubbers
                   100-122 Filter Cartridge Dust Collectors
                   100-123 Bag House Dust Collectors
                    100-124 Feeder Valves
Liquid And Liquid Solid Agitators, Blenders, Mixers
                   100-130 Portable Mixers
                   100-131 Gearmotor Mixers
                   100-132 High Speed Dispersion Mixers
                   100-135 Chemical Mixer/Feeder Packaged Units
                   100-136 Liquid Polymer Blender
                   100-140 Pipeline Homogenizer-Mixers
                   100-145 Batch Homogenizer-Mixers
                   100-155 Rotary Flask Agitators
Filters And Liquid Solid Separation Equipment
                   100-165 Liquid Clarifiers
                   100-170 Vibrating Separators
                   100-171 Lab Separators
                   100-180 Rubber Lined Filters
                   100-185 Vane-Type Separators
Dryers And Flakers
                   100-190 Drum Dryers
                   100-191 Rotary Vacuum Dryers
                   100-195 Conical Rotating Vacuum Dryers
                   100-198 Cooling Drum Flakers
Boilers, Feedwater Heaters, Fired Heaters And Tank Heating Coils
                   100-200 Packaged Boilers
                   100-203 Deaerating Feedwater Heaters
                   100-205 Steel Stacks For Boilers
                   100-211 Tank Heating Coils
                   100-212 Fired Tank Immersion Heaters
```

Heat Exchangers, Fuel Oil Heaters, Evaporators, Condensers, Coolers 100-213 Fuel Oil Heaters 100-214 Hairpin Type Heat Exchangers 100-215 Heat Exchangers For Heating Water 100-220 TEMA R Shell And Tube Heat Exchangers 100-230 Vertical Tube Surface Condensers and Receivers 100-235 Acid Coolers 100-240 Process Plant Cooling Towers 100-245 Inert Gas Generators Air And Gas Compressors, Pulsation Dampeners And Air Dryers 100-250 Reciprocating Air Compressors 100-251 Rotary Screw Air Compressors 100-252 Breathable Air Compressors 100-255 Centrifugal Air Compressors 100-260 Integral Gas Engine Compressors 100-266 Air Receivers/Gas Pulsation Dampeners 100-270 Refrigerated Air Dryers 100-271 Chiller Air Dryers 100-275 Air Dryers, Desiccant Type, 2 To 50 SCFM 100-276 Air Dryers, Desiccant Type, 50 To 1600 SCFM 100-277 Air Dryers, Desiccant Type, 1900 To 9600 SCFM 100-279 Air Dryer Prefilters, Afterfilters And Automatic Drain Valves **Pumps** 100-280 Centrifugal Pumps, Single Stage, Vertical Split Case 100-281 Centrifugal Pumps, Single Stage, Horizontal Split Case 100-282 Centrifugal Pumps, Single Stage, ANSI 100-283 Centrifugal Pumps, Single Stage, API 610 100-284 Centrifugal Pumps, Two Stage, Horizontal Split Case 100-285 Centrifugal Pumps, Multi-Stage, Radially Split Case 100-286 Centrifugal Pumps, Single Stage, In-Line 100-287 Centrifugal Pumps, Single Stage, In-Line, API 610 100-290 Turbine Pumps, Vertical, Single And Multi-Stage 100-293 Sump Pumps 100-295 Plunger Pumps 100-305 Sewage Pumps, Horizontal 100-306 Sewage Pumps, Vertical 100-310 Chemical Metering Pumps 100-315 Surge Suppressors Vacuum Pumps And Accessories 100-320 High Vacuum Pumps 100-321 Two-Stage Mechanical Vacuum Pumps

100-322 Multi-Stage Mechanical Booster Vacuum Pumps

100-323 Vacuum Booster Pumps 100-324 Hot Vacuum Pumps 100-325 Rotary Vane Vacuum Pumps 100-330 Vacuum Pump Accessories 100-338 Ejectors Asme Section Viii Pressure Vessels - Pressure Vessel Fabrication 100-341 Instructions for Using Pressure Vessel Fabrication Data 100-342 ASME Section VIII Pressure Vessel Shells & SE Heads 100-343 Wear Plates & Saddles For Horizontal Vessels 100-344 Angle Legs For Vertical Vessels 100-345 Skirts For Vertical Vessels 100-346 Coupling Nozzles 100-347 Buttweld Flange Type Nozzles 100-348 Long Weld Neck Type Nozzles 100-349 Nozzle Extensions And Internal Piping 100-350 Drip Legs 100-351 Baffles, Draw-Off Boxes, Vortex Breakers And Ladder Rungs 100-352 Tray Rings For Removable Trays 100-353 Shop Installation Of Trays In Columns 100-354 Shop Installation Of Demisting Pads 100-355 Insulation Supports And Vacuum Stiffeners 100-356 Ladder, Platform And Pipe Support Clips, Lifting Lugs And Davits 100-357 Stress Relief 100-358 Shop Costs, Engineering And Administrative Costs 100-359 Removable Type Trays 100-360 Demisting Pads 100-362 Installation of Pressure Vessels 100-365 Propane Storage Tanks, ASME 250 PSI 100-366 ASME Spheres 100-367 Glass Lined Reactors **Storage Tanks** 100-370 API Cone Roof Storage Tanks 100-371 API Floating Roof Storage Tanks 100-373 Concrete Silos 100-374 Hot Process Water Softener Systems 100-377 Gravity Filtration Units 100-380 High Speed Mechanical Surface Aerators 100-382 Floating Spray Coolers **Waste Treating Equipment** 100-390 Comminutors 100-402 Wastewater Stationary Screening

100-405 Wastewater Clarifier/Interceptors

100-406 Clarifier-Reactivators 100-420 Wastewater Chlorinators 100-421 High Capacity Chlorinators and Sulfonators 100-425 API Type Oil/Water Separators 100-426 Oil/Water Coalescer 100-427 Coalescing Filters 100-430 Oil Skimmers 100-431 Sludge Level Control Systems 100-432 Sludge Density Controllers Pollution Detection, Monitoring And Measuring Equipment 100-452 Nitric Oxide Analyzers 100-454 Hydrocarbon Analyzers 100-461 Automatic Liquid Samplers 100-485 Infrared Analyzers 100-486 Density Measuring Systems Hoist, Overhead Type 100-490 Electric Hoists 100-495 Overhead Traveling Bridge Cranes Scales 100-500 Motor Truck Scales 100-501 Railroad Track Scales 100-502 Tank And Hopper Scales 100-503 Self Contained Low Profile Platform Scales 100-504 Bench And Portable Scales 100-600 Generator Sets **Electric Motors** 100-652 Small Motors 100-653 Medium Size Motors 100-654 Large AC Motors **Gearing Products and Couplings** 100-656 Gearing Products 100-658 Horizontal Gearmotors 100-659 Concentric Shaft Speed Reducers 100-660 Flexible Couplings 100-680 Steam Turbines 100-690 Shaft Alignment Freight 100-700 Freight Rates For Process Equipment