



2020 NATIONAL PLUMBING & HVAC ESTIMATOR

By James A. Thomson

Includes inside the back cover:



Inside the back cover of this book you'll find a software download certificate. To access the download, follow the instructions printed there. The download includes the National Estimator, an easy to-use estimating program with all the cost estimates in this book. The software will run on PCs using Windows XP, Vista, 7, 8, or 10 operating systems.

Quarterly price updates on the Web are free and automatic all during 2020. You'll be prompted when it's time to collect the next update. A connection to the Web is required.

Download all of Craftsman's most popular costbooks for one low price with the Craftsman Site License. <http://CraftsmanSiteLicense.com>



- Turn your estimate into a bid.
- Turn your bid into a contract.
- ConstructionContractWriter.com



Craftsman Book Company

6058 Corte del Cedro, Carlsbad, CA 92011

Acknowledgments

The sample "Standard Form Subcontract" and "Subcontract Change Order" forms used in the final section of this book are reprinted with the permission of the publisher, the Associated General Contractors of America (National Office), 1957 E Street NW, Washington, District of Columbia 20006.

Looking for other construction reference manuals?

Craftsman has the books to fill your needs. **Call toll-free 1-800-829-8123**

Visit our Web site: <http://www.craftsman-book.com>

Online Preview

Cover design by: *Jennifer Johnson*

Photos: *iStock by Getty Images™*

© 2019 Craftsman Book Company

ISBN 978-1-57218-358-2

Published September 2019 for the year 2020.


Contents

How to Use This Book	5	Fire Protection Equipment	174
Plumbing Equipment		Fire Protection Sprinkler Pipe and Fittings (Roll Grooved).....	176
Domestic Hot Water Heaters	19	Fire Protection Branch Pipe & Fittings.....	180
Water Softeners	22	Fire Protection Sprinkler Pipe and Fittings (CPVC)	183
Kitchen Equipment.....	25	HVAC Equipment	
Kitchen Equipment Connections.....	26	Commercial Boilers.....	185
Plumbing Fixtures	27	Commercial Boiler Connections.....	190
Plumbing Fixture Rough-In	31	Commercial Boiler Components and Accessories.....	192
Piping Systems		Centrifugal Pumps and Pump Connections.....	206
Copper Pipe, Type K with Brazed Joints	33	Heat Exchangers and Connections	207
Copper Pipe, Type K with Soft-Soldered Joints ...	43	Fan Coil Units and Connections	208
Copper Pipe, Type L with Brazed Joints	53	Reheat Coils and Connections	209
Copper Pipe, Type L with Soft-Soldered Joints....	61	Unit Heaters and Connections.....	210
Copper Pipe, Type M with Brazed Joints	70	Chillers and Chiller Connections.....	211
Copper Pipe, Type M with Soft-Soldered Joints... 78		Condensing Units and Cooling Towers	212
Copper, Pressfit	86	Cooling Towers and Cooling Tower Connections	213
Copper Pipe, Type K & L with Roll Grooved Joints	89	Steel Piping Systems	
PVC, Schedule 40, with Solvent-Weld Joints.....	91	Carbon Steel, Schedule 40 with 150# Fittings & Butt-Welded Joints.....	214
PVC, Schedule 80, with Solvent-Weld Joints.....	101	Carbon Steel, Schedule 40 with 150# M.I. Fittings & Threaded Joints.....	223
Polyethylene-Aluminum Pipe with Crimped Joints.....	111	Carbon Steel, Schedule 5 with Pressfit Fittings.....	234
Polyethylene-Aluminum Pipe with Compression Joints	116	Carbon Steel, Schedule 80 with 300# Fittings & Butt-Welded Joints.....	237
Plumbing and Piping Specialties	119	Carbon Steel, Schedule 80 with 300# M.I. Fittings & Threaded Joints.....	247
Cast Iron, DWV, Service Weight, No-Hub with Coupled Joints.....	135	Carbon Steel, Schedule 160 with 3,000-6,000# Fittings	255
Cast Iron, DWV, Service Weight, Hub & Spigot with Gasketed Joints	141	Carbon Steel, Schedule 40 with Roll-Grooved Joints.....	266
Copper, DWV, with Soft-Soldered Joints.....	146	Carbon Steel, Schedule 10 with Roll-Grooved Joints.....	273
ABS, DWV with Solvent-Weld Joints	150	Carbon Steel, Schedule 40 with Cut-Grooved Joints	280
PVC, DWV with Solvent-Weld Joints	154	Residential HVAC Assemblies	286
PVC, DWV with Gasketed Bell and Spigot Joints.....	159	Air Handling Unit Accessories	290
Polypropylene, Schedule 40, with Heat-Fused Joints.....	164		
Floor, Area, Roof and Planter Drains	168		
Cleanouts	169		
Fire Protection			
Fire Protection Sprinklers.....	170		

Heat Recovery Ventilators - Commercial.....	291	Fiberglass Pipe Insulation.....	397
Heat Recovery Ventilators - Residential.....	292	Calcium Silicate Pipe Insulation with Aluminum Jacket.....	399
Water Coil Piping	294	Closed Cell Elastomeric Pipe Insulation	400
Air Handling Unit Coil Connections.....	297	Thermal Duct Insulation	401
Gas-Fired Furnaces.....	299	Balancing of HVAC Systems	402
Energy Recovery Systems, Enthalpy.....	301	Temperature Controls.....	405
Unit Heaters	302	Ductile Iron Pipe Systems	
Infrared Heaters.....	304	Ductile Iron, Class 153, Cement-Lined with Mechanical Joints.....	407
Heat Pump Systems.....	305	Ductile Iron, Class 153, Double Cement-Lined with Mechanical Joints.....	409
Water Pump Systems	313	Ductile Iron, Class 110, Cement-Lined with Mechanical Joints.....	411
Geothermal/Domestic Water Wells.....	316	Cast Iron, Class 150 with Mechanical Joints ...	412
Biomass-Fired Boilers	319	Asbestos-Cement, Class 2400 or 3000 with Mechanical Joints	413
Fans and Blowers	324	Fiberglass Tanks	415
Ventilators & Residential Exhaust Fans	326	Plastic Tanks	416
Apparatus Housing	331	Trenching	418
Air Devices, Registers & Grilles	333	Equipment Rental.....	420
Air Devices, Diffusers & Grilles	334	Close-Out Items.....	421
Terminal Units (VAV)	337	HVAC & Plumbing Demolition	422
Ducting Systems		Budget Estimating.....	435
Ductwork Specialties.....	339	Forms and Letters	
Galvanized Steel Ductwork.....	344	Change Estimates.....	438
Installed Ductwork Per Pound	346	Subcontract Forms.....	447
Galvanized Steel Spiral Ductwork	348	Purchase Orders	451
Galvanized Steel Round Spiral Fittings	349	Construction Schedules	453
Galvanized Steel Rectangular Ductwork	351	Letter of Intent.....	456
Galvanized Steel Rectangular 90 Degree Elbows.....	353	Submittal Data.....	458
Galvanized Steel Spiral Duct	356	Billing Breakdown Worksheet	461
Galvanized Steel Spiral Duct Fittings	358	Index	463
Galvanized Steel Spiral Tees	360		
Galvanized Steel Spiral Crosses	366		
Galvanized Steel Rectangular Ductwork	369		
Galvanized Steel Rectangular Elbows.....	381		
Galvanized Steel Drops and Tees	391		
Galvanized Steel Round Ductwork.....	394		
Fiberglass Ductwork.....	395		

How to Use This Book

This 2020 National Plumbing & HVAC Estimator is a guide to estimating labor and material costs for plumbing, heating, ventilating and air conditioning systems in residential, commercial and industrial buildings.

 Inside the back cover of this book you'll find a software download certificate. To access the download, follow the instructions printed there. The download includes an easy to-use estimating program with all the cost estimates in this book. The software will run on PCs using Windows XP, Vista, 7, 8, or 10 operating systems.

When the *National Estimator* program has been installed, click Help on the menu bar to see a list of topics that will get you up and running. Or, go online to www.craftsman-book.com and click on Support, then Tutorials, to view an interactive tutorial for *National Estimator*.

Costs in This Manual will apply within a few percent on a wide variety of projects. Using the information given on the pages that follow will explain how to use these costs and suggest procedures to follow when compiling estimates. Reading the remainder of this section will help you produce more reliable estimates for plumbing and HVAC work.



Manhour Estimates in This Book will be accurate for some jobs and inaccurate for others. No manhour estimate fits all jobs because every construction project is unique. Expect installation times to vary widely from job to job, from crew to crew, and even for the same crew from day to day.

There's no way to eliminate all errors when making manhour estimates. But you can minimize the risk of a major error by:

1. Understanding what's included in the manhour estimates in this book, and
2. Adjusting the manhour estimates in this book for unusual job conditions.

The Craft@Hrs Column. Manhour estimates in this book are listed in the column headed *Craft@Hrs*. For example, on page 19 you'll see an estimate for installing a 6 gallon hot water heater. In the *Craft@Hrs* column opposite 6 gallon you'll see:

P1@.500

To the left of the @ symbol you see an abbreviation for the recommended work crew.

Page 7 shows the wage rates and craft codes used in this book.

To the right of the @ symbol you see a number. The number is the estimated manhours (not crew hours) required to install each unit of material listed. In the case of a 6 gallon hot water heater, P1@.500 means that .500 manhours are required to install 1 hot water heater.



Costs in the Labor \$ Column are based on manhour estimates in the *Craft@Hrs* column. Multiply the manhour estimate by the assumed hourly labor cost to find the installation cost in the *Labor \$* column. For example, .500 manhours times \$36.70 (the average wage for crew P1) is \$18.35.

Quarterly price updates on the Web are free and automatic all during 2020. You'll be prompted by Craftsman Software Update when it's time to collect the next update. A connection to the Web is required.

Manhour Estimates include all productive labor normally associated with installing the materials described. These estimates assume normal conditions: experienced craftsmen working on reasonably well planned and managed new construction with fair to good productivity. Labor estimates also assume that materials are standard grade, appropriate tools are on hand, work done by other crafts is adequate, layout and installation are relatively uncomplicated, and working conditions don't slow progress.

All manhour estimates include tasks such as:

- Unloading and storing construction materials, tools and equipment on site.
- Working no more than two floors above or below ground level.
- Working no more than 10 feet above an uncluttered floor.
- Normal time lost due to work breaks.
- Moving tools and equipment from a storage area or truck not more than 200 feet from the work area.
- Returning tools and equipment to the storage area or truck at the end of the day.
- Planning and discussing the work to be performed.
- Normal handling, measuring, cutting and fitting.
- Regular cleanup of construction debris.
- Infrequent correction or repairs required because of faulty installation.

National Plumbing & HVAC Estimator

If the work you're estimating won't be done under these conditions, you need to apply a correction factor to adjust the manhour estimates in this book to fit your job.

Applying Correction Factors. Analyze your job carefully to determine whether a labor correction factor is needed. Failure to consider job conditions is probably the most common reason for inaccurate estimates.

Use one or more of the recommended correction factors in Table 1 to adjust for unusual job conditions. To make the adjustment, multiply the manhour estimate by the appropriate conversion factor. On some jobs, several correction factors may be needed. A correction factor less than 1.00 means that favorable working conditions will reduce the manhours required.



Supervision Expense to the installing contractor is not included in the labor cost. The cost of supervision and non-productive labor varies widely from job to job. Calculate the cost of supervision and non-productive labor and add this to the estimate.

Hourly Labor Costs also vary from job to job. This book assumes an average manhour labor cost of \$43.25 for plumbers and \$41.94 for sheet metal workers. If these hourly labor costs are not accurate for your jobs, adjust the labor costs up or down by an appropriate percentage. Instructions on the next page explain how to make these adjustments. If you're using the National Estimator disk, it's easy to set your own wage rates.

Hourly labor costs in this book include the basic wage, fringe benefits, the employer's contribution to welfare, pension, vacation and apprentice funds, and all tax and insurance charges based on wages. Table 2 at the top of the next page shows how hourly labor costs in this book were calculated. It's important that you understand what's included in the figures in each of the six columns in Table 2. Here's an explanation:

Column 1, the base wage per hour, is the craftsman's hourly wage. These figures are representative of what many contractors are paying plumbers, sheet metal workers and helpers in 2020.

Column 2, taxable fringe benefits, includes vacation pay, sick leave and other taxable benefits. These fringe benefits average about 5.53% of the base wage for many plumbing and HVAC contractors. This benefit is in addition to the base wage.

Condition	Correction Factor
Work in large open areas, no partitions	.85
Prefabrication under ideal conditions, bench work	.90
Large quantities of repetitive work	.90
Very capable tradesmen	.95
Work 300' from storage area	1.03
Work 400' from storage area	1.05
Work 500' from storage area	1.07
Work on 3rd through 5th floors	1.05
Work on 6th through 9th floors	1.10
Work on 10th through 13th floors	1.15
Work on 14th through 17th floors	1.20
Work on 18th through 21st floors	1.25
Work over 21 floors	1.35
Work in cramped shafts	1.30
Work in commercial kitchens	1.10
Work above a sloped floor	1.25
Work in attic space	1.50
Work in crawl space	1.20
Work in a congested equipment room	1.20
Work 15' above floor level	1.10
Work 20' above floor level	1.20
Work 25' above floor level	1.30
Work 30' above floor level	1.40
Work 35' to 40' above floor level	1.50

Table 1 Recommended Correction Factors



Column 3, insurance and employer-paid taxes in percent, shows the insurance and tax rate for the craft workers. The cost of insurance in this column includes workers' compensation and contractor's casualty and liability coverage. Insurance rates vary widely from state to state and depend on a contractor's loss experience. Note that taxes and insurance increase the hourly labor cost by approximately 30%. There is no legal way to avoid these costs.

Column 4, insurance and employer taxes in dollars, shows the hourly cost of taxes and insurance. Insurance and taxes are paid on the costs in both columns 1 and 2.

Column 5, non-taxable fringe benefits, includes employer paid non-taxable benefits such as medical coverage and tax-deferred pension and profit sharing plans. These fringe benefits average 4.88% of the base wage for many plumbing and HVAC contractors.

Column Number	1	2	3	4	5	6
	Base wage per hour	Taxable fringe benefits (at 5.53% of base wage)	Insurance and employer taxes (%)	Insurance and employer taxes (\$)	Non-taxable fringe benefits (at 4.88% of base wage)	Total hourly cost used in this book
Craft						
Laborer	20.89	1.15	32.14%	7.08	1.02	30.14
Plumber	31.85	1.76	24.03%	8.08	1.56	43.25
Sheet Metal Worker	30.50	1.69	25.66%	8.26	1.49	41.94
Operating Engineer	31.09	1.72	24.87%	8.16	1.52	42.49
Sprinkler Fitter	31.30	1.73	24.79%	8.19	1.53	42.75
Electrician	30.81	1.70	19.67%	6.39	1.50	40.40
Cement Mason	26.26	1.45	22.92%	6.35	1.28	35.34

Craft Code	Crew Composition	Average Hourly Cost per Manhour
ER	4 building plumbers, 2 building laborers, 1 operating engineer	39.40
SN	4 building sheet metal workers, 2 building laborers, 1 operating engineer	38.65
P1	1 building plumber and 1 building laborer	36.70
ST	1 sprinkler fitter	42.75
SK	4 sprinkler fitters, 2 building laborers, 1 operating engineer	39.11
SL	1 sprinkler fitter and 1 laborer	36.45
S2	1 building sheet metal worker, 1 building laborer	36.04
BE	1 electrician	40.40
CF	1 cement mason	35.34
SW	1 sheet metal worker	41.94

Table 2 Labor Costs Used in This Book

The employer pays no taxes or insurance on these benefits.

Column 6, the total hourly cost in dollars, is the sum of columns 1, 2, 4, and 5. The labor costs in Column 6 were used to compute costs in the Labor \$ column of this book.

Adjusting Costs in the Labor \$ Column. The hourly labor costs used in this book may apply within a few percent on many of your jobs. But wage rates may be much higher or lower in some areas. If the hourly costs shown in Column 6 of Table 2 are not accurate for your work, adjust labor costs to fit your jobs.

For example, suppose your hourly labor costs are as follows:

Plumber	\$19.00
Laborer	\$16.00
Total hourly crew cost	\$35.00

Your average cost per manhour would be \$17.50 (\$35.00 per crew hour divided by 2 because this is a crew of two).

A labor cost of \$17.50 is about 48% of the \$36.70 labor cost used for crew P1. Multiply costs in the Labor \$ column by .477 to find your estimated cost.

For example, notice on page 19 that the labor cost for installing a 6 gallon hot water heater is \$18.35 each. If installed by your plumbing crew working at an average cost of \$17.50 per manhour, your estimated cost would be 48% of \$18.35 or \$8.75 per heater.

Adjusting the labor costs in this book will make your estimates much more accurate. Making adjustments to labor costs is both quick and easy if you use the National Estimator program.

Equipment Cost will vary according to need and application. It is typically \$31.00 per day for a 2-ton chain hoist.

Material Costs in this manual are intended to reflect what medium- to low-volume contractors will be paying in 2020 after applying normal discounts. These costs include charges for delivery to within 25 to 30 miles of the supplier.

Overhead and Profit for the installing contractor are not included in the costs in this manual unless specifically identified in the text. Markup can vary widely with local economic conditions, competition and the installing contractor's operating expenses. Add the markup that's appropriate for your company, the job and the competitive environment.

National Plumbing & HVAC Estimator

How Accurate Are These Figures? As accurate as possible considering that the editors don't know your material suppliers, haven't seen the plans or specifications, don't know what building code applies or where the job is, had to project material costs at least six months into the future, and had no record of how much work the crew that will be assigned to the job can handle.

You wouldn't bid a job under those conditions. And I don't claim that all plumbing and HVAC work is done at these prices.

Estimating Is an Art, not a science. There is no one price that applies on all jobs. On many jobs the range between high and low bid will be 10% or more. There's room for legitimate disagreement on what the correct costs are, even when complete plans and specifications are available, the date and site are established, and labor and material costs are identical for all bidders.

No estimate fits all jobs. Good estimates are custom made for a particular project and a single contractor through judgment, analysis and experience. This book is not intended as a substitute for judgment, analysis and sound estimating practice. It's an aid in developing an informed opinion of cost, not an answer book.

Additional Costs to Consider

Here's a checklist of additional costs to consider before submitting any bid.

1. Sales taxes
2. Mobilization costs
3. Payment and performance bond costs
4. Permits and fees
5. Storage container rental costs
6. Utility costs
7. Tool costs
8. Callback costs during warranty period
9. Demobilization costs

Exclusions and Clarifications

Neither the job specifications nor the contract may identify exactly what work should be included in the plumbing and HVAC bid. Obviously, you have to identify what work is included in the job.

The most efficient way to define the scope of the work is to prepare a list of tasks not normally performed by your company and attach that list to each bid submitted. Here's a good list of work that should be excluded from your bid.

Your Bid Should Exclude

- Final cleaning of plumbing fixtures
- Backings for plumbing fixtures
- Toilet room accessories
- Electrical work, including motor starters
- Electrical wiring and conduit over 100 volts
- Temporary utilities
- Painting, priming and surface preparation
- Structural cutting, patching or repairing
- Fire protection and landscape sprinklers
- Equipment supports
- Surveying and layout of control lines
- Removal or stockpiling of excess soil
- Concrete work, including forming and rebar
- Setting of equipment furnished by others
- Equipment, unless shown, and personnel hoisting
- Wall and floor blockouts
- Pitch pockets
- The costs of performance or payment bonds
- Site utilities
- Asbestos removal or disposal
- Contaminated soil removal or disposal
- Major increases in copper material prices
- Fire dampers not shown on the plans

Your Bid Should Include

- Trash sweep-up only. Others haul it away
- Site utilities from building to property line only
- Piping to 5 feet outside the building only
- Plumbing & HVAC permits for your work only

Beware of Price Changes

There's no way to be sure what prices will be in three to six months. All labor, equipment, material and subcontract prices in a bid should be based on costs anticipated when the project is expected to be built, not when the estimate is compiled. That presents a

problem. Except for the installation of underground utilities, most plumbing and HVAC work is done six months to a year after the bid is submitted. When possible, get price protection in writing from your suppliers and subcontractors. If your suppliers and subs won't guarantee prices, include an escalation allowance in your bid to cover anticipated price increases.

Material Pricing Conditions

All equipment and material prices quoted by your vendors will be conditional. They usually don't include sales tax and are subject to specific payment and shipping terms. Every estimator should understand the meaning of common shipping terms. They define who pays the freight and who has responsibility for processing freight-damage claims. Here's a summary of important conditions you should understand.

F.O.B. Factory (Free On Board at the Factory): Title passes to the buyer when the goods are delivered by the seller to the freight carrier. The buyer pays the freight and is responsible for freight-damage claims.

F.O.B. Factory F.F.A. (Free On Board at the Factory, Full Freight Allowed): The title passes to the buyer when the goods are delivered by the seller to the freight carrier. The seller pays the freight charges, but the buyer is responsible for freight-damage claims.

F.O.B. (city of destination) (Free On Board to your city): The title passes to the buyer when the goods are delivered by the seller to the freight terminal in the city, or nearest city, of destination. The seller pays the freight and is responsible for freight-damage claims to the terminal. The buyer pays the freight charge and is responsible for freight-damage claims from the terminal to the final destination.

F.O.B. Job Site (Free On Board at job site, or contractor's shop): The title passes to the buyer when the goods are delivered to the job site (or shop). The seller pays the freight and is responsible for freight-damage claims.

F.A.S. Port [of a specific city] (Free Alongside Ship at the nearest port): The title passes to the buyer when goods are delivered to the ship dock or port terminal. The seller pays the freight and is responsible for freight-damage claims to the ship dock or port terminal only. The buyer pays the freight and is responsible for freight-damage claims from the ship dock or port terminal to the designated delivery point.

Obviously, it's to your advantage to instruct all vendors to quote costs F.O.B. the job site or your shop.

Reducing Costs

Most construction specifications allow the use of alternative equipment and materials. It's the estimator's responsibility to select the most cost-effective products. Research and compare your costs before making any decisions. Avoid selecting any material or equipment simply because that's what you've always done.

Don't recommend plastic products such as ABS, PVC, or polypropylene pipe or corrugated flexible ducts until you've checked local code requirements. Most building codes prohibit use of these materials inside public buildings such as schools, care centers and hospitals.

It's wise to select 100% factory-packaged equipment. Beware of equipment labeled "Some assembly required." Field labor costs for mounting loose coils, motors and similar equipment are very high.

Value Engineering

Let's suppose you've submitted a combined plumbing and HVAC bid for \$233,000. Your cutthroat competitor put in a bid at \$4,000 less, \$229,000. Obviously there's no way you're going to get the job. Right?

Not so fast! Maybe value engineering can help you win that contract — while fattening your profit margin.

Suppose the proposal you submitted had two parts. Part I is the bid for \$233,000, based entirely on job plans and specs, just the way they were written. But appended to your proposal is Part II, a list of suggestions for saving money without sacrificing any of the capacity or quality designed into the system. Here's an example of what might be in Part II:

1. Deduct for providing pipe hanger spacings per UPC in lieu of specified spacings: \$1,750.00
2. Deduct for reducing heating hot water pipe sizes by using 40 degrees F Delta T in lieu of specified 20 degrees F Delta T: \$4,600.00
3. Deduct for providing pressure/temperature taps at air handling units, pumps and chillers in lieu of specified thermometers and pressure gauges: \$875.00

National Plumbing & HVAC Estimator

4. Deduct for eliminating water treatment in closed piping systems: \$1,800.00
5. Deduct for piping chilled and heating hot water pumps in parallel in lieu of providing 100% standby pumps: \$2,900.00

Total deductions: \$11,925.00

Adopting these suggestions would make you low bidder by nearly \$8,000. A saving like that will be tempting to most owners, especially if the owner understands that your suggestions result in a system that is every bit as good and maybe better than the system as originally designed.

You're not offering to undercut the competition. Far from it. You're using knowledge and experience to create better value for the owner. That's called value engineering and it's likely to win the respect of nearly all cost-conscious owners.

Notice that reducing costs is only part of what value engineering is all about. You don't cut costs at the expense of system quality, integrity, capacity or performance.

Don't waste your time, and your client's, by offering to substitute cheaper or lower-quality fixtures or equipment. Any cutthroat contractor with a price list can do that. Recommend the use of inferior materials and you'll be associated with the inferior goods you promote. Some owners consider even the suggestion to be insulting.

The recommendations you make (like most of those in the example) will require design changes. You can expect to be examined (or even challenged) on these points. Be ready to explain and defend each of your suggestions. Convince the client (or the design engineer) that your ideas are based on sound engineering principles and you're well on the way to winning the owner's confidence and the contract.

Now, let's go back to the list and see how we might justify the five value engineering recommendations.

1. **Pipe Hanger Spacing.** The pipe hanger spacings recommended in the Uniform Plumbing Code (UPC) are calculated by experienced, professional structural engineers. The safety factors used in these calculations are very conservative. They've been widely used for many years and have proved to be more than adequate. There's no need for more hangers than the UPC requires.

2. **Changing HHW Delta T.** In hydronic heating systems, heat measured in Btus is pumped to terminal units. The proposed change of the Delta T, from 20 degrees F to 40 degrees F, has no effect whatsoever on how many Btus the system delivers. You're not changing anything but the volume of water being pumped. At lower volume levels, the size of the pump, the pipe and the pipe insulation can all be reduced. Not one of these changes will affect the system's ability to transmit heat. Furthermore, operating costs will also drop, since less pump horsepower will be needed to run the smaller pump.

3. **Thermometers/Pressure Gauges.** Thermometers and pressure gauges installed on or near vibrating machinery have a very short life expectancy. Gauges quickly lose accuracy under harsh conditions. Readings will become less and less reliable. That's potentially dangerous. You can avoid this problem by using insertion-type pressure/temperature taps instead. Store these sensitive gauges in a desk drawer or a tool crib when not in use. Safely stored, they're protected from damage. They'll give accurate readings longer and won't need to be replaced as often. And they're simple to use. Just insert a gauge in one of the conveniently located taps. Make the reading, then remove the gauge and put it away.

4. **Water Treatment.** ITT Bell & Gossett has done studies on corrosion in closed hydronic systems that have a make-up water rate of no more than 5% per year. These studies show that corrosion virtually stops when entrained air is either removed or depleted. No water treatment is needed in this closed system.

5. **100% Standby Pumps.** Two pumps piped and operated in parallel are more economical. Even if one pump fails, the other pump can maintain delivery at 75 to 80% of the designed flow rate. That's usually adequate for emergency operation.

These cost-saving ideas are small, but could tip the balance in your favor. I hope they demonstrate the potential that value engineering has when bidding jobs. Any time you're compiling an estimate, keep an eye out for ways to save money or reduce the owner's cost. Jot a note to yourself about each potential saving you identify. Before submitting the bid, make a list of your alternate suggestions. Maybe best of all, markup on your value engineering suggestions can be higher than your normal markup. If value engineering can cut costs by \$10,000, maybe as much as \$4,000 of that should end up in your pocket!

Value Engineering: Surplus Materials

Value engineering doesn't begin and end with job plans and specs. Value engineering means getting the most value at the least cost, no matter whether it's value to the owner or value to the contractor. Smart mechanical contractors learn to build extra value into their jobs by controlling shrinkage of materials. Nearly every significant plumbing and HVAC job ends with at least some surplus material on hand. Material left over when the job is done tends to be discarded as waste or hauled off the job in the back of a truck that doesn't have your company name on the door. And why not? It's surplus — not needed. The owner didn't need it. So now it's up for grabs.

Not quite. Let's consider who actually owns that surplus material. When your company has been paid, every piece of material your crew installed belongs to the building owner. But what about those fittings, hangers and valves delivered to the job site but never actually used? Almost certainly, those materials were included in your bid. So aren't they the property of the owner? Not in my opinion. The owner contracted for a mechanical system and (presumably) has one. Unless it's a cost-plus job or a labor-only job, the owner didn't buy materials delivered to the job site. The owner bought a mechanical system and has one — completely separate and apart from any surplus materials. In my mind, the property owner has no more claim to left-over materials than the same owner would have claim to labor hours not expended or equipment not used on the same job.

Unless there's some provision in your contract to the contrary, surplus material belongs to the installing contractor. But your right to that material and the chance of actually getting it back to your shop are two very different propositions. I see recovery of surplus material as a training issue. As a matter of company policy, make it clear to your crews that surplus material belongs to your company. The supervisor on every job should be accountable for recovery of excess material. Every significant job will have at least some surplus. Accounting for that surplus should be part of your routine close-out procedure. Fortunately, it's not difficult. I'll explain.

Control of surplus materials begins with a good checklist, or form. I recommend the Materials, Equipment and Tool form, "MET" for short. A blank MET form appears following this section. Your MET should show both what's delivered to the job site (material, equipment and tools) and surplus "drops" returned to your shop at project close-out. A MET

ensures that the estimator, the shop inventory manager and your field supervisor are on the same page. Your MET establishes accountability. Nothing falls through the cracks. Job input equals job output plus returns. Everything delivered to the job and not expended should be returned to your shop.

Here's how it works:

1. Based on the estimate that won you the job, the items needed are purchased for the job and staged for delivery to the job site.
2. As materials, equipment and tools are delivered to the job site, your supervisor completes the first three columns of the MET form: Description, Quantity and Date.
3. As work is completed, the same supervisor completes the four columns under Returned to Inventory: Quantity Returned, Date, Status Code and Value. The status code will be either "RS" (Returned and Salvaged) or "RN" (Returned New).
4. Back at your shop, both RS and RN materials should be restored to inventory.
5. If your company has an inventory manager, have that manager assign the return value to each item returned. If you're using QuickBooks Pro, the "Adjust Inventory" feature can handle this task quite easily. Add two new categories under "Inventory Stock on Hand by Vendor." The first new category is Returned Salvage. The second is Returned New. Be sure the value of RS materials includes the cost of any reconditioning done to restore salvaged materials (such as pumps and boilers) to serviceable condition.
6. Comparing MET deployed to the job site with MET returned to inventory yields MET actually used on the job. That's a very important number to every plumbing and HVAC estimator. Be sure actual usage gets entered on the Project Summary form.
7. When the take-off on your next estimate is complete, compare that materials list with a summary of RS and RN materials on hand from prior jobs.
8. Evaluate which returned materials can be redeployed on the new job.
9. It's a management decision to either (1) charge the new job for the cost of RS and RN materials already on hand, or (2) consider materials on hand as "free" and a competitive advantage in winning the new bid. Either way, RN and RS materials are an asset to your company.

National Plumbing & HVAC Estimator

Plumbing and HVAC materials are expensive. Every mechanical contractor has an interest in MET tracking. Everyone in your company should be aware of the need for good materials management. Used correctly, the MET form in this book can help engineer more value into your jobs.

Maximizing the Value of Old Estimates

There should be two profits in every job. The first is money in the bank — a return on time and expenses. The second is what you learn from the job — primarily by comparing the estimate you made with what turns out to be your actual cost. On some jobs, the value of lessons learned may outweigh net revenue.

Every plumbing and HVAC contractor has marginal jobs. That's normal. What *shouldn't* be normal is repeating mistakes. The best way to avoid trouble in your future is to keep track of your past. Keeping old estimates available for reference can help prevent errors on new estimates.

As your file of completed estimates grows, organization becomes more important. You need an easy way to find similar projects with the same components and comparable scope of work. If your estimating file is in QuickBooks Pro, searching by keyword may be enough. Otherwise, I recommend creating a short summary for each completed job, and an index that references all summaries available for comparison. You'll find a blank Project Summary form at the end of this section. To make reference easier, create an index by type of job and equipment used. You may choose to use an alphabetical index based on client name or project ID.

How to complete the Project Summary form is obvious. The many ways to use this form may not be so obvious, so here are a few pointers.

1. Use your index of Project Summary forms to find completed jobs most similar to the job you're bidding. Believe it or not, Project Summary forms with the widest margin of error will be most useful. Ask yourself: Who worked on those projects? Who was the field superintendent? Who were the vendors? Did the errors result from poor estimating or the poor performance of vendors, supervisors or crews? The most common estimating errors occur when (a) inspecting the job site, (b) examining the plans or (c) reading the specifications. What did you miss and why? Look for pitfalls to avoid in the job now being estimated. Identify the biggest two or three mistakes made when bidding that job. Make a notation about each on the Project Summary form.

2. Now look at your bid for the current job. Which mistakes made on a prior job might you expect on this job? Concentrate on the big three oversights to avoid: Inspecting the job site; examining the plans; and reading the specifications.
3. Unless there's a major error in take-off, your estimate of material costs should be within about 5 percent of the actual costs of materials. However, it's common for labor cost estimates to vary 20 percent or more from actual labor costs. This is precisely where data from old jobs comes in handy. If your Project Summary files show that some project types are consistent money-losers, either shift your company's focus to another class of work, factor more contingency into your bids, or find some way to wring inefficiencies out of the labor component. Poor staging, delivery and retrieval procedures drag down labor productivity on any job.
4. Use your file of Project Summary forms to spot any common thread that runs through either money-making jobs or money-losing jobs. For example, if the names of certain subcontractors or vendors are prominent on low-margin jobs, maybe there's a relationship between your profit margin and choice of subs and suppliers. Even the best and most reliable vendors can become complacent if not challenged occasionally.
5. Project Summary forms should note changes and extras identified after the contract was signed — both for which your company was paid and changes done without additional compensation. Projects with changes and extras that exceed about 4 percent of the contract price deserve special scrutiny. Jobs with changes beyond about 4 percent aren't good for business, at least in my opinion. Nearly all changes have a negative impact on your job schedule and require a disproportionate investment of management resources. Too many changes can antagonize the owner and design staff, even if they were responsible for the altered plans. You may know of a mechanical contractor with a reputation for capitalizing on change orders. But I've rarely seen a job plagued with changes that turned into a money-maker for anyone — except the attorneys. Your file of Project Summary forms will show job types that carry change order risk. Before finalizing and submitting any bid, consider whether the job will get mired in disputes over changes and extras. If similar jobs have ended on the courthouse steps, factor that risk into your estimate.

Utility of a Project Summary forms file is limited only by your ingenuity. The important point is to keep and organize the source of your second profit available on every job. What you learn can be more valuable than what you earn.

The Estimating Procedure

Every plumbing and HVAC estimator works under deadline pressure. You'll seldom have the luxury of spending as much time as you would like on an estimate. Estimators who aren't organized waste valuable time and tend to make careless errors. Try to be well-organized and consistent in your approach to estimating. For most projects, I recommend that you follow the procedures listed below and in the order listed:

1. Get a second set of project drawings and specifications for use by your suppliers and subcontractors. Remember that your subs and suppliers need access to the plans and specs and time to prepare their quotes.
2. Study the plans and specs carefully. Highlight important items. Make a list of specific tasks that require labor unit correction factors. The estimate is never complete until you're totally familiar with the project and the applicable construction codes.
3. Get the general contractor or owner to identify the proposed construction schedule and subcontractor lay-down (storage) area. Work schedule and site conditions always affect your costs.
4. Contact all potential suppliers and subcontractors as early as possible. Set a time when each can come to your office to make their take-offs from the spare set of contract documents.

When this important preliminary work is done, or in progress, it's time to begin your detailed take-off.

Guidelines for Good Estimating

You can compile estimates on a legal pad, a printed estimating form or on a computer. Regardless of the method, these guidelines will apply:

List Each Cost Separately on your take-off sheet. Don't combine system estimates, even if the materials are the same type. A combined system estimate may have to be completely redone if materials for one system are changed at a later date. Use the Estimate Detail Sheet on page 16 if you don't already have a good material take-off form.

Use Engineer's Identification Numbers when listing equipment. The word pump without any other description is ambiguous when there are several pumps included in the project.

Don't Forget Labor Adjustment factors if your labor costs are significantly higher or lower than the costs used in this book. See instructions on page 7 for adjusting labor costs.

Use Colored Pencils or highlighters to mark the items you've taken off and listed. Use a different color for each piping or ducting system.

Log Telephone Quotes and other important phone conversations on a telephone quote form. See the sample on page 18.

Project Estimated Costs for labor, material and equipment to the time when the work is expected to be done, not when the job is being estimated.

The only good estimate is a complete estimate. You've probably heard this saying, "He who makes the most mistakes is likely to be low bidder, and live to regret it."

Preparing the Proposal

It's both common courtesy and good business practice to deliver an unpriced copy of your bid or proposal letter to the general contractor three or four days before the bid deadline date. This gives the contractor time to study your proposal and obtain alternate pricing for items you may have excluded. To avoid misunderstandings, make sure your proposals include, as a minimum, the following elements:

1. The complete name and address of the proposed project.
2. Specification title and issue date.
3. A complete listing of drawings and their issue or revision date.
4. A complete list of addenda and their dates of issue.
5. A list of specification section numbers covered by your proposal.
6. A list of exclusions, clarifications and assumptions.

Your final bid can be phoned in or sent by fax, but it should reach the general contractor or owner no more than five or ten minutes before the bid deadline. Prices submitted too early may have to be revised because of last-minute price changes by subcontractors or suppliers.

MET Worksheet
Material, Equipment and Tool Delivery and Surplus Return Record

Project ID _____

Job Location _____

Supervisor _____

Start Date _____

Description of Material, Equipment or Tool Delivered or Returned	Delivered to Job Site		Returned to Inventory			
	Quantity Delivered	Date Delivered	Quantity Returned	Date Returned	Status Code RN or RS	Value at Return

Online Preview

PROJECT SUMMARY

Project ID _____ Job Location _____

Short description _____

Supervisor _____

Index ID _____ Start Date _____

Estimator _____ Client _____

Major vendors _____ Subcontractors _____

Sources of cost deviation _____

Related Projects by ID Number _____

	Thumbnail Summary	Labor	Material	Equipment	Subcontract	Deployed RN/RS	Total
Actual cost							
Estimate Over/(Under)							
Full Summary							
Bid amount							
Estimated cost							
Projected profit							
Cost overrun							
Bid profit							
Change orders							
Cost of changes							
Total profit							
Total profit with RN/RS							
Redeployment							

Estimate Detail Sheet

Data carried forward from Take-Off Quantity Survey Sheet(s)

Company/Department _____ Estimator _____ Date _____
 Project _____ Checked by _____ Date _____
 Address _____ Notes: _____
 Job description _____ Estimate # _____
 CSI Division/Account _____ Estimate due _____

Item Description	Quantity	Unit	Crew @ MH/Unit	Manhours Ext.	Materials		Labor		Equipment		Subcontract		Total \$
					Unit \$	Ext. \$	Unit \$	Ext. \$	Unit \$	Ext. \$	Unit \$	Ext. \$	
Totals This Sheet				Manhours		Material \$		Labor \$		Equipment \$		Subcontract \$	Total \$

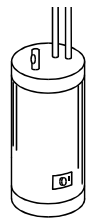
Carry totals forward to Estimate Summary Sheet _____ Estimate # _____ Estimate Detail Sheet _____ of _____

Domestic Hot Water Heaters

Description	Craft@Hrs	Unit	Material \$	Labor \$	Equipment \$	Total \$
-------------	-----------	------	-------------	----------	--------------	----------

Electric domestic hot water heater (residential). Set in place only (floor models). Make additional allowances for pipe and electrical connections. (See below)

6 gallon						
1.5 KW/110V	P1@.500	Ea	422.00	18.40	—	440.40
10 gallon						
1.5 KW/110V	P1@.500	Ea	472.00	18.40	—	490.40
15 gallon						
1.5 KW/110V	P1@.750	Ea	497.00	27.50	—	524.50
20 gallon						
1.5 KW/110V	P1@.750	Ea	513.00	27.50	—	540.50
30 gallon						
1.5 KW/110V	P1@1.00	Ea	457.00	36.70	—	493.70
40 gallon						
1.5 KW/110V	P1@1.20	Ea	479.00	44.00	—	523.00
50 gallon						
3 KW/110V	P1@1.30	Ea	516.00	47.70	—	563.70
12 gallon						
3 KW/220V	P1@.500	Ea	416.00	18.40	—	434.40
20 gallon						
3 KW/220V	P1@.750	Ea	455.00	27.50	—	482.50
30 gallon						
3 KW/220V	P1@1.00	Ea	497.00	36.70	—	533.70
40 gallon						
3 KW/220V	P1@1.20	Ea	541.00	44.00	—	585.00
50 gallon						
3 KW/220V	P1@1.30	Ea	579.00	47.70	—	626.70

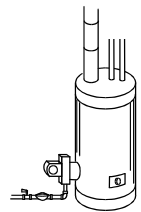


Electric domestic hot water heater (commercial), 208/240 volt. Set in place only. Make additional allowances for pipe and electrical connections. (See below)

96 gallon, 12 kw	P1@1.50	Ea	2,390.00	55.10	—	2,445.10
96 gallon, 18 kw	P1@1.50	Ea	3,240.00	55.10	—	3,295.10
96 gallon, 36 kw	P1@1.50	Ea	3,360.00	55.10	—	3,415.10
120 gallon, 18 kw	P1@2.00	Ea	3,440.00	73.40	—	3,513.40
120 gallon, 36 kw	P1@2.00	Ea	3,550.00	73.40	—	3,623.40
120 gallon, 54 kw	P1@2.00	Ea	4,200.00	73.40	—	4,273.40
120 gallon, 63 kw	P1@2.00	Ea	4,530.00	73.40	—	4,603.40

Gas-fired domestic hot water heater (residential). Set in place only, Make additional allowances for pipe and combustion venting connections. (See below)

30 gallon	P1@1.00	Ea	490.00	36.70	—	526.70
40 gallon	P1@1.00	Ea	792.00	36.70	—	828.70
50 gallon	P1@1.50	Ea	900.00	55.10	—	955.10



Domestic Hot Water Heaters

Description Craft@Hrs Unit Material \$ Labor \$ Equipment \$ Total \$

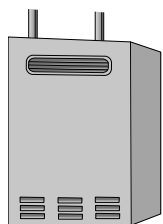
Gas-fired domestic hot water heater (commercial), standard efficiency. Set in place only, Make additional allowances for pipe and combustion venting connections. (See below)

50 gal./ 95 gph	P1@2.00	Ea	2,380.00	73.40	—	2,453.40
67 gal./106 gph	P1@2.00	Ea	2,810.00	73.40	—	2,883.40
76 gal./175 gph	P1@2.00	Ea	3,770.00	73.40	—	3,843.40
91 gal./291 gph	P1@2.00	Ea	4,550.00	73.40	—	4,623.40

Gas-fired domestic hot water heater (commercial), energy miser. Set in place only, Make additional allowances for pipe and combustion venting connections. (See below)

50 gal./ 95 gph	P1@2.00	Ea	5,600.00	73.40	—	5,673.40
67 gal./106 gph	P1@2.00	Ea	5,860.00	73.40	—	5,933.40
76 gal./175 gph	P1@2.00	Ea	7,260.00	73.40	—	7,333.40
91 gal./291 gph	P1@2.00	Ea	8,630.00	73.40	—	8,703.40

Tankless natural gas water heaters. Ambient pressure. DOE and UL rated. For residential, multi-dwelling and light commercial potable water applications. Add the cost of piping, tempering valve, circulating pump, controls, and electrical connection, post-installation inspection by both the fire marshal and the mechanical inspector to validate federal, state and local energy tax credits or energy tax credit offsets. For larger arrays (laundries, institutional facilities, food processing plants), develop an estimate based on the required capacity and multiply these costs by the number of heaters required. Rated in Btus and gallons per minute capacity. (1 Mbh = 1,000 Btus)



19.5-140 Mbh, .75-5.8 Gpm	P1@16.0	Ea	1,880.00	587.00	—	2,467.00
11-199 Mbh, .5-7 Gpm	P1@20.0	Ea	2,220.00	734.00	—	2,954.00
25-235 Mbh, .75-9.6 Gpm	P1@20.0	Ea	2,220.00	734.00	—	2,954.00

Tankless electric point-of-use water heaters. Ambient pressure, DOE and UL rated. For residential, multi-dwelling and light commercial potable water applications. Cost does not include piping, tempering valve, circulating pump, controls, storage tank, electrical connection. Add the cost of post-installation inspection by the mechanical inspector to validate federal, state and local energy tax credits or energy tax credit offsets. In rated gallons per minute capacity.



5.5 Kw/40 Amp, .75-2 Gpm	P1@4.00	Ea	475.00	147.00	—	622.00
9.5 Kw/50 Amp, .75-2.5 Gpm	P1@4.25	Ea	563.00	156.00	—	719.00
19 Kw/100 Amp, 1-3.5 Gpm	P1@4.50	Ea	936.00	165.00	—	1,101.00
28 Kw/120 Amp, 1.5-5 Gpm	P1@4.75	Ea	1,710.00	174.00	—	1,884.00

Domestic Hot Water Heater Connections

Description	Craft@Hrs	Unit	Material \$	Labor \$	Equipment \$	Total \$
-------------	-----------	------	-------------	----------	--------------	----------

Domestic hot water heater connection assembly. Includes supply, return, recirculation and relief piping and fittings (copper), relief and isolation valves. Make additional allowances for gas and venting connections where applicable.

¾" residential	P1@1.75	Ea	313.00	64.20	—	377.20
¾" commercial	P1@2.25	Ea	420.00	82.60	—	502.60
1" commercial	P1@2.75	Ea	736.00	101.00	—	837.00
1¼" commercial	P1@3.50	Ea	901.00	128.00	—	1,029.00
1½" commercial	P1@3.75	Ea	938.00	138.00	—	1,076.00
2" commercial	P1@4.50	Ea	1,000.00	165.00	—	1,165.00
2½" commercial	P1@5.75	Ea	2,080.00	211.00	—	2,291.00
3" commercial	P1@6.50	Ea	3,190.00	239.00	—	3,429.00

Domestic water heater combustion vent connection. Make additional allowances for piping distances greater than 25'.

2" B-vent	P1@.090	LF	6.47	3.30	—	9.77
3" B-vent	P1@.100	LF	7.99	3.67	—	11.66
4" B-vent	P1@.110	LF	10.60	4.04	—	14.64
6" B-vent	P1@.130	LF	13.00	4.77	—	17.77
Tankless heater vent kit	P1@2.50	Ea	454.00	91.80	—	545.80
Power vent kit	P1@2.00	Ea	1,160.00	73.40	—	1,233.40

Online Preview

Water Softeners and Controllers

Description	Craft@Hrs	Unit	Material \$	Labor \$	Equipment \$	Total \$
-------------	-----------	------	-------------	----------	--------------	----------

Water softener, time clock controller. Including brine tank, brine well and pick-up tube. Labor includes setting in place, connecting the unit to an existing domestic water distribution system, start up and testing.

20,000 grain water softener, TCC	P1@4.50	Ea	587.00	165.00	—	752.00
30,000 grain water softener, TCC	P1@4.50	Ea	626.00	165.00	—	791.00
45,000 grain water softener, TCC	P1@4.50	Ea	696.00	165.00	—	861.00
50,000 grain water softener, TCC	P1@4.75	Ea	785.00	174.00	—	959.00
60,000 grain water softener, TCC	P1@4.75	Ea	928.00	174.00	—	1,102.00
75,000 grain water softener, TCC	P1@5.00	Ea	996.00	184.00	—	1,180.00
90,000 grain water softener, TCC	P1@5.50	Ea	1,350.00	202.00	—	1,552.00
120,000 grain water softener, TCC	P1@5.75	Ea	1,450.00	211.00	—	1,661.00

Water softener, mechanically-metered controller. Including brine tank, brine well and pick up tube. Labor includes setting in place, connecting the unit to an existing domestic water distribution system, start up and testing.

20,000 grain water softener, MMC	P1@4.50	Ea	763.00	165.00	—	928.00
30,000 grain water softener, MMC	P1@4.50	Ea	797.00	165.00	—	962.00
45,000 grain water softener, MMC	P1@4.50	Ea	867.00	165.00	—	1,032.00
50,000 grain water softener, MMC	P1@4.75	Ea	955.00	174.00	—	1,129.00
60,000 grain water softener, MMC	P1@4.75	Ea	1,120.00	174.00	—	1,294.00
75,000 grain water softener, MMC	P1@5.00	Ea	1,190.00	184.00	—	1,374.00
90,000 grain water softener, MMC	P1@5.50	Ea	1,530.00	202.00	—	1,732.00
120,000 grain water softener, MMC	P1@5.75	Ea	1,630.00	211.00	—	1,841.00

Water Softeners and Controllers

Description	Craft@Hrs	Unit	Material \$	Labor \$	Equipment \$	Total \$
-------------	-----------	------	-------------	----------	--------------	----------

Water softener, electronically-metered controller. Including brine tank, brine well and pick up tube. Labor includes setting in place, connecting the unit to an existing domestic water distribution system, start up and testing.

20,000 grain water softener, EMC	P1@4.50	Ea	809.00	165.00	—	974.00
30,000 grain water softener, EMC	P1@4.50	Ea	833.00	165.00	—	998.00
45,000 grain water softener, EMC	P1@4.50	Ea	914.00	165.00	—	1,079.00
50,000 grain water softener, EMC	P1@4.75	Ea	1,000.00	174.00	—	1,174.00
60,000 grain water softener, EMC	P1@4.75	Ea	1,170.00	174.00	—	1,344.00
75,000 grain water softener, EMC	P1@5.00	Ea	1,230.00	184.00	—	1,414.00
90,000 grain water softener, EMC	P1@5.50	Ea	1,570.00	202.00	—	1,772.00
120,000 grain water softener, EMC	P1@5.75	Ea	1,680.00	211.00	—	1,891.00

Water softener accessories

By-pass valve Manifold	P1@.400	Ea	77.90	14.70	—	92.60
adapter kit	P1@.200	Ea	21.00	7.34	—	28.34
Turbulator	P1@.400	Ea	38.40	14.70	—	53.10

Iron filter, electronically-metered controller. Manganese green sand filter. Labor includes setting in place, connecting the unit to an existing domestic water distribution system, start-up and testing.

42,000 iron filter (1.5 cf media), 5 gpm	P1@4.00	Ea	765.00	147.00	—	912.00
65,000 iron filter (2.0 cf media), 6 gpm	P1@4.50	Ea	905.00	165.00	—	1,070.00
84,000 iron filter (2.5 cf media), 8 gpm	P1@4.75	Ea	966.00	174.00	—	1,140.00
Replacement green sand media	P1@1.20	CF	44.30	44.00	—	88.30

Iron filter accessories

By-pass valve	P1@.400	Ea	77.90	14.70	—	92.60
Air vent	P1@.200	Ea	61.80	7.34	—	69.14
Air controller	P1@.400	Ea	69.80	14.70	—	84.50

Water Softener Accessories

Description	Craft@Hrs	Unit	Material \$	Labor \$	Equipment \$	Total \$
-------------	-----------	------	-------------	----------	--------------	----------

Combination iron filter/water softener. Zeolite resins soften water and remove iron and manganese. Controller automatically controls PH level. Labor includes setting in place, connecting the unit to an existing domestic water distribution system, start-up and testing.

40,000 iron filter, 1.3 cf media	P1@4.00	Ea	1,480.00	147.00	—	1,627.00
60,000 iron filter, 1.7 cf media	P1@4.50	Ea	1,600.00	165.00	—	1,765.00
80,000 iron filter, 2.5 cf media	P1@4.75	Ea	2,320.00	174.00	—	2,494.00

Hot water softener, time clock controller. Brass valve construction. Designed for 150 F. maximum operating temperature. Includes brine tank, brine well and pick-up tube. Labor includes setting in place, connecting the unit to an existing domestic water distribution system, start-up and testing.

20,000 grain hot water softener	P1@4.50	Ea	1,860.00	165.00	—	2,025.00
30,000 grain hot water softener	P1@4.50	Ea	1,970.00	165.00	—	2,135.00
40,000 grain hot water softener	P1@4.50	Ea	2,060.00	165.00	—	2,225.00
60,000 grain hot water softener	P1@4.75	Ea	2,440.00	174.00	—	2,614.00

Pressure tank, fiberglass wound. Labor includes setting in place, connecting the tank to a domestic water distribution system and testing.

Fiberglass pressure tank, 20 gallon	P1@2.00	Ea	255.00	73.40	—	328.40
Fiberglass pressure tank, 30 gallon	P1@2.00	Ea	287.00	73.40	—	360.40
Fiberglass pressure tank, 80 gallon	P1@2.75	Ea	465.00	101.00	—	566.00
Fiberglass pressure tank, 120 gallon	P1@3.50	Ea	613.00	128.00	—	741.00
Brass tank tee assembly, ¾"	P1@3.50	Ea	35.70	128.00	—	163.70
Brass tank tee assembly, 1"	P1@3.50	Ea	66.50	128.00	—	194.50
Brass tank tee assembly, 1½"	P1@3.50	Ea	113.00	128.00	—	241.00

Description Craft@Hrs Unit Material \$ Labor \$ Equipment \$ Total \$

Ultra-violet water disinfection unit. Stainless steel reactor, audible and visible alarm, lamp end-of-life indicator and 7-day override. Gpm rating at 30,000 mj/m2 output. Labor includes setting in place, connecting to the water system and testing.

UV system, 1 gpm, ¼" in/out	P1@3.00	Ea	246.00	110.00	—	356.00
UV system, 6 gpm, ½" in/out	P1@3.00	Ea	478.00	110.00	—	588.00
UV system, 8 gpm, ¾" in/out	P1@4.00	Ea	553.00	147.00	—	700.00
UV system, 12 gpm, ¾" in/out	P1@4.00	Ea	709.00	147.00	—	856.00
UV replacement lamp, 20W, 1 gpm	P1@.750	Ea	55.00	27.50	—	82.50
UV replacement lamp, 32W, 6 gpm	P1@.750	Ea	62.40	27.50	—	89.90
UV replacement lamp, 39W, 8-12 gpm	P1@.750	Ea	79.90	27.50	—	107.40
UV replacement ballast, 420 Mv/110V	P1@1.00	Ea	241.00	36.70	—	277.70

Kitchen equipment booster heater

1,000 watt	P1@4.00	Ea	609.00	147.00	—	756.00
------------	---------	----	--------	--------	---	--------

Dishwasher

Built-in	P1@5.00	Ea	907.00	184.00	—	1,091.00
----------	---------	----	--------	--------	---	----------

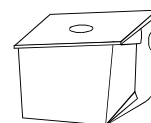
Garbage disposal

½ HP	P1@2.00	Ea	181.00	73.40	—	254.40
¾ HP	P1@2.00	Ea	302.00	73.40	—	375.40



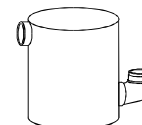
Grease and oil interceptor

4 GPM	P1@4.00	Ea	337.00	147.00	—	484.00
10 GPM	P1@5.00	Ea	549.00	184.00	—	733.00
15 GPM	P1@7.00	Ea	820.00	257.00	—	1,077.00
20 GPM	P1@8.00	Ea	992.00	294.00	—	1,286.00



Hair and lint interceptor

1½"	P1@.650	Ea	211.00	23.90	—	234.90
2"	P1@.750	Ea	301.00	27.50	—	328.50



All bronze ¾" to 1½" in-line NPT pump

1/12 HP	P1@1.50	Ea	551.00	55.10	—	606.10
1/6 HP	P1@1.50	Ea	823.00	55.10	—	878.10
1/4 HP	P1@1.50	Ea	965.00	55.10	—	1,020.10

Kitchen Equipment Connections

Description	Craft@Hrs	Unit	Material \$	Labor \$	Equipment \$	Total \$
-------------	-----------	------	-------------	----------	--------------	----------

Kitchen appliance gas trim

1/2"	P1@1.15	Ea	40.60	42.20	—	82.80
3/4"	P1@1.30	Ea	74.30	47.70	—	122.00
1"	P1@1.60	Ea	86.10	58.70	—	144.80
1 1/4"	P1@2.10	Ea	142.00	77.10	—	219.10
1 1/2"	P1@2.50	Ea	180.00	91.80	—	271.80
2"	P1@3.00	Ea	240.00	110.00	—	350.00

Hot and cold water supply

1/2"	P1@1.10	Ea	40.30	40.40	—	80.70
3/4"	P1@1.55	Ea	57.00	56.90	—	113.90
1"	P1@1.90	Ea	77.70	69.70	—	147.40
1 1/4"	P1@2.50	Ea	109.00	91.80	—	200.80
1 1/2"	P1@3.00	Ea	136.00	110.00	—	246.00

Continuous waste

2-part	P1@.250	Ea	60.80	9.18	—	69.98
3-part	P1@.350	Ea	103.00	12.80	—	115.80
4-part	P1@.450	Ea	132.00	16.50	—	148.50

Indirect waste

1/2"	P1@1.05	Ea	13.00	38.50	—	51.50
3/4"	P1@1.50	Ea	22.00	55.10	—	77.10
1"	P1@1.90	Ea	35.30	69.70	—	105.00
1 1/4"	P1@2.15	Ea	52.20	78.90	—	131.10
1 1/2"	P1@2.60	Ea	68.80	95.40	—	164.20
2"	P1@3.00	Ea	105.00	110.00	—	215.00

Kitchen fixture waste tailpiece

1 1/2"	P1@.100	Ea	13.10	3.67	—	16.77
--------	---------	----	-------	------	---	-------

Kitchen fixture trap with solder bushing

1 1/2"	P1@.250	Ea	44.00	9.18	—	53.18
2"	P1@.300	Ea	61.00	11.00	—	72.00

Description	Craft@Hrs	Unit	Material \$	Labor \$	Equipment \$	Total \$
-------------	-----------	------	-------------	----------	--------------	----------

Water closet, floor-mounted, flush tank, white vitreous china, lined tank. Complete with trim. Make additional allowances for rough-in. Based on American Standard Cadet series. ADA means American Disabilities Act compliant. (Wheelchair accessible)

Round bowl	P1@2.10	Ea	265.00	77.10	—	342.10
Elongated bowl	P1@2.10	Ea	320.00	77.10	—	397.10
ADA, 18" high	P1@2.10	Ea	436.00	77.10	—	513.10



Water closet, floor-mounted, flush valve, white vitreous china.

Complete with trim. Make additional allowances for rough-in. Based on American Standard. ADA means American Disabilities Act compliant. (Wheelchair accessible)

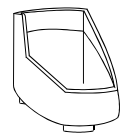
Elongated bowl	P1@2.60	Ea	415.00	95.40	—	510.40
Elongated bowl, ADA 18" high	P1@2.60	Ea	493.00	95.40	—	588.40
Elongated bowl with a bedpan cleanser	P1@4.10	Ea	717.00	150.00	—	867.00
Elongated bowl, ADA 18" high with a bedpan cleanser	P1@4.10	Ea	776.00	150.00	—	926.00

Water closet, wall-hung, flush valve, white vitreous china. Complete with fixture carrier and all trim. Make additional allowances for rough-in. Based on American Standard Afdwall series.

Elongated bowl	P1@3.55	Ea	658.00	130.00	—	788.00
Elongated bowl with electronic flush valve	P1@3.80	Ea	1,180.00	139.00	—	1,319.00
Elongated bowl with bedpan cleanser	P1@5.05	Ea	953.00	185.00	—	1,138.00
Electronic flush valve, add	P1@.600	Ea	519.00	22.00	—	541.00

Urinal, wall-hung, flush valve, white vitreous china. Complete with trim. Make additional allowances for rough-in.

Siphon-jet type	P1@3.15	Ea	658.00	116.00	—	774.00
Wash-out type	P1@3.10	Ea	537.00	114.00	—	651.00
Wash-down type	P1@3.00	Ea	379.00	110.00	—	489.00
Urinal carrier, add	P1@.600	Ea	120.00	22.00	—	142.00
Electronic flush valve, add	P1@.600	Ea	428.00	22.00	—	450.00



Urinal, stall-type, flush valve, white vitreous china. Complete with trim. Make additional allowances for rough-in.

Stall urinal	P1@5.00	Ea	1,280.00	184.00	—	1,464.00
--------------	---------	----	----------	--------	---	----------

Plumbing Fixtures

Description **Craft@Hrs** **Unit** **Material \$** **Labor \$** **Equipment \$** **Total \$**

Lavatory, wall-hung, white vitreous china. Complete with trim and fixture carrier. Make additional allowances for rough-in. ADA means American Disabilities Act compliant. (Wheelchair accessible)



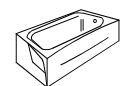
Wall-hung lav	P1@2.70	Ea	550.00	99.10	—	649.10
Wall-hung, ADA	P1@2.70	Ea	801.00	99.10	—	900.10
Fixture carrier	P1@.500	Ea	114.00	18.40	—	132.40

Countertop lavatory, white. Complete with trim. Make additional allowances for rough-in.



Vitreous china	P1@2.00	Ea	407.00	73.40	—	480.40
Enameled steel	P1@2.00	Ea	344.00	73.40	—	417.40
Acrylic	P1@2.00	Ea	250.00	73.40	—	323.40

Bathtub, white, 60" x 32". Complete with trim, including shower head. Make additional allowances for rough-in.

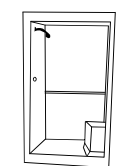


Enameled steel	P1@2.50	Ea	573.00	91.80	—	664.80
Cast iron	P1@3.50	Ea	828.00	128.00	—	956.00
Fiberglass	P1@2.50	Ea	529.00	91.80	—	620.80
Acrylic	P1@2.50	Ea	566.00	91.80	—	657.80

Tub and shower combination, fiberglass, white. Complete with trim. Make additional allowances for rough-in.

One-piece	P1@4.50	Ea	1,180.00	165.00	—	1,345.00
Two-piece (reno)	P1@5.50	Ea	1,510.00	202.00	—	1,712.00
Four-piece (reno)	P1@6.25	Ea	1,600.00	229.00	—	1,829.00

Shower stall, white, 36" x 36". Complete with trim. Make additional allowances for rough-in.



Fiberglass one-piece	P1@3.50	Ea	732.00	128.00	—	860.00
Fiberglass three-piece	P1@4.25	Ea	944.00	156.00	—	1,100.00
Acrylic one-piece	P1@3.50	Ea	1,100.00	128.00	—	1,228.00
Acrylic three-piece	P1@4.25	Ea	1,440.00	156.00	—	1,596.00

Shower basin, 36" x 36". Complete with trim (faucet, shower head and strainer). Make additional allowances for rough-in.

Fiberglass	P1@2.50	Ea	499.00	91.80	—	590.80
Acrylic	P1@2.50	Ea	537.00	91.80	—	628.80
Molded stone	P1@2.65	Ea	519.00	97.30	—	616.30

Plumbing Fixtures

Description Craft@Hrs Unit Material \$ Labor \$ Equipment \$ Total \$

Kitchen sink, double compartment. Complete with trim. Make additional allowances for rough-in.

Stainless steel	P1@2.15	Ea	420.00	78.90	—	498.90
Cast iron	P1@2.50	Ea	548.00	91.80	—	639.80
Acrylic	P1@2.15	Ea	497.00	78.90	—	575.90



Kitchen sink, single compartment. Complete with trim. Make additional allowances for rough-in.

Stainless steel	P1@2.00	Ea	355.00	73.40	—	428.40
Cast iron	P1@2.10	Ea	409.00	77.10	—	486.10
Acrylic	P1@2.00	Ea	369.00	73.40	—	442.40

Bar sink. Complete with trim. Make additional allowances for rough-in.

Stainless steel	P1@2.00	Ea	302.00	73.40	—	375.40
Acrylic	P1@2.00	Ea	203.00	73.40	—	276.40



Exam room sink. Complete with trim. Make additional allowances for rough-in.

Stainless steel	P1@2.10	Ea	438.00	77.10	—	515.10
Acrylic	P1@2.10	Ea	374.00	77.10	—	451.10

Laboratory sink. Complete with trim. Make additional allowances for rough-in.

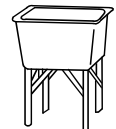
Stainless steel	P1@2.25	Ea	502.00	82.60	—	584.60
Acrylic	P1@2.25	Ea	438.00	82.60	—	520.60

Laundry sink, double compartment. Complete with trim. Make additional allowances for rough-in.

Cast iron	P1@3.50	Ea	587.00	128.00	—	715.00
Acrylic	P1@2.25	Ea	258.00	82.60	—	340.60

Laundry sink, single compartment. Complete with trim. Make additional allowances for rough-in.

Cast iron	P1@2.75	Ea	508.00	101.00	—	609.00
Acrylic	P1@2.00	Ea	178.00	73.40	—	251.40



Mop sink, floor-mounted, 36" x 24". Complete with trim. Make additional allowances for rough-in.

Molded stone	P1@2.65	Ea	715.00	97.30	—	812.30
Terrazzo	P1@2.65	Ea	788.00	97.30	—	885.30
Acrylic	P1@2.35	Ea	551.00	86.20	—	637.20

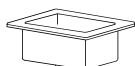
Plumbing Fixtures

Description Craft@Hrs Unit Material \$ Labor \$ Equipment \$ Total \$



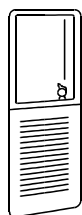
Slop sink, enameled cast iron with P-trap, standard. Complete with trim. Make additional allowances for rough-in.

Slop sink with P-trap, std.	P1@3.50	Ea	1,230.00	128.00	—	1,358.00
-----------------------------	---------	----	----------	--------	---	----------



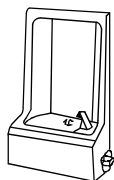
Floor sink, recessed, enameled steel, white. Add 40% to material prices for acid-resisting finish. Complete with strainer. Make additional allowances for rough-in.

9" x 9"	P1@1.00	Ea	105.00	36.70	—	141.70
12" x 12"	P1@1.00	Ea	123.00	36.70	—	159.70
15" x 15"	P1@1.15	Ea	83.70	42.20	—	125.90
18" x 18"	P1@1.25	Ea	110.00	45.90	—	155.90
24" x 24"	P1@1.50	Ea	149.00	55.10	—	204.10



Drinking fountain, refrigerated, stainless steel. Complete with trim. Make additional allowances for rough-in. ADA means American Disabilities Act compliant. (Wheelchair accessible)

Free-standing	P1@2.00	Ea	1,260.00	73.40	—	1,333.40
Semi-recessed	P1@2.50	Ea	1,670.00	91.80	—	1,761.80
Fully-recessed	P1@2.50	Ea	2,890.00	91.80	—	2,981.80
Wall-hung	P1@2.00	Ea	1,180.00	73.40	—	1,253.40
Wall-hung, ADA	P1@2.50	Ea	2,890.00	91.80	—	2,981.80



Drinking fountain, non-refrigerated. Complete with trim. Make additional allowances for rough-in. ADA means American Disabilities Act compliant. (Wheelchair accessible) S.S. means stainless steel.

Recessed, china	P1@2.50	Ea	972.00	91.80	—	1,063.80
Wall-hung, china	P1@2.00	Ea	554.00	73.40	—	627.40
Recessed, S.S.	P1@2.50	Ea	1,110.00	91.80	—	1,201.80
Wall-hung, S.S.	P1@2.00	Ea	590.00	73.40	—	663.40
ADA, S.S.	P1@2.50	Ea	1,010.00	91.80	—	1,101.80

Plumbing Fixtures Rough-in

Description	Craft@Hrs	Unit	Material \$	Labor \$	Equipment \$	Total \$
Commercial plumbing fixture rough-in. Includes type L copper supply pipe and DWV copper (to 2½") or cast iron (MJ) DWV (over 2½") drain and vent piping. Make additional allowances for plumbing fixtures and trim. Use these costs for preliminary estimates.						
Water closet, wall-hung, flush valve, with carrier	P1@2.25	Ea	883.00	82.60	—	965.60
Water closet, wall-hung, flush valve, no carrier	P1@1.95	Ea	809.00	71.60	—	880.60
Water closet, floor-mounted, flush valve	P1@2.75	Ea	715.00	101.00	—	816.00
Water closet, floor-mounted, tank type	P1@2.25	Ea	548.00	82.60	—	630.60
Bidet	P1@2.00	Ea	382.00	73.40	—	455.40
Urinal, wall-hung, flush valve, with carrier	P1@3.10	Ea	963.00	114.00	—	1,077.00
Urinal, wall-hung, flush valve, without carrier	P1@2.35	Ea	548.00	86.20	—	634.20
Lavatory, wall-hung, with carrier	P1@2.40	Ea	793.00	88.10	—	881.10
Lavatory	P1@1.90	Ea	382.00	69.70	—	451.70
Sink	P1@1.90	Ea	411.00	69.70	—	480.70
Bath tub	P1@2.35	Ea	587.00	86.20	—	673.20
Shower	P1@2.60	Ea	688.00	95.40	—	783.40
Mop sink	P1@2.40	Ea	487.00	88.10	—	575.10
Slop sink	P1@2.60	Ea	349.00	95.40	—	444.40
Laundry tub	P1@1.95	Ea	414.00	71.60	—	485.60
Wash fountain	P1@2.10	Ea	447.00	77.10	—	524.10
Lab sink, glass drainage	P1@3.80	Ea	1,760.00	139.00	—	1,899.00
Lab sink, acid resistant plastic drainage	P1@2.65	Ea	280.00	97.30	—	377.30
Drinking fountain	P1@2.20	Ea	304.00	80.70	—	384.70
Emergency eyewash and shower	P1@1.75	Ea	115.00	64.20	—	179.20
Washing machine	P1@2.25	Ea	445.00	82.60	—	527.60

Plumbing Fixtures Rough-in

Description	Craft@Hrs	Unit	Material \$	Labor \$	Equipment \$	Total \$
-------------	-----------	------	-------------	----------	--------------	----------

Commercial plumbing fixture group rough-in. Includes Type L copper supply pipe and DWV copper (to 2½") or cast iron (MJ) DWV (over 2½") drain and vent piping. Make additional allowances for plumbing fixtures and trim. Use these costs for preliminary estimates.

3-piece washroom group	P1@5.50	Ea	1,050.00	202.00	—	1,252.00
3-piece washroom group back to back	P1@9.75	Ea	1,940.00	358.00	—	2,298.00
Kitchen sink, back to back	P1@2.15	Ea	566.00	78.90	—	644.90
Battery of water closets, floor-mounted, tank type, per water closet	P1@1.75	Ea	441.00	64.20	—	505.20
Battery of water closets, floor-mounted, flush valve, per water closet	P1@2.20	Ea	576.00	80.70	—	656.70
Battery of water closets, wall-hung, flush valve, with carrier, per water closet	P1@1.80	Ea	758.00	66.10	—	824.10
Battery of water closets, wall-hung, flush valve, without carrier, per water closet	P1@1.50	Ea	222.00	55.10	—	277.10
Battery of urinals, wall-hung, flush valve with carrier, per urinal	P1@2.45	Ea	911.00	89.90	—	1,000.90
Battery of urinals, wall-hung, flush valve without carrier, per urinal	P1@1.90	Ea	470.00	69.70	—	539.70
Battery of lavatory basins, wall-hung, with carrier, per lavatory	P1@2.00	Ea	709.00	73.40	—	782.40
Battery of lavatory basins, without carrier, per lavatory	P1@1.50	Ea	320.00	55.10	—	375.10

Residential plumbing fixture rough-in. Includes polyethylene (PE) supply pipe and ABS DWV drain and vent piping. Make additional allowances for plumbing fixtures and trim. Use these costs for preliminary estimates.

Water closet, floor-mounted, tank type	P1@2.00	Ea	122.00	73.40	—	195.40
Bidet	P1@1.85	Ea	91.70	67.90	—	159.60
Lavatory	P1@1.75	Ea	91.70	64.20	—	155.90
Counter sink	P1@1.75	Ea	101.00	64.20	—	165.20
Bathtub	P1@2.10	Ea	91.70	77.10	—	168.80
Shower	P1@2.45	Ea	134.00	89.90	—	223.90
Laundry tub	P1@1.75	Ea	83.70	64.20	—	147.90
Washing machine	P1@2.00	Ea	104.00	73.40	—	177.40

Index

A		
ABS, DWV pipe	150	
1/8 bend.....	150	
1/4 bend.....	150	
adapters.....	152	
bushings	152	
cleanouts	152	
closet bend	150	
closet flanges.....	150	
combinations	151	
couplings	153	
hanger assemblies	153	
P-traps	151	
reducers.....	153	
riser clamps	153	
solvent-weld joints	152-153	
tees.....	151	
wyes	151-152	
ABS, DWV, test cap	152	
A/C systems	286	
Access doors, steel	121	
Accessories		
iron filter.....	23	
water softener.....	23	
Acid DWV systems	164	
Actuator, damper.....	404	
Adapters		
copper, DWV, soldered	148	
copper, press fit.....	88	
CPVC sprinkler pipe	184	
F.I.P., ABS.....	152	
PE-AL pipe	113	
PEX-AL pipe	113	
polypropylene pipe	166	
PVC, DWV.....	156	
PVC, Schedule 40	94	
PVC, Schedule 80	104	
PVC sewer, bell & spigot.....	163	
Schedule 5 steel, pressfit	236	
Schedule 10 steel, roll-grooved.....	275	
Schedule 40 steel, cut-grooved.....	281	
Schedule 40 steel, roll-grooved.....	268	
Type K copper, brazed.....	37	
Type K copper, soldered	47-48	
Type L copper, brazed	56	
Type L copper, soldered.....	64	
Type M copper, brazed	73	
Type M copper, soldered.....	81	
Additional costs	8	
Adjusting costs	7	
Air admittance valve	328	
Air balance software.....	338	
Air balancing		
air handling units	402	
centrifugal fans	403	
diffusers	402	
fan coil units	403	
fume hoods.....	403	
grilles	403	
terminal boxes	402	
Air compressor	406	
rental.....	420	
Air conditioning		
budget estimates	435	
residential	286	
Air conditioning condensate systems		
PVC, Schedule 40	91	
PVC, Schedule 80	101	
Type K copper, brazed.....	33	
Type K copper, soldered	43	
Type L copper, brazed	53	
Type L copper, soldered.....	61	
Type M copper, brazed	70	
Type M copper, soldered.....	78	
Air conditioning units	288	
Air cooled condenser.....	426	
condensing unit	212	
Air grilles, return	333	
Air handling equipment		
air conditioner	288	
exhaust fans	326	
housings	331	
ventilators	326	
Air handling units.....	289	
accessories.....	290	
air balancing	402	
coil connection.....	297-298	
removal.....	424	
Air mixing box, removal.....	423	
Air separators, Rolaitrol type.....	201	
Air vents	121	
Alarm valves.....	171	
Apartments, HVAC estimates.....	437	
Area drains	168	
installation costs	435	
Arresters, water hammer.....	133	
As-built drawings	421	
Assemblies		
air conditioning	286	
forced air heating.....	287	
Auditoriums, HVAC estimates	437	
B		
Backfill costs, trenching.....	418	
Backflow preventers		
double check	120	
reduced pressure.....	119	
Backhoes, rental.....	420	
Balancing valves PEX-AL pipe... 114, 118		
Ball valves		
copper, press fit.....	88	
PEX-AL pipe.....	114, 118	
pipe and plumbing specialty... 126-127		
PVC, Schedule 40	97	
PVC, Schedule 80	107	
PVC, Solid body, EDPM.....	97, 107	
PVC, Solid body, threaded	97, 107	
PVC, Tru-union, threaded	97, 107	
PVC, Union type, Solvent		
weld.....	98, 107	
Schedule 40 steel, threaded.....	230	
Schedule 80 steel, threaded.....	252	
Type K copper, brazed.....	40	
Type K copper, soldered	50	
Type L copper, brazed	59	
Type L copper, soldered.....	67	
Type M copper, brazed	76	
Type M copper, soldered.....	84	
Banks, HVAC estimates	437	
Bar sinks.....	29	
estimating	435	
Barber shops, HVAC estimates	437	
Base wage.....	6	
Baseboard fins	204	
Bathroom		
fans.....	328-329	
fixtures	28	
heaters.....	328	
Bathroom sink, disconnect	433	
Bathtubs	28	
disconnect	433	
estimating	435	
Beauty shops, HVAC estimates	437	
Bell & spigot pipe, PVC.....	159	
Benders, hydraulic, rental.....	420	
Bends		
ABS, DWV pipe	150	
cast iron, no-hub.....	136-138	
class 110 DI, cement lined	411	
class 150 cast iron.....	412	
class 153 DI, cement lined	407	
class 153 DI, double cement		
lined.....	409	
class 2400 or 3000 asbestos		
cement.....	413	
copper, DWV, soldered	147	
polypropylene pipe	164	
PVC, DWV.....	159-160	
PVC sewer, bell & spigot.....	160	
Bevel machines, rental	420	
Billing breakdown worksheet... 461-462		

Biomass fired	Type M copper, brazed77	roll grooved, Victaulic178
boilers 319-320	Type M copper, soldered.....85	Schedule 10 steel, roll-grooved....276
central airspace heater.....321	Boom lifts, rental.....420	Schedule 40 steel, cut-grooved....282
Black steel pipe 177	Booster heaters25	Schedule 40 steel, roll-grooved....269
assemblies.....176	Bore holes, geothermal317	Schedule 40 steel, threaded.....226
Blowers, centrifugal324	Bowling alleys, HVAC estimates437	Schedule 40 steel, welded217
Boiler	Branch pipe and fittings, sprinkler...182	Schedule 80 steel, threaded.....250
blowdown.....203	Brazed joint pipe	Schedule 80 steel, welded241
burners195	Type K copper33	Schedule 160 steel, welded261
stack203	Type L copper53	Type K copper, brazed38
trim.....204	Type M copper70	Type K copper, soldered48
Boiler connections190	Bucket steam trap126	Type L copper, brazed57
boiler pumps205	Budget estimating.....435	Type L copper, soldered.....65
Boilers	Buildings, HVAC estimates437	Type M copper, brazed74
biomass fired 319-320	Burners, dual fuel195	Type M copper, soldered.....82
pulse type322	Bushings	Carbon steel fittings..... 214-265
removal.....425	ABS152	Carbon steel pipe
steam heating189	PVC, DWV156	Schedule 40.....180
Boilers, commercial	PVC, Schedule 4094	Schedule 80.....238
accessories.....204	PVC, Schedule 80104	Cast iron class 150.....412
adjusting198	Type K copper, brazed38	Cast iron DWV pipe, hub & spigot...141
cast iron185	Type K copper, soldered48	1/16 bend.....142
chemical feed pump202	Type L copper, brazed57	1/8 bend.....141
combustion controls..... 197-198	Type L copper, soldered.....65	1/4 bend.....141
combustion train192	Type M copper, brazed74	bends142
components204	Type M copper, soldered.....82	closet flanges.....142
deaerator/condenser201	Butterfly valves	combinations143
electrical service196	pipe and plumbing specialty127	gaskets145
feedwater pumps197	PVC, Schedule 4096	hanger assemblies145
firebox.....187	PVC, Schedule 80106	P-traps142
firetube..... 186-187	Schedule 10 steel, roll-grooved....277	reducers.....144
fuel train piping..... 193-194	Schedule 40 steel, cut-grooved....283	riser clamps145
packaged, feedwater systems202	Schedule 40 steel, roll-grooved....270	sanitary tees142
pumping unit201	Schedule 40 steel, threaded.....230	tees142
refractory197	Schedule 40 steel, welded .. 219-220	wyes 143-144
stacks203	Schedule 80 steel, threaded.. 251-252	Cast iron DWV pipe, mechanical
water softening systems.....198	Schedule 80 steel, welded243	joint.....135
watertube188	Type K copper, brazed39	Cast iron DWV pipe, no-hub135
Boilers, gas fired	Type K copper, soldered50	1/8 bend..... 135-136
cast iron189	Type K & L copper, roll grooved90	1/4 bend.....136
steel188	Type L copper, brazed58	caps139
Bolt and gasket sets	Type L copper, soldered.....66	closet bends136
pipe and plumbing specialty122	Type M copper, brazed75	closet flanges.....136
polypropylene pipe167	Type M copper, soldered.....83	combinations138
PVC, Schedule 4099		couplings139
PVC, Schedule 80109		crosses139
Schedule 10 steel, roll-grooved....279	C	hanger assemblies140
Schedule 40 steel, cut-grooved....284	Calcium silicate pipe insulation399	horizontal assembly.....135
Schedule 40 steel, roll-grooved....271	California Code, 2010.....199	P-traps136
Schedule 40 steel, threaded.....232	Can washers, installation costs.....435	reducers.....139
Schedule 40 steel, welded222	Caps	riser clamps140
Schedule 80 steel, threaded.....253	cast iron, no-hub.....139	tees 138-139
Schedule 80 steel, welded245	cast iron, threaded.....181	wyes 136-138
Schedule 160 steel, full face264	CPVC sprinkler pipe184	Cast iron sprinkler pipe fittings
Schedule 160 steel, ring face.....264	PE-AL pipe114, 117	cap181
Type K copper, brazed.....41	PEX-AL pipe114, 117	couplings181
Type K copper, soldered52	PVC sewer, bell & spigot.....163	cross181
Type L copper, brazed60	PVC, Schedule 4095	ells180
Type L copper, soldered.....68	PVC, Schedule 80105	plugs181

reducers.....	180	Closed loop heat pump	306	Computer rooms, HVAC estimates ...	437
reducing tee.....	180	Close-out items	421	Condenser units	205
Ceiling diffusers.....	334-335	Closet bends, ABS, DWV pipe.....	150	Condenser water systems	
Central air space heater,		Closet flanges		Schedule 40 steel, cut-grooved....	280
biomass fired.....	321	ABS, DWV pipe	150	Schedule 40 steel, roll-grooved....	266
Central dehumidification.....	300	cast iron, hub & spigot.....	142	Condensing units, air cooled.....	212
Centrifugal blowers.....	324	cast iron, no-hub.....	136	Condominiums, HVAC estimates....	437
Centrifugal fans, air balancing.....	403	copper, DWV, soldered	147	Configurable controller	338
Centrifugal pumps, HVAC	206	PVC, DWV.....	155-156	Connections	
Centrifugal water-cooled chiller.....	211	Clothes dryers, exhaust.....	327	air handling unit, HVAC	297-298
Ceramic heater	304	Cocktail lounges, HVAC estimates...437		continuous waste.....	26
Chain hoists, rental.....	420	Coil connection, air handling		fire department	174
Change estimates	438-448	unit.....	297-298	flexible duct.....	343
change order log	443	Coil, duct mounted, removal	429	hot and cold water supply	26
example	439	Coils, reheat, HVAC	209	indirect waste.....	26
summary	442, 446	Cold water connections.....	26	kitchen equipment	26
take-off.....	440, 444	Collars, galvanized steel	343	Siamese.....	174
worksheet	441, 445	Combinations		water heaters.....	21
Check valves	171	ABS	151	Connectors, pipe	123
Chemical feed pump, boiler	202	cast iron, hub & spigot.....	143	flexible	124
Chemical feed system	202	cast iron, no-hub.....	138	Construction schedule.....	453-455
Chemical systems		copper, DWV, soldered	147	Contents	3
polypropylene, DWV.....	164	polypropylene pipe	165	Continuous waste connections.....	26
PVC, Schedule 40	91	Combustion controls, boiler.....	197-198	Control modules, pollution.....	199
PVC, Schedule 80	101	Combustion monitoring	205	Control valves	
Chilled water systems		Combustion train, boiler	192	2 way	405-406
Schedule 10 steel, roll-grooved...273		Come-alongs, rental.....	420	3 way	405-406
Schedule 40 steel, cut-grooved...280		Commercial boilers.....	186-189	electric	405
Schedule 40 steel, roll-grooved...266		combustion trains	192	pipe and plumbing specialty ...	132-133
Schedule 40 steel, threaded.....223		components and accessories.....204		pneumatic.....	406
Schedule 80 steel, threaded.....247		connections	190	PVC, Schedule 40	99
Type K copper, brazed.....	33	Commercial fans and blowers.....	324	PVC, Schedule 80	109
Type K copper, soldered	43	Commercial fixture rough-ins	31	Schedule 10 steel, roll-grooved...278	
Type L copper, brazed	53	group	32	Schedule 40 steel, cut-grooved...284	
Type L copper, soldered.....	61	Commercial water heaters	19, 20	Schedule 40 steel, roll-grooved...271	
Type M copper, brazed	70	Compaction, trenching	418	Schedule 40 steel, threaded.....231	
Type M copper, soldered.....	80	Compactors, rental.....	420	Schedule 40 steel, welded	221
Chillers		Companion flanges		Schedule 80 steel, threaded.....253	
centrifugal	211	150 pound, threaded	122	Schedule 80 steel, welded ...	244-245
drinking fountain	30	300 pound, threaded	122	Schedule 160 steel, flanged... 263-264	
reciprocating.....	211	PVC	122	Schedule 160 steel, threaded.....263	
removal.....	426	PVC, Schedule 40	99	Type K copper, brazed	41
water cooled, connection.....211		PVC, Schedule 80	109	Type K copper, soldered	51
Chlorinated polyvinyl chloride pipe...183		Schedule 40 steel, threaded.....232		Type L copper, brazed	60
Churches, HVAC estimates.....	437	Type K copper, brazed.....	41	Type L copper, soldered.....	68
Circuit balance valves	127	Type K copper, soldered	51	Type M copper, brazed	77
Circulating pumps		Type L copper, brazed	60	Type M copper, soldered.....	85
all bronze	120	Type L copper, soldered.....	68	Controllers	338
iron body.....	121	Type M copper, brazed	77	Controls	
Clarifications.....	8	Type M copper, soldered.....	85	boiler.....	203
Classrooms, HVAC estimates	437	welding type.....	121	HVAC.....	404
Cleanouts		Composite pipe	111	Cooling systems, residential.....	286
ABS	152	compression fittings.....	116	Cooling towers	
ABS/PVC	169	compression joint fittings.....	117	connection assembly.....	213
copper, DWV, soldered	147	compression joints.....	116	demolition	427
end-of-line.....	169	crimped joint	111	forced draft	213
floor.....	169	crimped joint fittings.....	111-112	galvanized steel.....	212
installation costs	435	Compressed air systems		induced draft.....	212
PVC, DWV.....	157	Type K copper, brazed.....	33	removal.....	427
wall	169	Type L copper, brazed	53	Cooling units, variable volume	337

Copper fittings, roll grooved	89	thermometers with wells	52	Copper pipe, Type M soldered....	78-79
Copper pipe	89	unions	48	adapters	81
ball valve, press fit	88	valves	49-51	bolt and gasket sets	85
coupling, press fit	86	Copper pipe, Type K & L	89-90	bushings	82
ells, press fit	86	coupling	90	caps	82
female adapter, press fit	88	ells	89	companion flanges	85
male adapter, press fit	88	flange adapter	90	couplings	82
tee, press fit	87	reducers	90	ells	79-80
tee, reducing, press fit	87	roll grooved	89	maximum working pressure	78
union, press fit	87	tees	89	pressure gauges	85
Copper pipe, DWV, soldered	146	valves	90	reducers	81
1/8 bend	146	Copper pipe, Type L brazed	53-54	strainers	84
1/4 bend	147	adapters	56	tees	80
adapters	148	bolt and gasket sets	60	thermometers with wells	85
assembly with riser	146	bushings	57	unions	82
cleanouts	147	caps	57	valves	83-85
closet flanges	147	companion flanges	60	Copper piping, removal	430
combinations	147	couplings	57	Correction factors	6
couplings	148	ells	54-55	Countertop sinks/lavatories	28
crosses	147	pressure gauges	60	Couplings	
hanger assemblies	149	reducers	56	ABS	153
horizontal assemblies	146	strainers	59	cast iron, no-hub	139
P-traps	147	tees	55	cast iron, threaded	181
reducers	148	thermometers with wells	60	copper, DWV, soldered	148
riser clamps	149	unions	57	copper, press fit	86
tees	147	valves	58-60	CPVC sprinkler pipe	183
test caps	148	Copper pipe, Type L soldered	61-62	galvanized steel spiral duct	359
test tees	148	adapters	64	PE-AL pipe	112-113, 117
wyes	147	bolt and gasket sets	68	PEX-AL pipe	113, 117
Copper pipe, Type K brazed	33-34	bushings	65	polypropylene pipe	166
adapters	37	caps	65	PVC, DWV	156
bolt and gasket sets	41	companion flanges	68	PVC, Schedule 40	95
bushings	38	couplings	65	PVC, Schedule 80	105
caps	38	ells	62-63	PVC sewer, bell & spigot	160
companion flanges	41	hanger assemblies	69	roll grooved, Victaulic	179
couplings	38	maximum working pressure	61	Schedule 5 steel, pressfit	235-236
ells	34-35	pressure gauges	68	Schedule 10 steel, roll-grooved	276
hanger assemblies	42	reducers	64	Schedule 40 steel, cut-grooved	282
pressure gauges	41	riser clamps	69	Schedule 40 steel, roll-grooved	269
reducers	37	strainers	67	Schedule 40 steel, threaded	226
riser clamp	42	tees	63	Schedule 80 steel, threaded	251
strainers	40	thermometers with wells	68	Type K copper, brazed	38
tees	35-36	unions	65	Type K copper, soldered	49
thermometers with wells	41	valves	66-68	Type K & L copper, roll grooved	90
unions	38	Copper pipe, Type M brazed	70-71	Type L copper, brazed	57
valves	39-41	adapters	73	Type L copper, soldered	65
Copper pipe, Type K soldered	43-44	bolt and gasket sets	77	Type M copper, brazed	74
adapters	47-48	bushings	74	Type M copper, soldered	82
bolt and gasket sets	52	caps	74	CPVC sprinkler pipe	183
bushings	48	companion flanges	77	adapters	184
caps	48	couplings	74	cap	184
companion flanges	51	ells	71	coupling	183
couplings	49	maximum working pressure	70	elbows	183
ells	44-45	pressure gauges	77	fittings	184
hanger assemblies	52	reducers	73	flange	184
pressure gauges	52	strainers	76	head adapter	184
reducers	47	tees	72	reducing tees	183
riser clamps	52	thermometers with wells	77	tees	183
strainers	51	unions	74	Craft codes	7
tees	45-46	valves	75-77	Craft@hrs	5

Cranes, rental.....	420	removal.....	432	CPVC sprinkler.....	183
Crew composition.....	7	Drinking water tank.....	415-416	Electric water heaters.....	19
Crimp rings		Drops and tees, ductwork	391-393	Electrical service for boilers	196
PE-AL pipe	115, 118	Dry valves.....	171	Ells	
PEX-AL pipe	115, 118	Dryers, exhaust.....	327	cast iron, threaded.....	180
Croll-Reynolds.....	199	Dual-fuel burners.....	195	copper, press fit.....	86
Cross linked PEX-AL.....	111	Duct insulation		PE-AL pipe	111-112, 116-117
Cross linked Polyethylene-		calcium silicate	399	PEX-AL pipe.....	111-112, 116-117
Aluminum pipe	116	fiberglass	401	PVC, DWV.....	154
Crucibles		removal.....	434	PVC, Schedule 40.....	92
cast iron, no-hub.....	139	Duct lining		PVC, Schedule 80.....	102-103
cast iron, threaded.....	181	calcium silicate	399	Schedule 5 steel, pressfit	234-235
copper, DWV, soldered	147	fiberglass	401	Schedule 10 steel, roll-grooved....	274
Schedule 40 steel, threaded.....	225	Duct markers.....	421	Schedule 40 steel, cut-grooved....	280
Schedule 80 steel, threaded.....	250	Ductwork		Schedule 40 steel, roll-grooved....	267
D		correction factors.....	340	Schedule 40 steel, threaded.....	224
Daily rental, equipment.....	420	demolition	422	Schedule 40 steel, welded	215
Dampers		removal.....	422	Schedule 80 steel, threaded.....	248
actuator.....	404	Ductwork specialties		Schedule 80 steel, welded	238
correction factors	340	collars.....	343	Schedule 160 steel,	
fire.....	340	connections	343	threaded	257-258
fusible plug	341	dampers.....	339-340	Schedule 160 steel, welded ...	257-258
rectangular.....	339	flexible connections	343	Type K copper, brazed	34-35
round	339	turning vanes.....	342	Type K copper, soldered	44-45
Deaerator/condenser, boiler.....	201	Ductwork, fiberglass		Type K & L copper, roll grooved ...	89
Deck drains, installation costs.....	435	fabrication labor.....	395	Type L copper, brazed	54-55
Deep well jet pump.....	313	installation costs	396	Type L copper, soldered.....	62-63
dehumidification.....	300	vinyl cover.....	396	Type M copper, brazed	71
Dehumidifiers.....	291-292	Ductwork, galvanized steel		Type M copper, soldered.....	79-80
Demolition.....	422	per pound installed	346-347	Emissions reduction module	199
Department stores, HVAC		rectangular.....	380	Emissions sensing.....	205
estimates	437	rectangular 20 gauge	378-380	Energy recovery	
Dielectric unions	38, 122	rectangular 22 gauge	373-377	ventilators	291-292
Diffusers		rectangular 24 gauge	371-373	wheel	301
air balancing	402	rectangular 26 gauge	369-370	Engraved nameplates	421
ceiling	334-335	rectangular fittings	381-393	Enthalpy energy and heat recovery...	301
removal.....	423	round fittings.....	394	Equipment	
Dishwashers.....	25	spiral	356-357	nameplates	421
Disinfection unit.....	25	spiral fittings.....	358-368	plumbing.....	19
Disposals, garbage.....	25	DWV pipe		rental costs	420
Domestic water iron filter.....	23	ABS	150	Equipment costs.....	7
Domestic water softeners.....	22-24	cast iron	135	Estimate detail sheet.....	16
Doors.....	121	cast iron, hub & spigot.....	141	Estimates, budget.....	435
Double check detector valves	171	copper.....	146	Estimating	
Downblast ventilation	329	polypropylene	164	accuracy	8
Drain, waste, vent pipe		polypropylene heat-fused	164	guidelines	13
cast iron, hub & spigot.....	141	PVC	154	Exclusions	8
cast iron, no-hub.....	135	E		Exhaust.....	327
copper.....	146	EDPM valves.....	97, 107	clothes dryer.....	327
polypropylene	164	Elastomeric gaskets	159	fans.....	325-329
PVC	154	Elastomeric pipe insulation.....	400	wall hood	327
Drains.....	168	Elbows, ductwork		Exhauster arrays	330
Drawings, as-built.....	421	galvanized steel spiral duct	358	Exhausters.....	329
Drilling wells	316	rectangular, galvanized steel...	381-390	Expansion tanks	123
Drinking fountains.....	30	round, galvanized steel	394	F	
disconnect	433	Elbows, pipe		F.O.B.	9
refrigerated	30	black steel.....	177-178	Fabrication, fiberglass ductwork.....	395

Fan coil units		Fittings		Floor sinks	30, 168
air balancing	403	ductwork	359	estimating	435
HVAC equipment	208	roll grooved	89	Flues, water heater	21
Fan coils	427	Fittings, pipe		Foot valve	314
Fan controls	327	copper, DWV, soldered	146	Forced air heating, residential	287
Fans		expansion tank	123	Forced-draft cooling tower	213
attic	326	M.I., 150 pound	224	Forklifts, rental	420
bathroom	326-328	malleable iron, Schedule 40	266	Forms and letters	438
ceiling exhaust	326-327	polypropylene	164	Fringe benefits	6
ceiling mounted	326	PVC, DWV	154	Front-end loaders, rental	420
centrifugal air foil	324	PVC sewer, bell & spigot	159	Fuel train piping	193-194
centrifugal utility	324	PVC, Schedule 40	92	Fume hoods, air balancing	403
commercial	326	PVC, Schedule 80	101-102	Furnace removal	425
exhaust	326, 328-329	Schedule 10 steel, roll-grooved	274	Furnaces, residential	299
exhaust, roof	325	Schedule 40 steel, cut-grooved	280	high efficiency	299
humidistat	327	Schedule 40 steel, roll-grooved	267	wall	300
kitchen	327	Schedule 40 steel, threaded	224	with A/C	299
roof	326	Schedule 40 steel, welded	215	Fusible plug dampers	341
room ventilation	326	Schedule 80 steel, threaded	248		
speed controller	327	Type K copper, brazed	42		
thru-wall	326	Type L copper, brazed	54		
timer	327	Type L copper, soldered	62	G	
tube-axial	325	Type M copper, brazed	71	Galvanized steel collars	343
vane-axial	324	Type M copper, soldered	79	Galvanized steel cooling tower	212
ventilation	326-327	Fixtures		Galvanized steel ductwork	
wall exhaust	326	bathroom	28	installation costs	345
wall mounted	326	disconnect	433	per pound installed	346-347
washroom	326-327	estimating costs	435	rectangular	369-380
Feedwater pumps, boiler	197	removal	432	rectangular 20 gauge	377-380
feedwater systems	205	Flange adapter, Type K & L		rectangular 22 gauge	373-377
Fiberglass		copper, roll grooved	90	rectangular 24 gauge	371-373
blanket	401	Flanges		rectangular 26 gauge	370
ductwork	396	CPVC sprinkler pipe	184	rectangular fittings	381-393
pipe insulation	397-398	polypropylene pipe	167	round	394
pressure tank	23	roll grooved, Victaulic	179	round elbow	394
rigid board	401	Schedule 10 steel, roll-grooved	276	round snap-lock	394
tank	24, 415	Schedule 40 steel, cut-grooved	282	spiral	356-357
Filter, iron	24	Schedule 40 steel, roll-grooved	269	spiral coupling	359
Fire dampers	340	Schedule 40 steel, threaded	232	spiral crosses	366-368
Fire department connection	174	Schedule 40 steel, welded	218	spiral elbows	358
Fire extinguisher	175	Schedule 40 steel, threaded	253	spiral tees	360-365
Fire extinguishing systems	322	Schedule 80 steel, welded	242	Galvanized steel pipe sleeves	153
Fire hydrant	175	Schedule 160 steel, slip on	262	Garbage disposals	25
Fire protection		Schedule 160 steel, weld neck	262	Gas furnaces	
CPVC sprinkler pipe	183	Flanges, companion		high efficiency	299
fire hose cabinets	173	150 pound, threaded	122	residential	299
plastic sprinkler pipe	183	150 pound, welding type	121	wall	300
pumps	174	300 pound, threaded	122	with A/C	299
Siamese connections	174	PVC	122	Gas heaters	303
sprinkler fittings	177-181	Flashing		Gas trim connections	26
sprinkler heads	172	pipe	167	Gas valves	133
sprinkler pipe	176-177	roof	123, 153, 158	Gas water heaters	19-20
steel pipe nipples	182	Flat panel water heater	323	tankless	20
switches	172	Flexible connections, ductwork	343	Gaskets	
valves	171	Flexible fiberglass duct	396	cast iron, hub & spigot	145
Fire pumps	174	Flexible pipe connectors	124	elastomeric	159
Firebox boilers	187	Floor drains	168	Gate valves	
Fire-rated doors	121	estimating	435	pipe and plumbing specialty	129-130
Firetube boilers	186-187			PVC, Schedule 40	96

PVC, Schedule 80.....	106	Schedule 10 steel, roll-grooved.....	279	Help.....	5
Schedule 10 steel, roll-grooved.....	276	Schedule 40 steel, cut-grooved.....	285	High rise offices, HVAC estimates ...	437
Schedule 40 steel, cut-grooved.....	283	Schedule 40 steel, roll-grooved.....	272	Holding tank	415-416
Schedule 40 steel, roll-grooved.....	269	Schedule 40 steel, threaded.....	232	Hood, duct kit	327
Schedule 40 steel, threaded... 229-230		Schedule 40 steel, welded	222	Hooks, pipe	125
Schedule 40 steel, welded	219	Schedule 80 steel, threaded.....	254	Hose bibbs	133
Schedule 80 steel, threaded.....	251	Schedule 80 steel, welded	246	Hot and cold water connections.....	26
Schedule 80 steel, welded	242	Schedule 160 steel.....	265	Hot water boilers	
Schedule 160 steel, flanged... 262-263		Type K copper, brazed	42	biomass fired	319-320
Type K copper, brazed.....	39	Type K copper, soldered	52	connections, HVAC	190
Type K copper, soldered	49	Type L copper, soldered.....	69	gas fired.....	185-187
Type L copper, brazed	58	Hangers, pipe	124	gas fired, cast iron.....	189
Type L copper, soldered.....	66	PE-AL	115, 118	gas fired, steel.....	188
Type M copper, brazed	75	PEX-AL.....	115, 118	high pressure.....	188
Type M copper, soldered.....	83	steel band.....	124	oil fired.....	187
Geothermal		Hard water softener.....	22-24	Hot water reheat coils	209
bore holes.....	317	Head adapter, CPVC.....	184	Hot water softener.....	24
heat pump.....	306-308	Headers, PEX-AL pipe	114	Hot water systems	
wells.....	316	Heads, sprinkler	172	piping.....	214
Globe valves		Heat/cool thermostat	405	Schedule 40 steel, cut-grooved....	280
pipe and plumbing specialty... 130-131		Heat exchangers		Schedule 40 steel, roll-grooved....	266
PVC, Schedule 40	96	demolition	429	Type K copper, brazed.....	33
PVC, Schedule 80	106	HVAC.....	207	Type K copper, soldered	43
Schedule 10 steel, roll-grooved....	277	removal.....	429	Type L copper, brazed	53
Schedule 40 steel, cut-grooved....	283	Heat pumps	307-311	Type L copper, soldered.....	61
Schedule 40 steel, roll-grooved....	270	accessories.....	312	Type M copper, brazed	70
Schedule 40 steel, threaded.....	230	air to air	309	Type M copper, soldered.....	78
Schedule 40 steel, welded	219	demolition	428	Hot water tank	
Schedule 80 steel, threaded.....	251	geothermal.....	306	disconnect	433
Schedule 80 steel, welded ... 242-243		removal.....	428	removal.....	432
Schedule 160 steel, flanged.....	263	split system.....	309	Hourly labor costs.....	6
Type K copper, brazed.....	39	supplemental electric heating		How to use this book.....	5
Type K copper, soldered	49	coil.....	312	HRV (heat recovery	
Type L copper, brazed	58	thermostats	312	ventilators).....	291-292
Type L copper, soldered.....	66	Heat reclaimer	204	Hub & spigot C.I. pipe, DWV.....	141
Type M copper, brazed	75	Heat recovery	203, 205, 301	Humidistat control.....	327
Type M copper, soldered.....	83	Heat recovery systems		HVAC	
Grease and oil interceptors.....	25	continuous blowdown	202	boiler connections.....	190
Green sand filter.....	23	stack waste.....	199	controls.....	404
Greywater tank	417	Heat recovery ventilators.....	292	demolition	422
Grilles		Heat transfer equipment.....	210	HVAC balancing	
air balancing	403	Heat-A-Lamp®.....	329	air.....	403
removal.....	423	Heaters		wet.....	404
return air	333	bathroom	328	HVAC equipment	
Ground source heat pump	306	biomass fired	321	air conditioning units.....	288
		ceramic	304	air handling equipment.....	331
		commercial	304	air handling units	289-290
		gas fired.....	304	boilers	185-189
		infrared	304	centrifugal blowers.....	324
		infrared bulb.....	328	connections, air handling	
		infrared tube	304	unit.....	297-298
		residential furnaces	299	fan coil units	208
		resistance	329	heat exchangers.....	207
		unit.....	303	heat transfer equipment	210
		Heat-fused joint pipe,		pumps.....	206
		polypropylene.....	164	reheat coils	209
		Heating systems.....	287	unit heaters.....	210
		estimating	435	variable-air volume units	337
		residential	287		

H

Hair and lint interceptors	25
Hanger assemblies	
ABS	153
cast iron, hub & spigot.....	145
cast iron, no-hub.....	140
copper, DWV, soldered	149
polypropylene pipe	167
PVC, DWV	157
PVC, Schedule 40.....	100
PVC, Schedule 80	110

HVAC systems
 Type K copper, brazed33
 Type K copper, soldered43
 Type L copper, brazed53
 Type L copper, soldered.....61
 Type M copper, brazed70
 Type M copper, soldered.....78
 Hydrant, fire175
 Hydraulic benders, rental420

I

Indicator post.....175
 Indirect waste connections26
 Indirect water heater.....203
 Induced-draft cooling tower212
 Infrared
 bulb heater.....328
 heater304
 tube heater304
 Injector.....314
 Installation costs, ductwork396
 Instructing, operating personnel421
 Instructions for this book5
 Insulation, pipe
 calcium silicate399
 elastomeric400
 fiberglass 397-398
 Insulation removal434
 Insurance.....6
 Interceptors.....25
 Iron filter 23-24
 accessories.....23
 Iron removal23
 Irrigation systems
 PVC, Schedule 4091
 PVC, Schedule 80101

J

Jet pump.....313

K

Kitchen equipment.....25
 connections26
 Kitchen fixtures
 tailpiece connections26
 trap connections26
 Kitchen sinks29
 disconnect433

L

Labor costs.....6
 Laboratories, HVAC estimates437
 Laboratory DWV pipe systems.....164

Laundry sinks29
 disconnect433
 Lavatories28
 estimating435
 Lead flashing 123, 153, 158
 LEED certification 185-186, 187-189,
 286, 305, 308, 312, 319-320, 322
 Letter of intent 456-457
 Libraries, HVAC estimates437
 Line voltage thermostat405
 Lined ductwork, installed 346-347
 Low voltage thermostat405

M

Makeup air units336
 Malleable iron fittings
 150 pound.....214
 300 pound.....237
 Schedule 10 steel pipe274
 Schedule 40 steel, roll-grooved.....266
 Manganese filters
 green sand.....23
 iron.....23
 Manhours.....5
 Manifolds, PEX-AL pipe114
 Manufacturing plants, HVAC
 estimates437
 Markers, pipe and duct.....421
 Markets, HVAC estimates437
 Material costs7
 Material pricing conditions.....9
 Materials, Equipment, and
 Tool form10
 Maximum working pressures
 Type K copper, brazed33
 Type K copper, soldered43
 Type L copper, brazed53
 Type L copper, soldered.....61
 Type M copper, brazed70
 Type M copper, soldered.....78
 Mechanical joint coupling139
 Mechanical tee, roll grooved,
 Victaulic.....179
 Medical buildings, HVAC estimates..437
 MET10
 worksheet14
 Miscellaneous tools
 PE-AL pipe115, 118
 PEX-AL pipe115, 118
 MJ coupling139
 Molded stone
 mop sinks29
 shower basins.....28
 Monthly rental, equipment420
 Mop sink, disconnect.....433
 Motels, HVAC estimates437
 Museums, HVAC estimates437

N

Nail clips
 PE-AL pipe115, 118
 PEX-AL pipe.....115, 118
 Nameplates, equipment421
 Nipples
 Schedule 40 steel, threaded... 227-229
 steel pipe, fire protection182
 Non-taxable fringe benefits6
 NPT pump, in-line..... 25, 120-121
 Nursing homes, HVAC estimates....437

O

Office buildings, HVAC estimates ...437
 Office trailers, rental420
 Oil fuel train piping205
 Old estimates12
 Open loop heat pump..... 307-308
 O-rings
 PE-AL pipe115, 118
 PEX-AL pipe115, 118
 Overflow drains168
 estimating435
 Overhead and profit.....7

P

Packaged boiler feedwater
 systems202
 PE-AL pipe 111-115
 PEX-AL pipe..... 116-118
 adapters.....113
 brass fittings111
 caps114, 117
 compression brass fittings.....116
 couplings 112-113, 117
 crimp rings.....115, 118
 crimped brass fittings111
 ells 111-112, 116-117
 hangers.....115, 118
 miscellaneous tools115, 118
 nail clips.....115, 118
 O-rings.....115, 118
 tees112, 117
 valves114, 118
 Pipe
 connector..... 123-124
 flashing 123, 153, 158, 167
 hangers.....124
 hooks125
 markers.....421
 sleeves 125, 153, 158, 167
 sleeves, cut-grooved285
 Pipe insulation
 calcium silicate399
 elastomeric400

fiberglass	397-398, 415	fixtures	32	Schedule 40 steel, roll-grooved.....	271
removal.....	434	specialties	134	Schedule 40 steel, threaded.....	232
Pipe machines, rental.....	420	Plumbing fixture		Schedule 40 steel, welded	222
Pipe sizes		disconnect	433	Schedule 80 steel, threaded.....	254
Type K copper, brazed.....	33	removal.....	432	Schedule 80 steel, welded	245
Type K copper, soldered	43	Pollution control modules	199	Type K copper, brazed	41
Type L copper, brazed	53	Pollution control stack retrofit ...	319, 321	Type K copper, soldered	52
Type L copper, soldered.....	61	Polyethylene sewage pit.....	417	Type L copper, brazed	60
Type M copper, brazed	70	Polyethylene sump pit	417	Type L copper, soldered.....	68
Type M copper, soldered.....	78	Polyethylene-aluminum pipe ...	111-116	Type M copper, brazed	77
Piping		Polypropylene DWV pipe	164	Type M copper, soldered.....	85
air handling unit coil.....	297-298	adapters.....	166	Pressure pump	174
cast iron	141	bends.....	164	Pressure reducing valves	133
class 110 DI, cement lined	411	bolt and gasket sets	167	Pressure switches	172, 314
class 150 cast iron.....	412	combinations	165	Pressure tank	23-24, 314
class 153 DI, cement lined	407	couplings	166	Pressure/temperature taps	
class 153 DI, double cement		fittings	164	Schedule 10 steel, roll-grooved....	279
lined.....	409	flanges	167	Schedule 40 steel, cut-grooved....	285
class 2400 or 3000 asbestos		hanger assemblies	167	Schedule 40 steel, roll-grooved....	272
cement.....	413	heat-fused joint pipe	164	Schedule 40 steel, threaded.....	232
copper.....	146	plugs	166	Schedule 40 steel, welded	222
CPVC sprinkler.....	183	P-traps	164	Schedule 80 steel, threaded.....	254
polypropylene	164	reducers.....	167	Schedule 80 steel, welded	245
PVC	154	riser clamps	167	Schedule 160 steel.....	264
PVC, DWV.....	154	tees.....	165	Price updates	5
Schedule 10 steel,		wyes	165-166	Pricing, HVAC systems	435
roll-grooved	273-274	Polyvinyl chloride pipe		Process systems	
Schedule 40 steel, cut-grooved....	280	Schedule 40.....	91	PVC, Schedule 40	91-92
Schedule 40 steel, roll-grooved....	266	Schedule 80.....	101	PVC, Schedule 80	101-102
Schedule 40 steel, threaded.....	223	Potable water storage tank	416	Project summary	12
Schedule 40 steel, welded	214	Potable water systems		Project summary worksheet.....	15
Schedule 80 steel, threaded.....	248	PVC, Schedule 40	91	Proposal, preparing	13
Schedule 80 steel, welded ...	237-238	PVC, Schedule 80	101	P-traps	
Piping, removal.....	430	Type K copper, brazed.....	33	ABS	151
Piping specialties.....	134	Type K copper, soldered	43	cast iron, hub & spigot.....	142
Piping systems		Type L copper, brazed	53	cast iron, no-hub.....	136
chilled water.....	214	Type L copper, soldered.....	61	copper, DWV, soldered	147
hot water.....	214	Type M copper, brazed	70	polypropylene pipe	164
recirculating water	246	Type M copper, soldered.....	78	PVC, DWV.....	156
Planter drains	168	Pressfit		Pulse type boilers	322
Plastic		ball valve, copper	88	Pumping unit for boilers	201
sewage pit	417	coupling, copper	86	Pumps	
sprinkler pipe	183	ells, copper	86	boiler.....	205
sump pit.....	417	female adapter, copper	88	centrifugal	206
tank.....	416	fittings	234	heat.....	306-308
Plug dampers, fusible.....	341	male adapter, copper	88	in-line	25
Plugs		tee, copper.....	87	in-line circulating.....	120-121
cast iron, threaded.....	181	tee, reducing, copper.....	87	removal.....	431
polypropylene pipe	166	Type O o-rings.....	234	submersible	313
PVC, Schedule 40	95	union, copper.....	87	sump, installation costs	435
PVC, Schedule 80	105	Pressure controller	338	well water.....	313
Schedule 40 steel, threaded.....	226	Pressure fiberglass tank.....	24	Purchase order.....	451-452
Schedule 80 steel, threaded.....	250	Pressure gauges		PVC	
Plumbing		dial-type	125	valves, EDPM.....	97, 107
budget estimates	435	PVC, Schedule 40	100	valves, threaded	97, 107
equipment.....	26	PVC, Schedule 80	109	valves, Tru-union.....	97, 107
fixture costs	435	Schedule 10 steel, roll-grooved....	279	valves, union type, solvent	
fixture rough-in.....	31-32	Schedule 40 steel, cut-grooved....	285	weld.....	98, 107

PVC, DWV pipe.....	154	1/4 bend.....	160	Type M copper, soldered.....	81
adapters.....	156	adapters.....	163	Reducing costs.....	9
bushings.....	156	caps.....	163	Reducing ells, Schedule 5 steel, pressfit.....	235
cleanouts.....	157	couplings.....	160	Reducing tees	
closet flanges.....	155-156	gasket joints.....	159	cast iron.....	180
couplings.....	156	reducers.....	163	CPVC sprinkler pipe.....	183
ells.....	154	tees.....	162	roll grooved, Victaulic.....	178
fittings.....	154	test plugs.....	163	Schedule 5 steel, pressfit.....	236
hanger assemblies.....	157	wyes.....	160-162	Schedule 10 steel, roll-grooved....	275
P-traps.....	156			Schedule 40 steel, cut-grooved....	281
reducers.....	157			Schedule 40 steel, roll-grooved....	268
riser clamps.....	157	Q		Schedule 40 steel, threaded.....	225
solvent-weld joints.....	154	Quotation sheet.....	17	Schedule 80 steel, threaded.....	249
tees.....	155			Reducing valves, pressure.....	133
wyes.....	155			Refractory, boiler.....	197
PVC, Schedule 40 pipe.....	92	R		Refrigeration systems	
adapters.....	94	Rainwater systems, PVC.....	159	Type K copper, brazed.....	33
assembly.....	91	Reciprocating water-cooled chiller....	211	Type L copper, brazed.....	53
bolt and gasket sets.....	99	Recirculating water systems.....	246	Registers	
bushings.....	94	Record of telephone conversation.....	18	return.....	334
caps.....	95	Recorder, digital.....	405	supply.....	333
companion flange.....	99	Recording equipment.....	205	Reheat coils.....	209
control valves.....	99	Rectangular duct, galvanized steel.....	345, 380	Reheat units, variable volume.....	337
couplings.....	95	Rectangular elbow, galvanized steel.....	390	Removal costs	
ells.....	92	Reducers		air cooled condensers.....	426
hanger assemblies.....	100	ABS.....	153	air handling units.....	424
plugs.....	95	cast iron, hub & spigot.....	144	air mixing box.....	423
pressure gauges.....	100	cast iron, no-hub.....	139	boilers.....	425
pressure/temperature taps.....	100	cast iron, threaded.....	180	chillers.....	426
riser clamps.....	100	class 110 DI, cement lined.....	411	cooling towers.....	427
solvent-weld joints.....	91	class 150 cast iron.....	412	copper piping.....	430
strainers.....	98-99	class 153 DI, cement lined.....	408	diffusers.....	423
tees.....	93	class 153 DI, double cement lined.....	410	duct insulation.....	434
thermometers with wells.....	100	class 2400 or 3000 asbestos cement.....	414	duct mounted coils.....	429
unions.....	95	copper, DWV, soldered.....	148	ductwork.....	422-423
valves.....	96-99	galvanized steel spiral duct.....	359	fan coils.....	427
PVC, Schedule 80 pipe.....	101-102	polypropylene pipe.....	167	furnaces.....	425
adapters.....	104	PVC.....	163	grilles.....	423
assembly.....	101-102	PVC, DWV.....	157	heat exchangers.....	429
bolt and gasket sets.....	109	roll grooved, Victaulic.....	178	heat pumps.....	428
bushings.....	104	Schedule 10 steel, roll-grooved....	275	hot water tank.....	432
caps.....	105	Schedule 40 steel, cut-grooved....	282	pipe insulation.....	434
companion flanges.....	109	Schedule 40 steel, roll-grooved....	268	plastic piping.....	430
couplings.....	105	Schedule 40 steel, threaded.....	225	plumbing fixtures.....	432
ells.....	102-103	Schedule 40 steel, welded.....	217	pumps.....	431
hanger assemblies.....	110	Schedule 40 steel, threaded.....	249	roof top unit.....	424
plugs.....	105	Schedule 80 steel, threaded.....	249	steel piping.....	430
pressure gauges.....	109	Schedule 80 steel, welded... 240-241		unit heaters.....	428
pressure/temperature taps.....	110	Schedule 160 steel, welded... 260-261		valves.....	431
riser clamps.....	110	Type K copper, brazed.....	37	Rental costs, equipment.....	420
solvent-weld joints.....	101	Type K copper, soldered.....	47	Residences, HVAC estimates.....	437
strainers.....	108	Type K & L copper, roll grooved....	90	Residential fixture rough-ins.....	32
tees.....	103	Type L copper, brazed.....	56	Residential furnaces.....	299-300
thermometers with wells.....	109	Type L copper, soldered.....	64	Residential water heaters.....	19-20
unions.....	105	Type M copper, soldered.....	64	Resistance heater.....	329
valves.....	106-109	Type M copper, brazed.....	73	Retail shops, HVAC estimates.....	437
PVC sewer pipe, bell & spigot.....	159			Retrofit pollution control stack... 319-321	
1/16 bend.....	159			Return air grilles.....	333
1/8 bend.....	159-160				

Return registers.....	334	Schedule 10 carbon steel pipe,	tees.....	267
Riser clamps		roll-grooved.....	thermometers with wells.....	271
ABS.....	153	adapters.....	valves.....	269-271
cast iron, hub & spigot.....	145	bolt and gasket sets.....	vertical assembly.....	266
cast iron, no-hub.....	140	caps.....	Schedule 40 carbon steel pipe,	
copper, DWV, soldered.....	149	couplings.....	threaded.....	224
pipe and plumbing specialty.....	125	ells.....	bolt and gasket sets.....	232
polypropylene pipe.....	167	flanges.....	caps.....	226
PVC, DWV.....	157	hanger assemblies.....	companion flanges.....	232
PVC, Schedule 40.....	100	horizontal assembly.....	control valves.....	231-232
PVC, Schedule 80.....	110	pressure gauges.....	couplings.....	226
Schedule 10 steel, roll-grooved.....	279	pressure/temperature taps.....	crosses.....	225
Schedule 40 steel, cut-grooved.....	285	reducers.....	ells.....	224
Schedule 40 steel, roll-grooved.....	272	reducing tees.....	fire protection.....	180
Schedule 40 steel, threaded.....	233	riser clamps.....	hanger assemblies.....	232
Schedule 40 steel, welded.....	222	strainers.....	horizontal assembly.....	223
Schedule 80 steel, threaded.....	254	tees.....	nipples.....	227-229
Schedule 80 steel, welded.....	246	thermometers with wells.....	plugs.....	226
Schedule 160 steel.....	265	valves.....	pressure gauges.....	232
Type K copper, brazed.....	42	vertical assembly.....	pressure/temperature taps.....	232
Type K copper, soldered.....	52	Schedule 40	reducers.....	225
Type L copper, soldered.....	69	threadolet.....	reducing tees.....	225
Rolairtrol type air separators.....	201	weldolet.....	riser clamps.....	233
Roll-grooved fittings.....	179	Schedule 40 carbon steel pipe.....	strainers.....	231
Roll-grooved joint, Schedule 40		Schedule 40 carbon steel pipe,	tees.....	224
carbon steel.....	266	cut grooved.....	thermometers with wells.....	232
Roof		adapters.....	unions.....	226
drains.....	168	bolt and gasket sets.....	valves.....	227, 229-231
exhaust fan.....	325	caps.....	vertical assembly.....	223
fans.....	326	couplings.....	Schedule 40 carbon steel pipe,	
flashing.....	123, 153, 158	ells.....	welded.....	214
Roof exhauster.....	326	flanges.....	bolt and gasket sets.....	222
Roof top unit, removal.....	424	hanger assemblies.....	caps.....	217-218
Rough-ins		pipe sleeves.....	companion flanges.....	218
commercial fixture.....	31	pressure gauges.....	ells.....	215
commercial group.....	32	pressure/temperature taps.....	pressure gauges.....	222
residential.....	32	reducers.....	pressure/hanger assemblies.....	222
Round galvanized steel ductwork.....	394	reducing tees.....	pressure/temperature tap.....	222
Roustabouts, rental.....	420	riser clamps.....	reducers.....	217
Run and branch, tees, galvanized		strainers.....	riser clamp.....	222
steel.....	365	tees.....	strainers.....	220-221
		thermometers with wells.....	tees.....	216
		valves.....	thermometers with wells.....	222
		283-284	threadolets.....	218
		Schedule 40 carbon steel pipe,	valves.....	219-221
		roll-grooved.....	vertical assembly.....	214
		266-267	weldolets.....	218
		adapters.....	Schedule 40 polypropylene pipe.....	164
		bolt and gasket sets.....	Schedule 40 PVC pipe.....	91-92
		caps.....	Schedule 80	
		couplings.....	PVC pipe.....	101
		ells.....	threadolet.....	134
		flanges.....	weldolet.....	134
		hanger assemblies.....	Schedule 80 carbon steel pipe,	
		horizontal assembly.....	threaded.....	247-248
		pressure gauges.....	bolt and gasket sets.....	253
		pressure/temperature taps.....	caps.....	250
		reducers.....	couplings.....	251
		reducing tees.....		
		riser clamps.....		
		strainers.....		
		271		

S

Saddle tee, roll grooved, Victaulic.....	179
Safety, trenching.....	418
Sandstone, trenching.....	418
Sanitary tees	
cast iron DWV pipe.....	142
polypropylene pipe.....	165
Schedule, construction.....	453-455
Schedule 5 carbon steel pipe,	
pressfit.....	234
adapters.....	236
couplings.....	235-236
ells.....	234-235
reducing ells.....	235
reducing tees.....	236
tees.....	236

crosses	250	threadlets	262	Skip loaders, rental.....	420
ells	248	unions	260	Sleeves	
flanges	253	valves	262-264	galvanized steel pipe	153, 158
hanger assemblies	254	weldolets.....	261	polypropylene pipe	167
horizontal assembly.....	247	Schedule 80 PVC pipe.....	102	Slop sink, disconnect.....	433
plugs	250	Scissor-lifts, rental.....	420	Slope, trench	418
pressure gauges.....	254	Scotch marine firetube boilers...	186-187	Softener, water	22
pressure/temperature taps	254	Self-sticking markers	421	Software	338
reducers.....	249	Sensor		Solar water heater.....	323
reducing tees	249	CO2	405	Solder, soft	33, 43
riser clamps	254	HVAC controls.....	404	Soldered joint fittings	
strainers.....	252-253	Septic tank.....	415	Type K copper	43
tees.....	249	Service sinks	29	Type L copper	61
thermometers with wells.....	254	estimating	435	Soldered joint pipe.....	43, 78
unions	250	Sewage lift tank.....	417	copper, DMV.....	146
valves	251-253	Sewage tank.....	415	Type K copper	43
vertical assembly.....	247	Sewer pipe, PVC bell & spigot.....	159	Type L copper	61
Schedule 80 carbon steel pipe,		Shale, trenching	418	Type M copper	78
welded.....	238	Shallow well water pump.....	313	Solenoid valves	204
bolt and gasket sets	245	Sheet metal	346-347	Solvent-weld joint pipe	
caps	241	Shoring, trench	418	PVC, DWV.....	154
ells	238	Shower stall		PVC, Schedule 40.....	91
flanges	242	disconnect	433	PVC, Schedule 80.....	101
hanger assemblies	246	removal.....	432	Specialties, piping and plumbing.....	134
horizontal assembly.....	237	Showers.....	28	Speed controller, fan	327
pressure gauges.....	245	estimating	435	Spin-ins, plain.....	343
pressure/temperature tap	245	Siamese connection.....	174	Spiral crosses, galvanized	
reducers.....	240-241	Silent check valves		steel.....	366-368
riser clamps	246	pipe and plumbing specialty	129	Spiral duct, galvanized	
strainers.....	244	PVC, Schedule 40	98	steel.....	356-357, 366-368
tees.....	239-240	PVC, Schedule 80.....	108	Spiral tees, galvanized steel ...	363, 365
thermometers with wells.....	245	Schedule 10 steel, roll-grooved....	278	Sprinkler fittings.....	177-181
threadlets.....	242	Schedule 40 steel, cut-grooved....	284	Sprinkler heads	172
unions	241	Schedule 40 steel, roll-grooved....	270	Sprinkler systems	
valves	242-245	Schedule 40 steel, threaded.....	231	black steel pipe.....	176-177
vertical assembly.....	237	Schedule 40 steel, welded	220	branch pipe and fittings	182
weldolets.....	241	Schedule 80 steel, threaded.....	252	heads.....	172
Schedule 160 carbon steel pipe,		Schedule 80 steel, welded	244	per head costs.....	170
plain end.....	256	Type K copper, brazed	40	square foot costs	170
Schedule 160 carbon steel pipe,		Type K copper, soldered	50	switches.....	172
threaded	255	Type L copper, brazed	59	valves	171
ells	257-258	Type L copper, soldered.....	67	Square-foot costs, HVAC	435
horizontal assembly.....	255	Type M copper, brazed	76	Stack waste, heat recovery.....	199
tees.....	259	Type M copper, soldered.....	84	Stainless steel	
unions	260	Sinks.....	28-30	doors.....	121
vertical assembly.....	256	acrylic	29	sinks	29
Schedule 160 carbon steel pipe,		bar	29	Standard form subcontract.....	448
welded.....	255	cast iron	29	Steam boiler connections, HVAC....	190
bolt and gasket sets	264	countertop	28	Steam boilers	
caps	261	disconnect	433	biomass fired	320
ells	257-258	exam room.....	29	connections	190
flanges.....	262	kitchen	29	gas fired.....	185
hanger assemblies	265	laboratory.....	29	Steam heating boilers.....	189
horizontal assembly.....	255	laundry.....	29	Steam systems, piping	238
pressure gauges.....	264	medical	29	Steam traps	125, 204
pressure/temperature taps	264	molded stone	29	Steel collars.....	343
reducers.....	260-261	mop.....	29	Steel doors	121
riser clamps	265	removal.....	432	Steel ductwork,	
tees.....	259	slop	30	galvanized	356-357, 359
thermometers with wells.....	264	stainless steel.....	29	fittings	358

Steel pipe			
black	176-177	adapters	268
cooling systems	234	bolt and gasket sets	271
heating systems	234	caps	269
nipples, threaded	182, 229	couplings	269
pressfit system	234	ells	267
process applications	234	flanges	269
Steel pipe fittings, Schedule 40		hanger assemblies	272
steel, roll-grooved	266	pressure gauges	271
Steel pipe nipples, threaded	227-229	pressure/temperature taps	272
Steel pipe, Schedule 5 pressfit	234	reducers	268
adapters	236	reducing tees	268
couplings	235-236	riser clamps	272
ells	234-235	strainers	271
reducing ells	235	tees	267
reducing tees	236	thermometers with wells	271
tees	236	valves	269-271
Steel pipe, Schedule 10		Steel pipe, Schedule 40	
roll-grooved	273-274	threaded	224
adapters	275	ball valves	230
bolt and gasket sets	279	bolt and gasket sets	232
caps	276	butterfly valves	230
control valves	278	caps	226
couplings	276	companion flanges	232
ells	274	control valves	231
flanges	276	couplings	226
hanger assemblies	279	crosses	225
horizontal assembly	273	ells	224
pressure gauges	279	hanger assemblies	232
pressure/temperature taps	279	horizontal assembly	223
reducers	275	nipples	227-229
reducing tees	275	plugs	226
riser clamps	279	pressure gauges	232
strainers	278	pressure/temperature taps	232
tees	274	reducers	225
thermometers with wells	279	riser clamps	233
valves	276-278	silent check valves	231
vertical assembly	273	strainers	231
Steel pipe, Schedule 40		swing check valves	231
cut-grooved	280	tees	224-225
adapters	281	thermometers with wells	232
bolt and gasket sets	284	unions	226
caps	282	valves	229-230, 232
couplings	282	vertical assembly	223
ells	280	Steel pipe, Schedule 40	
flanges	282	welded	214-215
hanger assemblies	285	bolt and gasket sets	222
pipe sleeves	285	caps	217
pressure gauges	285	control valves	221
pressure/temperature taps	285	ells	215
reducers	282	flanges	218
reducing tees	281	hanger assemblies	222
riser clamps	285	pressure gauges	222
strainers	284	pressure/temperature tap	222
tees	281	reducers	217
thermometers with wells	285	riser clamp	222
valves	283-284	strainers	220-221
Steel pipe, Schedule 40		tees	216
roll-grooved	266	thermometers	222
		threadolets	218
		unions	218
		valves	219-221
		weldolets	218
		Steel pipe, Schedule 80	
		threaded	247-248
		ball valves	252
		bolt and gasket sets	253
		butterfly valves	251-252
		caps	250
		control valves	253
		couplings	251
		crosses	250
		ells	248
		flanges	253
		gate valves	251
		globe valves	251
		hanger assemblies	254
		plugs	250
		pressure gauges	254
		pressure/temperature taps	254
		reducers	249
		reducing tees	249
		riser clamps	254
		silent check valves	252
		strainers	252-253
		swing check valves	252
		tees	249
		thermometers with wells	254
		unions	250
		valves	253
		Steel pipe, Schedule 80	
		welded	237-238
		bolt and gasket sets	245
		butterfly valves	243
		caps	241
		control valves	244-245
		ells	238
		flanges	242
		gate valves	242
		globe valves	242-243
		hanger assemblies	246
		pressure gauges	245
		pressure/temperature tap	245
		reducers	240-241
		riser clamps	246
		silent check valves	244
		strainers	244
		swing check valves	243
		tees	239-240
		thermometers with wells	245
		threadolets	242
		unions	241
		valves	245
		weldolets	241
		Steel pipe, Schedule 160	256
		bolt and gasket sets	264
		ells	258
		hanger assemblies	265
		pressure gauges	264

pressure/temperature taps.....264	Supports, wall bracket.....124	Tees
riser clamps.....265	Surplus materials.....10	ABS.....151-152
thermometers with wells.....264	Swimming pool heat recovery	cast iron, hub & spigot.....142
Steel pipe, Schedule 160	ventilators.....291	cast iron, no-hub.....138-139
plain end.....256	Swing check valves	cast iron, threaded.....180
Steel pipe, Schedule 160	pipe and plumbing specialty... 127-128	class 110 DI, cement lined.....411
threaded.....256-260	PVC, Schedule 40.....98	class 150 cast iron.....412
ells.....257-258	PVC, Schedule 80.....108	class 153 DI, cement lined.....407
horizontal assembly.....255	Schedule 10 steel, roll-grooved...277	class 153 DI, double cement
tees.....259	Schedule 40 steel, cut-grooved...283	lined.....410
unions.....260	Schedule 40 steel, roll-grooved...270	class 2400 or 3000 asbestos
vertical assembly.....256	Schedule 40 steel, threaded.....231	cement.....414
Steel pipe, Schedule 160 welded...256	Schedule 40 steel, welded.....220	copper, DWV, soldered.....147
caps.....261	Schedule 40 steel, welded.....220	copper, press fit.....87
ells.....257-258	Schedule 80 steel, threaded.....252	CPVC sprinkler pipe.....183
flanges.....262	Schedule 80 steel, welded.....243	PE-AL pipe.....112, 117
horizontal assembly.....255	Schedule 160 steel, flanged.....263	PEX-AL pipe.....112, 117
reducers.....260-261	Type K copper, brazed.....40	polypropylene pipe.....165
tees.....259	Type K copper, soldered.....50	PVC, DWV.....155
threadolets.....262	Type L copper, brazed.....59	PVC, Schedule 40.....93
unions.....260	Type L copper, soldered.....67	PVC, Schedule 80.....103
valves.....262-264	Type M copper, brazed.....76	PVC sewer, bell & spigot.....162
vertical assembly.....256	Type M copper, soldered.....84	roll grooved, Victaulic.....178-179
weldolets.....261	Switches, sprinkler system.....172	Schedule 5 steel, pressfit.....236
Steel piping, removal.....430		Schedule 10 steel, roll-grooved...274
Storage vans, rental.....420		Schedule 40 steel, cut-grooved...281
Stores, HVAC estimates.....437		Schedule 40 steel, roll-grooved...267
Strainers	T	Schedule 40 steel, threaded.....224
pipe and plumbing specialty... 131-132	Table of contents.....3	Schedule 40 steel, welded.....216
PVC, Schedule 40.....98-99	Tables	Schedule 80 steel, threaded.....249
PVC, Schedule 80.....108	budget estimates.....435	Schedule 80 steel, welded... 239-240
Schedule 10 steel, roll-grooved...278	trenching costs.....417-419	Schedule 160 steel, threaded.....259
Schedule 40 steel, cut-grooved...284	Tailpiece connections.....26	Schedule 160 steel, welded.....259
Schedule 40 steel, roll-grooved...271	Tank tee.....314	spiral, galvanized steel.....360-365
Schedule 40 steel, threaded...231	Tankless water heaters.....20, 203	Type K copper, brazed.....35-36
Schedule 40 steel, welded... 220-221	Tanks	Type K copper, soldered.....45-46
Schedule 80 steel,	above ground.....416	Type K & L copper, roll grooved...89
threaded.....252-253	buried.....415-416	Type L copper, brazed.....55
Schedule 80 steel, welded.....244	deep burial.....415-416	Type L copper, soldered.....63
Type K copper, brazed.....40	drinking water.....415-416	Type M copper, brazed.....72
Type K copper, soldered.....51	expansion.....123	Type M copper, soldered.....80
Type L copper, brazed.....59	fiberglass.....415	with run and branch, galvanized
Type L copper, soldered.....67	greywater.....417	steel.....365
Type M copper, brazed.....76	heat/cool.....405	Terminal box controller.....338
Type M copper, soldered.....84	holding.....415-416	Terminal boxes, air balancing.....402
Subcontract	line voltage.....405	Test caps
change order.....450	low voltage.....405	ABS DWV.....152
forms.....447	plastic.....416-417	copper, DWV, soldered.....148
Submersible pump.....313	polyethylene.....416	Test plugs, PVC sewer, bell
Submittal data.....458-459	septic.....415-416	& spigot.....163
Submittal index.....460	sewage.....415	Test tees, copper, DWV, soldered...148
Suction diffusers.....120	sewage lift.....417	Theaters, HVAC estimates.....437
Sump pit.....417	sewer.....416	Thermometers with wells
Sump pumps, installation costs...435	shallow burial.....415-416	pipe and plumbing specialty.....126
Supermarkets, HVAC estimates...437	sump.....417	PVC, Schedule 40.....100
Supervision expense.....6	swimming pool.....291	PVC, Schedule 80.....109
Supervision valves	water.....416	Schedule 10 steel, roll-grooved...279
flanged.....170	Taxable fringe benefits.....6	Schedule 40 steel, cut-grooved...285
grooved.....171	Taxes.....6	Schedule 40 steel, roll-grooved...271
Supply registers.....333	Tee, reducing	Schedule 40 steel, threaded.....232
	copper, press fit.....87	

Schedule 40 steel, welded	222	bolt and gasket sets	52	bushings	74
Schedule 80 steel, threaded.....	254	bushings	48	caps	74
Schedule 80 steel, welded	245	caps	48	couplings	74
Schedule 160 steel.....	264	companion flanges	51	ells	71
Type K copper, brazed.....	41	couplings	49	pressure gauges.....	77
Type K copper, soldered	52	ells	44-45	pressure/temperature taps	77
Type L copper, brazed	60	hanger assemblies	52	reducers.....	73
Type L copper, soldered.....	68	pressure gauges.....	52	strainers.....	76
Type M copper, brazed	77	pressure/temperature taps	52	tees.....	72
Type M copper, soldered.....	85	reducers.....	47	thermometers with wells.....	77
Thermostats, heat pump	312	riser clamps	52	unions	74
Threadolets		strainers.....	51	valves	75-77
pipe and plumbing specialty	134	tees.....	45-46	Type M copper pipe, soldered....	78-79
Schedule 40 steel, welded	218	thermometers with wells.....	52	adapters.....	81
Schedule 80 steel, welded	242	unions	48	bolt and gasket sets	85
Schedule 160 steel, welded	262	valves	49-51	bushings	82
Tier IV.....	199	Type K & L copper pipe,		caps	82
Timer, fan	327	roll grooved		companion flanges	85
Tin solder.....	33, 43, 61, 78	coupling	90	couplings	82
Toilet		ells	89	ells.....	79-80
disconnect	433	flange adapter.....	90	pressure gauges.....	85
removal.....	432	reducers.....	90	pressure/temperature taps	85
Tools.....	115, 118	tees.....	89	reducers.....	81
Trailers, office, rental.....	420	valves	90	strainers.....	84
Transceiver.....	338	Type L copper pipe, brazed	53-54	tees.....	80
Trap primers, installation costs	435	adapters.....	56	thermometers with wells.....	85
Traps with bushing connections.....	26	bolt and gasket sets	60	unions	82
Traps, steam	125	bushings	57	valves	83-85
Treatment tank	417	cap.....	57		
Triple duty valves	120	companion flanges	60	U	
Trucks, rental.....	420	couplings	57	U-bolts, galvanized.....	124
Tub		ells.....	54	Ultra-violet	
disconnect	433	pressure gauges.....	60	disinfection.....	25
removal.....	432	reducers.....	56	water treatment.....	25
Tub and shower combinations	28	strainers.....	59	Underground piping, PVC	159
Tube-axial fan.....	325	tees.....	55	Unions	
Turning vanes.....	342	thermometers with wells.....	60	copper, press fit.....	87
Tutorial.....	5	unions	57	dielectric	122
Type I and II PVC		valves	58-60	PVC, Schedule 40	95
pipe.....	91-92, 101-102	Type L copper pipe, soldered....	61-62	PVC, Schedule 80	105
Type K copper pipe, brazed.....	33-34	adapters.....	64	Schedule 40 steel, threaded.....	226
adapters.....	37	bolt and gasket sets	68	Schedule 40 steel, welded	218
bolt and gasket sets	41	bushings	65	Schedule 80 steel, threaded.....	250
bushings	38	caps	65	Schedule 80 steel, welded	241
caps	38	companion flanges	68	Schedule 160 steel, threaded.....	260
companion flanges	41	couplings	65	Schedule 160 steel, welded	260
couplings	38	ells	62-63	Type K copper, brazed.....	38
ells	34	hanger assemblies	69	Type K copper, soldered	48
hanger assemblies	42	pressure gauges.....	68	Type L copper, brazed	57
pressure gauges.....	41	pressure/temperature taps	68	Type L copper, soldered.....	65
pressure/temperature taps	42	reducers.....	64	Type M copper, brazed	74
reducers.....	37	riser clamps	69	Type M copper, soldered.....	82
riser clamps	42	strainers.....	67	Unit heaters	210, 303
strainers.....	40	tees.....	63	connections	210
tees.....	35-36	thermometers with wells.....	68	demolition	428
thermometers with wells.....	41	unions	65	gas fired.....	210
unions	38	valves	66-68	hot water.....	301
valves	39-41	Type M copper pipe, brazed	70-71	HVAC connections	210
Type K copper pipe, soldered	43-44	adapters.....	73		
adapters.....	47-48	bolt and gasket sets	77		

removal.....428
 steam.....302
 Upblast ventilation330
 Updates5
 Urinals27
 disconnect433
 estimating435
 Using this book.....5
 Utility fan.....324
 UV disinfection unit.....25

V

Vacuum breakers120, 204
 atmospheric120
 hose connection120
 Value engineering9
 Valves
 air admittance328
 alarm.....171
 check, flanged171
 check, grooved171
 control.....221
 double check detector171
 dry.....171
 fire protection.....171
 PE-AL pipe114, 118
 PEX-AL pipe.....114, 118
 pipe and plumbing
 specialty 126-128, 133
 PVC, Schedule 40 96-99
 PVC, Schedule 80 106-109
 PVC, threaded97, 107
 PVC, Tru-union.....97, 107
 PVC, union type, solvent
 weld98, 107
 removal.....431
 Schedule 40 steel,
 cut-grooved 283-284
 Schedule 40 steel, roll-grooved....271
 Schedule 40 steel, threaded.....232
 Schedule 40, welded221
 Schedule 80 steel, threaded.....253
 Schedule 80 steel, welded245
 Schedule 160 steel, flanged.....263
 solenoid204
 solvent weld.....97, 107
 sprinkler system.....171
 supervision, flanged.....170
 supervision, grooved171

tags.....421
 triple duty.....120
 Type K copper, brazed.....40
 Type K copper, soldered50
 Type L copper, brazed60
 Type L copper, soldered..... 66-68
 Type M copper, brazed 75-77
 Type M copper, soldered..... 83-85
 Vane-axial fan324
 Vans, storage, rental420
 Variable-air volume
 cooling units.....337
 reheat units.....337
 Vent systems435
 cast iron, hub & spigot.....141
 cast iron, no-hub.....141
 copper.....146
 PVC, DWV154
 Ventilation
 ductwork 346-347
 exhausters329
 fans 326-327
 Ventilator, heat recovery301
 Vents, air121
 Verantis199
 Victaulic roll-grooved fittings.... 177-179

W - X - Y - Z

Wall exhauster.....326
 Wall fan326
 Wash fountains, installation costs...435
 Waste heat controls.....203
 Waste systems
 cast iron, hub & spigot.....141
 cast iron, no-hub.....141
 copper.....146
 PVC154
 PVC, DWV154
 Water closets.....27
 disconnect433
 estimating435
 Water coil piping.....294
 Water connections, hot and cold.....26
 Water cooled chiller connection211
 Water hammer arresters133
 Water heaters
 commercial 19-20
 connections21

estimating435
 residential 19-20
 solar323
 tankless20
 tankless indirect.....203
 Water meters
 by-pass and connection
 assembly119
 compound type119
 turbine type119
 Water motor gong.....175
 Water pump.....313
 Water softener..... 22-24
 accessories.....23
 Water softening systems, boiler198
 Water source heat pump..... 307-308
 Water storage tank.....416
 Water wells, drilling316
 Watertube boilers188
 Weekly rental, equipment.....420
 Welding machines, rental420
 Weldolets
 pipe and plumbing specialty134
 Schedule 40 steel, welded218
 Schedule 80 steel, welded241
 Schedule 160 steel, welded261
 Wells
 drilling316
 geothermal.....316
 pipe314
 water pump.....313
 Well-to-well heat pump..... 307-308
 Wheel, heat recovery301
 Wireless transceiver338
 Wyes
 ABS 151-152
 cast iron, hub & spigot..... 143-144
 cast iron, no-hub..... 136-138
 class 150 cast iron.....412
 class 153 DI, cement lined408
 class 153 DI, double cement
 lined.....410
 class 2400 or 3000 asbestos
 cement.....414
 copper, DWV, soldered147
 polypropylene pipe 165-166
 PVC, DWV155
 PVC sewer, bell & spigot..... 160-162

Practical References for Builders

Basic Plumbing with Illustrations, Revised

This completely revised edition brings this comprehensive manual fully up-to-date with all the latest plumbing codes. It is the journeyman's and apprentice's guide to installing plumbing, piping, and fixtures in residential and light commercial buildings: how to select the right materials, lay out the job and do professional-quality plumbing work, use essential tools and materials, make repairs, maintain plumbing systems, install fixtures, and add to existing systems. Includes extensive study questions at the end of each chapter, and a section with all the correct answers.

384 pages, 8 1/2 x 11, \$44.75

eBook (PDF) also available; \$22.37 at www.craftsman-book.com

Construction Contract Writer



Relying on a "one-size-fits-all" boilerplate construction contract to fit your jobs can be dangerous — almost as dangerous as a handshake agreement. *Construction Contract Writer* lets you draft a contract in minutes that precisely fits your needs and the particular job, and meets both state and federal requirements. You just answer a series of questions — like an interview — to construct a legal contract for each project you take on. Anticipate where disputes could arise and settle them in the contract before they happen. Include the warranty protection you intend, the payment schedule, and create subcontracts from the prime contract by just clicking a box. Includes a feedback button to an attorney on the Craftsman staff to help should you get stumped — *No extra charge.*

\$149.95. Download the *Construction Contract Writer* at <http://www.constructioncontractwriter.com>

CD Estimator

If your computer has *Windows*™ and a CD-ROM drive, CD Estimator puts at your fingertips over 150,000 construction costs for new construction, remodeling, renovation & insurance repair, home improvement, framing & finish carpentry, electrical, concrete & masonry, painting, earthwork and heavy equipment and plumbing & HVAC. Quarterly cost updates are available at no charge on the Internet. You'll also have the *National Estimator* program — a stand-alone estimating program for *Windows*™ that *Remodeling* magazine called a "computer wiz," and *Job Cost Wizard*, a program that lets you export your estimates to QuickBooks Pro for actual job costing. A 60-minute interactive video teaches you how to use this CD-ROM to estimate construction costs. And to top it off, to help you create professional-looking estimates, the disk includes over 40 construction estimating and bidding forms in a format that's perfect for nearly any *Windows*™ word processing or spreadsheet program. **CD Estimator is \$149.50**

Plumber's Handbook Revised

This edition shows what will and won't pass inspection in drainage, vent, and waste piping, septic tanks, water supply, graywater recycling systems, pools and spas, fire protection, and gas piping systems. All tables, standards, and specifications are completely up-to-date with recent plumbing code changes. Covers common layouts for residential work, how to size piping, select and hang fixtures, practical recommendations, and trade tips. It's the approved reference for the plumbing contractor's exam in many states. Includes an extensive set of multiple-choice questions after each chapter, with answers and explanations in the back of the book, along with a complete sample plumber's exam. **352 pages, 8 1/2 x 11, \$44.50**

eBook (PDF) also available; \$20.75 at www.craftsman-book.com

Building Code Compliance for Contractors & Inspectors

Have you ever failed a construction inspection? Have you ever dealt with an inspector who has his own interpretation of the Code and forces you to comply with it? This new book explains what it takes to pass inspections under the 2009 *International Residential Code*. It includes a Code checklist — with explanations and the Code section number — for every trade, covering some of the most common reasons why inspectors reject residential work. The author uses his 30 years' experience as a building code official to provide you with little-known information on what code officials look for during inspections. **232 pages, 8 1/2 x 11, \$32.50**

eBook (PDF) also available; \$16.25 at www.craftsman-book.com

Uniform Plumbing Code Quick-Card

This 6-page, laminated, fold-out guide provides the basic numbers, flow rates and formulas the plumber needs based on the 2015 *Uniform Plumbing Code (UPC)* and 2015 *International Plumbing Code (IPC)*. Like a Cliffs Notes to the Plumbing Code. **6 pages, 8 1/2 x 11, \$7.95**

Buy similar Craftsman Book Co. titles here: <https://www.Craftsman-Book.com>

Plumbing & HVAC Manhour Estimates

Hundreds of tested and proven manhours for installing just about any plumbing and HVAC component you're likely to use in residential, commercial, and industrial work. You'll find manhours for installing piping systems, specialties, fixtures and accessories, ducting systems, and HVAC equipment. If you estimate the price of plumbing, you shouldn't be without the reliable, proven manhours in this unique book.

224 pages, 5 1/2 x 8 1/2, \$28.25

Paper Contracting: The How-To of Construction Management Contracting

Risk, and the headaches that go with it, have always been a major part of any construction project — risk of loss, negative cash flow, construction claims, regulations, excessive changes, disputes, slow pay — sometimes you'll make money, and often you won't. But many contractors today are avoiding almost all of that risk by working under a construction management contract, where they are simply a paid consultant to the owner, running the job, but leaving him the risk. This manual is the how-to of construction management contracting. You'll learn how the process works, how to get started as a CM contractor, what the job entails, how to deal with the issues that come up, when to step back, and how to get the job completed on time and on budget. Includes a link to free downloads of CM contracts legal in each state.

272 pages, 8 1/2 x 11, \$55.50

eBook (PDF) also available; \$27.75 at www.craftsman-book.com

Planning Drain, Waste & Vent Systems

How to design plumbing systems in residential, commercial, and industrial buildings. Covers designing systems that meet code requirements for homes, commercial buildings, private sewage disposal systems, and even mobile home parks. Includes relevant code sections and many illustrations to guide you through what the code requires in designing drainage, waste, and vent systems. **192 pages, 8 1/2 x 11, \$29.95**

Code Check Plumbing & Mechanical, 4th Edition

Save time, money, and potential delays for code violations. Code Check Plumbing & Mechanical is an essential reference guide, providing reliable information on up-to-date residential plumbing and mechanical codes. This handy guide, cross-referenced to the current International Residential Code, Uniform Plumbing Code, and Uniform Mechanical Code, provides answers to hundreds of commonly-asked plumbing questions. This spiral-bound book, in easy-to-use flip chart format, and with durable laminated pages, easily withstands abuse on the jobsite. It's specifically designed for quick on-site reference, and summarizes national code specifications. It includes 116 drawings and 45 tables to answer questions on the plumbing code in force anywhere in the U.S. **49 pages, 8 1/2 x 11, \$24.95**

Construction Forms for Contractors

This practical guide contains 78 practical forms, letters and checklists, guaranteed to help you streamline your office, organize your jobsites, gather and organize records and documents, keep a handle on your subs, reduce estimating errors, administer change orders and lien issues, monitor crew productivity, track your equipment use, and more. Includes accounting forms, change order forms, forms for customers, estimating forms, field work forms, HR forms, lien forms, office forms, bids and proposals, subcontracts, and more. All are also on the CD-ROM included, in Excel spreadsheets, as formatted Rich Text that you can fill out on your computer, and as PDFs. **360 pages, 8 1/2 x 11, \$48.50**

eBook (PDF) also available; \$24.25 at www.craftsman-book.com

National Construction Estimator

Current building costs for residential, commercial, and industrial construction. Estimated prices for every common building material. Provides manhours, recommended crew, and gives the labor cost for installation. Includes a free download of an electronic version of the book with *National Estimator*, a stand-alone *Windows*™ estimating program. Additional information and *National Estimator ShowMe* tutorial video is available on our website under the "Support" dropdown tab.

672 pages, 8 1/2 x 11, \$97.50. Revised annually

eBook (PDF) also available; \$48.75 at www.craftsman-book.com

National Appraisal Estimator



An Online Appraisal Estimating Service. Produce credible single-family residence appraisals – in as little as five minutes. A smart resource for appraisers using the cost approach. Reports consider all significant cost variables and both physical and functional depreciation. For more information, visit www.craftsman-book.com/national-appraisal-estimator-online-software

Plumber's Exam Preparation Guide

Hundreds of questions and answers to help you pass the apprentice, journeyman, or master plumber's exam. Questions are in the style of the actual exam. Gives answers for both the Standard and Uniform plumbing codes. Includes tips on studying for the exam and the best way to prepare yourself for examination day. **320 pages, 8 1/2 x 11, \$34.00**

Insurance Restoration Contracting: Startup to Success



Insurance restoration — the repair of buildings damaged by water, fire, smoke, storms, vandalism and other disasters — is an exciting field of construction that provides lucrative work that's immune to economic downturns. And, with insurance companies funding the repairs, your payment is virtually guaranteed. But this type of work requires special knowledge and equipment, and that's what you'll learn about in this book. It covers fire repairs and smoke damage, water losses and specialized drying methods, mold remediation, content restoration, even damage to mobile and manufactured homes. You'll also find information on equipment needs, training classes, estimating books and software, and how restoration leads to lucrative remodeling jobs. It covers all you need to know to start and succeed as the restoration contractor that both homeowners and insurance companies call on first for the best jobs. **640 pages, 8 1/2 x 11, \$69.00**

eBook (PDF) also available; \$34.50 at www.craftsman-book.com

Insurance Replacement Estimator

Insurance underwriters demand detailed, accurate valuation data. There's no better authority on replacement cost for single-family homes than the *Insurance Replacement Estimator*. In minutes you get an insurance-to-value report showing the cost of re-construction based on your specification. You can generate and save unlimited reports. For more details, visit www.craftsman-book.com/insurance-replacement-estimator-online-software



Craftsman eLibrary

Craftsman's eLibrary license gives you immediate access to 60+ PDF eBooks in our bookstore for 12 full months!

You pay only one low price. \$129.99.

Visit www.craftsman-book.com for more details.



Home Building Mistakes & Fixes

This is an encyclopedia of practical fixes for real-world home building and repair problems. There's never an end to "surprises" when you're in the business of building and fixing homes, yet there's little published on how to deal with construction that went wrong - where out-of-square or non-standard or jerry-rigged turns what should be a simple job into a nightmare. This manual describes jaw-dropping building mistakes that actually occurred, from disastrous misunderstandings over property lines, through basement floors leveled with an out-of-level instrument, to a house collapse when a siding crew removed the old siding. You'll learn the pitfalls the painless way, and real-world working solutions for the problems every contractor finds in a home building or repair jobsite. Includes dozens of those "surprises" and the author's step-by-step, clearly illustrated tips, tricks and workarounds for dealing with them.

384 pages, 8 1/2 x 11, \$52.50

eBook (PDF) also available; \$26.25 at www.craftsman-book.com



Craftsman Book Company
6058 Corte del Cedro
Carlsbad, CA 92011

Call me.
1-800-829-8123
Fax (760) 438-0398

Name _____
e-mail address (for order tracking and special offers) _____
Company _____
Address _____
City/State/Zip _____ This is a residence

Total enclosed _____ (In California add 7.5% tax)

*Free Media Mail shipping, within the US,
when your check covers your order in full.*

In A Hurry?

We accept phone orders charged to your

Visa, MasterCard, Discover or American Express

Card# _____

Exp. date _____ CVV# _____ Initials _____

Tax Deductible: Treasury regulations make these references tax deductible when used in your work. Save the canceled check or charge card statement as your receipt.

Order online: www.craftsman-book.com

Free on the Internet! Download any of Craftsman's estimating databases for a 30-day free trial! www.craftsman-book.com/downloads

**Download free construction contracts legal for your state at:
www.construction-contract.net**

10-Day Money Back Guarantee

Prices subject to change without notice

- 44.75 Basic Plumbing with Illustrations, Revised
- 32.50 Building Code Compliance for Contractors & Inspectors
- 149.50 CD Estimator
- 24.95 Code Check Plumbing & Mechanical, 4th Edition
- 48.50 Construction Forms for Contractors
- 52.50 Home Building Mistakes & Fixes
- 69.00 Insurance Restoration Contracting: Startup to Success
- 97.50 National Construction Estimator w/FREE *Natl Estimator* Download

- 55.50 Paper Contracting: The How-To of Construction Management Contracting
- 29.95 Planning Drain, Waste & Vent Systems
- 34.00 Plumber's Exam Preparation Guide
- 44.50 Plumber's Handbook Revised
- 28.25 Plumbing & HVAC Manhour Estimates
- 7.95 Uniform Plumbing Code Quick-Card
- 98.25 National Plumbing & HVAC Estimator w/FREE *Natl Estimator* Download