



James A. Thomson

# 2019 NATIONAL PLUMBING & HVAC ESTIMATOR



PDF eBook



**Manhours, Labor & Material Costs  
For Residential, Commercial, and Industrial Plumbing  
Heating, Ventilating & Air Conditioning**

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# **2019 NATIONAL PLUMBING & HVAC ESTIMATOR**

**By James A. Thomson**

SAMPLE

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# How to Use This Book

This 2019 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.



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](http://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 \$36.51 (the average wage for crew P1) is \$18.255, or \$18.26 rounded.

**Quarterly price updates on the Web are free** and automatic all during 2019. 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.

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 \$43.02 for plumbers and \$41.72 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 2019.

**Column 2**, taxable fringe benefits, includes vacation pay, sick leave and other taxable benefits. These fringe benefits average about 5.49% 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 4.85% of the base wage for many plumbing and HVAC contractors.

| Column Number      | 1                  | 2                                               | 3                                | 4                                 | 5                                                   | 6                                   |
|--------------------|--------------------|-------------------------------------------------|----------------------------------|-----------------------------------|-----------------------------------------------------|-------------------------------------|
|                    |                    | Taxable fringe benefits (at 5.49% of base wage) | Insurance and employer taxes (%) | Insurance and employer taxes (\$) | Non-taxable fringe benefits (at 4.85% of base wage) | Total hourly cost used in this book |
| Craft              | Base wage per hour |                                                 |                                  |                                   |                                                     |                                     |
| Laborer            | 20.78              | 1.14                                            | 32.27%                           | 7.07                              | 1.01                                                | 30.00                               |
| Plumber            | 31.69              | 1.74                                            | 24.08%                           | 8.05                              | 1.54                                                | 43.02                               |
| Sheet Metal Worker | 30.34              | 1.67                                            | 25.74%                           | 8.24                              | 1.47                                                | 41.72                               |
| Operating Engineer | 30.93              | 1.70                                            | 24.95%                           | 8.14                              | 1.50                                                | 42.27                               |
| Sprinkler Fitter   | 31.14              | 1.71                                            | 24.86%                           | 8.17                              | 1.51                                                | 42.53                               |
| Electrician        | 30.65              | 1.68                                            | 19.71%                           | 6.37                              | 1.49                                                | 40.19                               |
| Cement Mason       | 26.13              | 1.43                                            | 22.97%                           | 6.33                              | 1.27                                                | 35.16                               |

| Craft Code | Crew Composition                                                          | Average Hourly Cost per Manhour |
|------------|---------------------------------------------------------------------------|---------------------------------|
| ER         | 4 building plumbers, 2 building laborers, 1 operating engineer            | 39.19                           |
| SN         | 4 building sheet metal workers, 2 building laborers, 1 operating engineer | 38.45                           |
| P1         | 1 building plumber and 1 building laborer                                 | 36.51                           |
| ST         | 1 sprinkler fitter                                                        | 42.53                           |
| SK         | 4 sprinkler fitters, 2 building laborers, 1 operating engineer            | 38.91                           |
| SL         | 1 sprinkler fitter and 1 laborer                                          | 36.27                           |
| S2         | 1 building sheet metal worker, 1 building laborer                         | 35.86                           |
| BE         | 1 electrician                                                             | 40.19                           |
| CF         | 1 cement mason                                                            | 35.16                           |
| SW         | 1 sheet metal worker                                                      | 41.72                           |

**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 \$36.51 labor cost used for crew P1. Multiply costs in the Labor \$ column by .479 to find your estimated cost.

For example, notice on page 19 that the labor cost for installing a 6 gallon hot water heater is \$18.30 each. If installed by your plumbing crew working at an average cost of \$17.50 per manhour, your estimated cost would be 48% of \$18.30 or \$8.77 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 typically is \$125.00 per hour for a 10-ton hydraulic truck-mounted crane.

**Material Costs** in this manual are intended to reflect what medium- to low-volume contractors will be paying in 2019 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.



**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

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.



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

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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

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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

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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 \_\_\_\_\_

[illegible]

# 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 |
|-------------------------|-------|----------|-----------|-------------|----------------|-------|
| <b>Actual cost</b>      |       |          |           |             |                |       |
| Estimate                |       |          |           |             |                |       |
| Over/(Under)            |       |          |           |             |                |       |
|                         |       |          |           |             |                |       |
|                         |       |          |           |             |                |       |
| <b>Full Summary</b>     |       |          |           |             |                |       |
| 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 @<br>MH/Unit | Manhours |      | Materials          |         | Labor   |                 | Equipment           |         | Subcontract |                       | Total \$        |
|--------------------------|----------|------|-------------------|----------|------|--------------------|---------|---------|-----------------|---------------------|---------|-------------|-----------------------|-----------------|
|                          |          |      |                   | MH       | Ext. | Unit \$            | Ext. \$ | Unit \$ | Ext. \$         | Unit \$             | Ext. \$ | Unit \$     | Ext. \$               |                 |
|                          |          |      |                   |          |      |                    |         |         |                 |                     |         |             |                       |                 |
|                          |          |      |                   |          |      |                    |         |         |                 |                     |         |             |                       |                 |
|                          |          |      |                   |          |      |                    |         |         |                 |                     |         |             |                       |                 |
|                          |          |      |                   |          |      |                    |         |         |                 |                     |         |             |                       |                 |
|                          |          |      |                   |          |      |                    |         |         |                 |                     |         |             |                       |                 |
|                          |          |      |                   |          |      |                    |         |         |                 |                     |         |             |                       |                 |
|                          |          |      |                   |          |      |                    |         |         |                 |                     |         |             |                       |                 |
|                          |          |      |                   |          |      |                    |         |         |                 |                     |         |             |                       |                 |
|                          |          |      |                   |          |      |                    |         |         |                 |                     |         |             |                       |                 |
|                          |          |      |                   |          |      |                    |         |         |                 |                     |         |             |                       |                 |
|                          |          |      |                   |          |      |                    |         |         |                 |                     |         |             |                       |                 |
|                          |          |      |                   |          |      |                    |         |         |                 |                     |         |             |                       |                 |
|                          |          |      |                   |          |      |                    |         |         |                 |                     |         |             |                       |                 |
|                          |          |      |                   |          |      |                    |         |         |                 |                     |         |             |                       |                 |
|                          |          |      |                   |          |      |                    |         |         |                 |                     |         |             |                       |                 |
|                          |          |      |                   |          |      |                    |         |         |                 |                     |         |             |                       |                 |
| <b>Totals This Sheet</b> |          |      | <b>Manhours</b>   |          |      | <b>Material \$</b> |         |         | <b>Labor \$</b> | <b>Equipment \$</b> |         |             | <b>Subcontract \$</b> | <b>Total \$</b> |

Carry totals forward to Estimate Summary Sheet Estimate # \_\_\_\_\_ of \_\_\_\_\_ Estimate Detail Sheet

# Quotation Sheet

**Job:** \_\_\_\_\_

**Supplier:** \_\_\_\_\_

**Salesperson:** \_\_\_\_\_ **Phone No:** \_\_\_\_\_

**Per Plans/Specs:** \_\_\_\_\_ **Freight:** \_\_\_\_\_ **Terms:** \_\_\_\_\_

[illegible]

By: \_\_\_\_\_

**Details of Conversation:** \_\_\_\_\_

SAMPLE

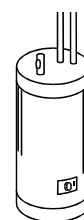
**By:** \_\_\_\_\_

## 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 | 410.00 | 18.30 | — | 428.30 |
| 10 gallon   |         |    |        |       |   |        |
| 1.5 KW/110V | P1@.500 | Ea | 458.00 | 18.30 | — | 476.30 |
| 15 gallon   |         |    |        |       |   |        |
| 1.5 KW/110V | P1@.750 | Ea | 483.00 | 27.40 | — | 510.40 |
| 20 gallon   |         |    |        |       |   |        |
| 1.5 KW/110V | P1@.750 | Ea | 498.00 | 27.40 | — | 525.40 |
| 30 gallon   |         |    |        |       |   |        |
| 1.5 KW/110V | P1@1.00 | Ea | 444.00 | 36.50 | — | 480.50 |
| 40 gallon   |         |    |        |       |   |        |
| 1.5 KW/110V | P1@1.20 | Ea | 465.00 | 43.80 | — | 508.80 |
| 50 gallon   |         |    |        |       |   |        |
| 3 KW/110V   | P1@1.30 | Ea | 501.00 | 47.50 | — | 548.50 |
| 12 gallon   |         |    |        |       |   |        |
| 3 KW/220V   | P1@.500 | Ea | 404.00 | 18.30 | — | 422.30 |
| 20 gallon   |         |    |        |       |   |        |
| 3 KW/220V   | P1@.750 | Ea | 442.00 | 27.40 | — | 469.40 |
| 30 gallon   |         |    |        |       |   |        |
| 3 KW/220V   | P1@1.00 | Ea | 483.00 | 36.50 | — | 519.50 |
| 40 gallon   |         |    |        |       |   |        |
| 3 KW/220V   | P1@1.20 | Ea | 525.00 | 43.80 | — | 568.80 |
| 50 gallon   |         |    |        |       |   |        |
| 3 KW/220V   | P1@1.30 | Ea | 562.00 | 47.50 | — | 609.50 |

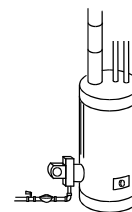


**Electric domestic hot water heater (commercial), 208/240 volt.** Set in place only. Make additional allowances for pipe and electrical connections. (See below)

|                   |         |    |          |       |   |          |
|-------------------|---------|----|----------|-------|---|----------|
| 96 gallon, 12 kw  | P1@1.50 | Ea | 2,320.00 | 54.80 | — | 2,374.80 |
| 96 gallon, 18 kw  | P1@1.50 | Ea | 3,150.00 | 54.80 | — | 3,204.80 |
| 96 gallon, 36 kw  | P1@1.50 | Ea | 3,260.00 | 54.80 | — | 3,314.80 |
| 120 gallon, 18 kw | P1@2.00 | Ea | 3,340.00 | 73.00 | — | 3,413.00 |
| 120 gallon, 36 kw | P1@2.00 | Ea | 3,450.00 | 73.00 | — | 3,523.00 |
| 120 gallon, 54 kw | P1@2.00 | Ea | 4,080.00 | 73.00 | — | 4,153.00 |
| 120 gallon, 63 kw | P1@2.00 | Ea | 4,400.00 | 73.00 | — | 4,473.00 |

**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 | 476.00 | 36.50 | — | 512.50 |
| 40 gallon | P1@1.00 | Ea | 769.00 | 36.50 | — | 805.50 |
| 50 gallon | P1@1.50 | Ea | 874.00 | 54.80 | — | 928.80 |



## 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 | 2,310.00 | 73.00 | — | 2,383.00 |
| 67 gal./106 gph | P1@2.00 | Ea | 2,730.00 | 73.00 | — | 2,803.00 |
| 76 gal./175 gph | P1@2.00 | Ea | 3,660.00 | 73.00 | — | 3,733.00 |
| 91 gal./291 gph | P1@2.00 | Ea | 4,420.00 | 73.00 | — | 4,493.00 |

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

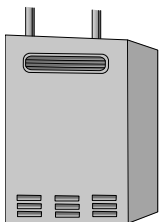
|                 |         |    |          |       |   |          |
|-----------------|---------|----|----------|-------|---|----------|
| 50 gal./ 95 gph | P1@2.00 | Ea | 5,440.00 | 73.00 | — | 5,513.00 |
| 67 gal./106 gph | P1@2.00 | Ea | 5,690.00 | 73.00 | — | 5,763.00 |
| 76 gal./175 gph | P1@2.00 | Ea | 7,050.00 | 73.00 | — | 7,123.00 |
| 91 gal./291 gph | P1@2.00 | Ea | 8,380.00 | 73.00 | — | 8,453.00 |

**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,<br>.75-5.8 Gpm | P1@16.0 | Ea | 1,830.00 | 584.00 | — | 2,414.00 |
| 11-199 Mbh,<br>.5-7 Gpm      | P1@20.0 | Ea | 2,160.00 | 730.00 | — | 2,890.00 |
| 25-235 Mbh,<br>.75-9.6 Gpm   | P1@20.0 | Ea | 2,160.00 | 730.00 | — | 2,890.00 |

**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,<br>.75-2 Gpm   | P1@4.00 | Ea | 461.00   | 146.00 | — | 607.00   |
| 9.5 Kw/50 Amp,<br>.75-2.5 Gpm | P1@4.25 | Ea | 547.00   | 155.00 | — | 702.00   |
| 19 Kw/100 Amp,<br>1-3.5 Gpm   | P1@4.50 | Ea | 909.00   | 164.00 | — | 1,073.00 |
| 28 Kw/120 Amp,<br>1.5-5 Gpm   | P1@4.75 | Ea | 1,660.00 | 173.00 | — | 1,833.00 |





## 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   | 63.90  | — | 376.90   |
| ¾" commercial  | P1@2.25 | Ea | 420.00   | 82.10  | — | 502.10   |
| 1" commercial  | P1@2.75 | Ea | 736.00   | 100.00 | — | 836.00   |
| 1¼" commercial | P1@3.50 | Ea | 901.00   | 128.00 | — | 1,029.00 |
| 1½" commercial | P1@3.75 | Ea | 938.00   | 137.00 | — | 1,075.00 |
| 2" commercial  | P1@4.50 | Ea | 1,000.00 | 164.00 | — | 1,164.00 |
| 2½" commercial | P1@5.75 | Ea | 2,080.00 | 210.00 | — | 2,290.00 |
| 3" commercial  | P1@6.50 | Ea | 3,190.00 | 237.00 | — | 3,427.00 |

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

|                 |         |    |          |       |   |          |
|-----------------|---------|----|----------|-------|---|----------|
| 2" B-vent       | P1@.090 | LF | 6.40     | 3.29  | — | 9.69     |
| 3" B-vent       | P1@.100 | LF | 7.90     | 3.65  | — | 11.55    |
| 4" B-vent       | P1@.110 | LF | 10.50    | 4.02  | — | 14.52    |
| 6" B-vent       | P1@.130 | LF | 12.90    | 4.75  | — | 17.65    |
| Tankless heater |         |    |          |       |   |          |
| vent kit        | P1@2.50 | Ea | 449.00   | 91.30 | — | 540.30   |
| Power vent kit  | P1@2.00 | Ea | 1,150.00 | 73.00 | — | 1,223.00 |

SAMPLE

## 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,<br>TCC  | P1@4.50 | Ea | 571.00   | 164.00 | — | 735.00   |
| 30,000 grain water softener,<br>TCC  | P1@4.50 | Ea | 609.00   | 164.00 | — | 773.00   |
| 45,000 grain water softener,<br>TCC  | P1@4.50 | Ea | 677.00   | 164.00 | — | 841.00   |
| 50,000 grain water softener,<br>TCC  | P1@4.75 | Ea | 764.00   | 173.00 | — | 937.00   |
| 60,000 grain water softener,<br>TCC  | P1@4.75 | Ea | 903.00   | 173.00 | — | 1,076.00 |
| 75,000 grain water softener,<br>TCC  | P1@5.00 | Ea | 969.00   | 183.00 | — | 1,152.00 |
| 90,000 grain water softener,<br>TCC  | P1@5.50 | Ea | 1,310.00 | 201.00 | — | 1,511.00 |
| 120,000 grain water softener,<br>TCC | P1@5.75 | Ea | 1,410.00 | 210.00 | — | 1,620.00 |

**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,<br>MMC  | P1@4.50 | Ea | 742.00   | 164.00 | — | 906.00   |
| 30,000 grain water softener,<br>MMC  | P1@4.50 | Ea | 775.00   | 164.00 | — | 939.00   |
| 45,000 grain water softener,<br>MMC  | P1@4.50 | Ea | 843.00   | 164.00 | — | 1,007.00 |
| 50,000 grain water softener,<br>MMC  | P1@4.75 | Ea | 929.00   | 173.00 | — | 1,102.00 |
| 60,000 grain water softener,<br>MMC  | P1@4.75 | Ea | 1,090.00 | 173.00 | — | 1,263.00 |
| 75,000 grain water softener,<br>MMC  | P1@5.00 | Ea | 1,160.00 | 183.00 | — | 1,343.00 |
| 90,000 grain water softener,<br>MMC  | P1@5.50 | Ea | 1,490.00 | 201.00 | — | 1,691.00 |
| 120,000 grain water softener,<br>MMC | P1@5.75 | Ea | 1,590.00 | 210.00 | — | 1,800.00 |

## 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,<br>EMC  | P1@4.50 | Ea | 787.00   | 164.00 | — | 951.00   |
| 30,000 grain water softener,<br>EMC  | P1@4.50 | Ea | 810.00   | 164.00 | — | 974.00   |
| 45,000 grain water softener,<br>EMC  | P1@4.50 | Ea | 889.00   | 164.00 | — | 1,053.00 |
| 50,000 grain water softener,<br>EMC  | P1@4.75 | Ea | 974.00   | 173.00 | — | 1,147.00 |
| 60,000 grain water softener,<br>EMC  | P1@4.75 | Ea | 1,140.00 | 173.00 | — | 1,313.00 |
| 75,000 grain water softener,<br>EMC  | P1@5.00 | Ea | 1,200.00 | 183.00 | — | 1,383.00 |
| 90,000 grain water softener,<br>EMC  | P1@5.50 | Ea | 1,530.00 | 201.00 | — | 1,731.00 |
| 120,000 grain water softener,<br>EMC | P1@5.75 | Ea | 1,630.00 | 210.00 | — | 1,840.00 |

### Water softener accessories

|                      |         |    |       |       |   |       |
|----------------------|---------|----|-------|-------|---|-------|
| By-pass valve        | P1@.400 | Ea | 75.80 | 14.60 | — | 90.40 |
| Manifold adapter kit | P1@.200 | Ea | 20.40 | 7.30  | — | 27.70 |
| Turbulator           | P1@.400 | Ea | 37.40 | 14.60 | — | 52.00 |

**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),<br>5 gpm | P1@4.00 | Ea | 744.00 | 146.00 | — | 890.00   |
| 65,000 iron filter (2.0 cf media),<br>6 gpm | P1@4.50 | Ea | 880.00 | 164.00 | — | 1,044.00 |
| 84,000 iron filter (2.5 cf media),<br>8 gpm | P1@4.75 | Ea | 940.00 | 173.00 | — | 1,113.00 |
| Replacement green sand<br>media             | P1@1.20 | CF | 43.10  | 43.80  | — | 86.90    |

### Iron filter accessories

|                |         |    |       |       |   |       |
|----------------|---------|----|-------|-------|---|-------|
| By-pass valve  | P1@.400 | Ea | 75.80 | 14.60 | — | 90.40 |
| Air vent       | P1@.200 | Ea | 60.10 | 7.30  | — | 67.40 |
| Air controller | P1@.400 | Ea | 67.90 | 14.60 | — | 82.50 |

## 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,<br>1.3 cf media | P1@4.00 | Ea | 1,440.00 | 146.00 | — | 1,586.00 |
| 60,000 iron filter,<br>1.7 cf media | P1@4.50 | Ea | 1,560.00 | 164.00 | — | 1,724.00 |
| 80,000 iron filter,<br>2.5 cf media | P1@4.75 | Ea | 2,260.00 | 173.00 | — | 2,433.00 |

**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<br>softener | P1@4.50 | Ea | 1,810.00 | 164.00 | — | 1,974.00 |
| 30,000 grain hot water<br>softener | P1@4.50 | Ea | 1,920.00 | 164.00 | — | 2,084.00 |
| 40,000 grain hot water<br>softener | P1@4.50 | Ea | 2,000.00 | 164.00 | — | 2,164.00 |
| 60,000 grain hot water<br>softener | P1@4.75 | Ea | 2,370.00 | 173.00 | — | 2,543.00 |

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

|                                         |         |    |        |        |   |        |
|-----------------------------------------|---------|----|--------|--------|---|--------|
| Fiberglass pressure tank,<br>20 gallon  | P1@2.00 | Ea | 248.00 | 73.00  | — | 321.00 |
| Fiberglass pressure tank,<br>30 gallon  | P1@2.00 | Ea | 279.00 | 73.00  | — | 352.00 |
| Fiberglass pressure tank,<br>80 gallon  | P1@2.75 | Ea | 452.00 | 100.00 | — | 552.00 |
| Fiberglass pressure tank,<br>120 gallon | P1@3.50 | Ea | 596.00 | 128.00 | — | 724.00 |
| Brass tank tee assembly,<br>¾"          | P1@3.50 | Ea | 34.70  | 128.00 | — | 162.70 |
| Brass tank tee assembly,<br>1"          | P1@3.50 | Ea | 64.70  | 128.00 | — | 192.70 |
| Brass tank tee assembly,<br>1¼"         | P1@3.50 | Ea | 110.00 | 128.00 | — | 238.00 |

## Kitchen Equipment

| 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,<br>¼" in/out         | P1@3.00 | Ea | 237.00 | 110.00 | — | 347.00 |
| UV system, 6 gpm,<br>½" in/out         | P1@3.00 | Ea | 461.00 | 110.00 | — | 571.00 |
| UV system, 8 gpm,<br>¾" in/out         | P1@4.00 | Ea | 534.00 | 146.00 | — | 680.00 |
| UV system, 12 gpm,<br>¾" in/out        | P1@4.00 | Ea | 684.00 | 146.00 | — | 830.00 |
| UV replacement lamp, 20W,<br>1 gpm     | P1@.750 | Ea | 53.10  | 27.40  | — | 80.50  |
| UV replacement lamp, 32W,<br>6 gpm     | P1@.750 | Ea | 60.20  | 27.40  | — | 87.60  |
| UV replacement lamp, 39W,<br>8-12 gpm  | P1@.750 | Ea | 77.10  | 27.40  | — | 104.50 |
| UV replacement ballast,<br>420 Mv/110V | P1@1.00 | Ea | 233.00 | 36.50  | — | 269.50 |

### Kitchen equipment booster heater

|            |         |    |        |        |   |        |
|------------|---------|----|--------|--------|---|--------|
| 1,000 watt | P1@4.00 | Ea | 609.00 | 146.00 | — | 755.00 |
|------------|---------|----|--------|--------|---|--------|

### Dishwasher

|          |         |    |        |        |   |          |
|----------|---------|----|--------|--------|---|----------|
| Built-in | P1@5.00 | Ea | 872.00 | 183.00 | — | 1,055.00 |
|----------|---------|----|--------|--------|---|----------|

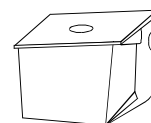
### Garbage disposal

|      |         |    |        |       |   |        |
|------|---------|----|--------|-------|---|--------|
| ½ HP | P1@2.00 | Ea | 177.00 | 73.00 | — | 250.00 |
| ¾ HP | P1@2.00 | Ea | 296.00 | 73.00 | — | 369.00 |



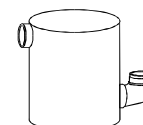
### Grease and oil interceptor

|        |         |    |        |        |   |          |
|--------|---------|----|--------|--------|---|----------|
| 4 GPM  | P1@4.00 | Ea | 337.00 | 146.00 | — | 483.00   |
| 10 GPM | P1@5.00 | Ea | 549.00 | 183.00 | — | 732.00   |
| 15 GPM | P1@7.00 | Ea | 820.00 | 256.00 | — | 1,076.00 |
| 20 GPM | P1@8.00 | Ea | 992.00 | 292.00 | — | 1,284.00 |



### Hair and lint interceptor

|     |         |    |        |       |   |        |
|-----|---------|----|--------|-------|---|--------|
| 1½" | P1@.650 | Ea | 211.00 | 23.70 | — | 234.70 |
| 2"  | P1@.750 | Ea | 301.00 | 27.40 | — | 328.40 |



### All bronze ¾" to 1½" in-line NPT pump

|         |         |    |        |       |   |        |
|---------|---------|----|--------|-------|---|--------|
| 1/12 HP | P1@1.50 | Ea | 532.00 | 54.80 | — | 586.80 |
| 1/6 HP  | P1@1.50 | Ea | 794.00 | 54.80 | — | 848.80 |
| 1/4 HP  | P1@1.50 | Ea | 931.00 | 54.80 | — | 985.80 |



## Kitchen Equipment Connections

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

### Kitchen appliance gas trim

|        |         |    |        |        |   |        |
|--------|---------|----|--------|--------|---|--------|
| 1/2"   | P1@1.15 | Ea | 38.70  | 42.00  | — | 80.70  |
| 3/4"   | P1@1.30 | Ea | 70.80  | 47.50  | — | 118.30 |
| 1"     | P1@1.60 | Ea | 82.00  | 58.40  | — | 140.40 |
| 1 1/4" | P1@2.10 | Ea | 135.00 | 76.70  | — | 211.70 |
| 1 1/2" | P1@2.50 | Ea | 171.00 | 91.30  | — | 262.30 |
| 2"     | P1@3.00 | Ea | 229.00 | 110.00 | — | 339.00 |

### Hot and cold water supply

|        |         |    |        |        |   |        |
|--------|---------|----|--------|--------|---|--------|
| 1/2"   | P1@1.10 | Ea | 40.30  | 40.20  | — | 80.50  |
| 3/4"   | P1@1.55 | Ea | 57.00  | 56.60  | — | 113.60 |
| 1"     | P1@1.90 | Ea | 77.70  | 69.40  | — | 147.10 |
| 1 1/4" | P1@2.50 | Ea | 109.00 | 91.30  | — | 200.30 |
| 1 1/2" | P1@3.00 | Ea | 136.00 | 110.00 | — | 246.00 |

### Continuous waste

|        |         |    |        |       |   |        |
|--------|---------|----|--------|-------|---|--------|
| 2-part | P1@.250 | Ea | 59.80  | 9.13  | — | 68.93  |
| 3-part | P1@.350 | Ea | 101.00 | 12.80 | — | 113.80 |
| 4-part | P1@.450 | Ea | 130.00 | 16.40 | — | 146.40 |

### Indirect waste

|        |         |    |        |        |   |        |
|--------|---------|----|--------|--------|---|--------|
| 1/2"   | P1@1.05 | Ea | 13.00  | 38.30  | — | 51.30  |
| 3/4"   | P1@1.50 | Ea | 22.00  | 54.80  | — | 76.80  |
| 1"     | P1@1.90 | Ea | 35.30  | 69.40  | — | 104.70 |
| 1 1/4" | P1@2.15 | Ea | 52.20  | 78.50  | — | 130.70 |
| 1 1/2" | P1@2.60 | Ea | 68.80  | 94.90  | — | 163.70 |
| 2"     | P1@3.00 | Ea | 105.00 | 110.00 | — | 215.00 |

### Kitchen fixture waste tailpiece

|        |         |    |       |      |   |       |
|--------|---------|----|-------|------|---|-------|
| 1 1/2" | P1@.100 | Ea | 13.10 | 3.65 | — | 16.75 |
|--------|---------|----|-------|------|---|-------|

### Kitchen fixture trap with solder bushing

|        |         |    |       |       |   |       |
|--------|---------|----|-------|-------|---|-------|
| 1 1/2" | P1@.250 | Ea | 44.00 | 9.13  | — | 53.13 |
| 2"     | P1@.300 | Ea | 61.00 | 11.00 | — | 72.00 |

## Plumbing Fixtures

| 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 | 261.00 | 76.70 | — | 337.70 |
| Elongated bowl | P1@2.10 | Ea | 316.00 | 76.70 | — | 392.70 |
| ADA, 18" high  | P1@2.10 | Ea | 430.00 | 76.70 | — | 506.70 |



**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)

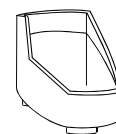
|                                                     |         |    |        |        |   |        |
|-----------------------------------------------------|---------|----|--------|--------|---|--------|
| Elongated bowl                                      | P1@2.60 | Ea | 409.00 | 94.90  | — | 503.90 |
| Elongated bowl, ADA 18" high                        | P1@2.60 | Ea | 486.00 | 94.90  | — | 580.90 |
| Elongated bowl with a bedpan cleanser               | P1@4.10 | Ea | 707.00 | 150.00 | — | 857.00 |
| Elongated bowl, ADA 18" high with a bedpan cleanser | P1@4.10 | Ea | 765.00 | 150.00 | — | 915.00 |

**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 Aftwall series.

|                                            |         |    |          |        |   |          |
|--------------------------------------------|---------|----|----------|--------|---|----------|
| Elongated bowl                             | P1@3.55 | Ea | 649.00   | 130.00 | — | 779.00   |
| Elongated bowl with electronic flush valve | P1@3.80 | Ea | 1,160.00 | 139.00 | — | 1,299.00 |
| Elongated bowl with bedpan cleanser        | P1@5.05 | Ea | 940.00   | 184.00 | — | 1,124.00 |
| Electronic flush valve, add                | P1@.600 | Ea | 512.00   | 21.90  | — | 533.90   |

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

|                             |         |    |        |        |   |        |
|-----------------------------|---------|----|--------|--------|---|--------|
| Siphon-jet type             | P1@3.15 | Ea | 649.00 | 115.00 | — | 764.00 |
| Wash-out type               | P1@3.10 | Ea | 530.00 | 113.00 | — | 643.00 |
| Wash-down type              | P1@3.00 | Ea | 374.00 | 110.00 | — | 484.00 |
| Urinal carrier, add         | P1@.600 | Ea | 118.00 | 21.90  | — | 139.90 |
| Electronic flush valve, add | P1@.600 | Ea | 422.00 | 21.90  | — | 443.90 |



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

|              |         |    |          |        |   |          |
|--------------|---------|----|----------|--------|---|----------|
| Stall urinal | P1@5.00 | Ea | 1,260.00 | 183.00 | — | 1,443.00 |
|--------------|---------|----|----------|--------|---|----------|

## 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 | 542.00 | 98.60 | — | 640.60 |
| Wall-hung, ADA  | P1@2.70 | Ea | 790.00 | 98.60 | — | 888.60 |
| Fixture carrier | P1@.500 | Ea | 112.00 | 18.30 | — | 130.30 |

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



|                |         |    |        |       |   |        |
|----------------|---------|----|--------|-------|---|--------|
| Vitreous china | P1@2.00 | Ea | 401.00 | 73.00 | — | 474.00 |
| Enameled steel | P1@2.00 | Ea | 339.00 | 73.00 | — | 412.00 |
| Acrylic        | P1@2.00 | Ea | 247.00 | 73.00 | — | 320.00 |

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

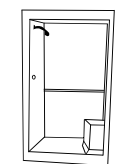


|                |         |    |        |        |   |        |
|----------------|---------|----|--------|--------|---|--------|
| Enameled steel | P1@2.50 | Ea | 565.00 | 91.30  | — | 656.30 |
| Cast iron      | P1@3.50 | Ea | 817.00 | 128.00 | — | 945.00 |
| Fiberglass     | P1@2.50 | Ea | 522.00 | 91.30  | — | 613.30 |
| Acrylic        | P1@2.50 | Ea | 558.00 | 91.30  | — | 649.30 |

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

|                   |         |    |          |        |   |          |
|-------------------|---------|----|----------|--------|---|----------|
| One-piece         | P1@4.50 | Ea | 1,160.00 | 164.00 | — | 1,324.00 |
| Two-piece (reno)  | P1@5.50 | Ea | 1,490.00 | 201.00 | — | 1,691.00 |
| Four-piece (reno) | P1@6.25 | Ea | 1,580.00 | 228.00 | — | 1,808.00 |

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



|                        |         |    |          |        |   |          |
|------------------------|---------|----|----------|--------|---|----------|
| Fiberglass one-piece   | P1@3.50 | Ea | 722.00   | 128.00 | — | 850.00   |
| Fiberglass three-piece | P1@4.25 | Ea | 931.00   | 155.00 | — | 1,086.00 |
| Acrylic one-piece      | P1@3.50 | Ea | 1,080.00 | 128.00 | — | 1,208.00 |
| Acrylic three-piece    | P1@4.25 | Ea | 1,420.00 | 155.00 | — | 1,575.00 |

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

|              |         |    |        |       |   |        |
|--------------|---------|----|--------|-------|---|--------|
| Fiberglass   | P1@2.50 | Ea | 492.00 | 91.30 | — | 583.30 |
| Acrylic      | P1@2.50 | Ea | 530.00 | 91.30 | — | 621.30 |
| Molded stone | P1@2.65 | Ea | 512.00 | 96.80 | — | 608.80 |

## 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 | 414.00 | 78.50 | — | 492.50 |
| Cast iron       | P1@2.50 | Ea | 540.00 | 91.30 | — | 631.30 |
| Acrylic         | P1@2.15 | Ea | 490.00 | 78.50 | — | 568.50 |



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

|                 |         |    |        |       |   |        |
|-----------------|---------|----|--------|-------|---|--------|
| Stainless steel | P1@2.00 | Ea | 350.00 | 73.00 | — | 423.00 |
| Cast iron       | P1@2.10 | Ea | 403.00 | 76.70 | — | 479.70 |
| Acrylic         | P1@2.00 | Ea | 364.00 | 73.00 | — | 437.00 |

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

|                 |         |    |        |       |   |        |
|-----------------|---------|----|--------|-------|---|--------|
| Stainless steel | P1@2.00 | Ea | 298.00 | 73.00 | — | 371.00 |
| Acrylic         | P1@2.00 | Ea | 200.00 | 73.00 | — | 273.00 |



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

|                 |         |    |        |       |   |        |
|-----------------|---------|----|--------|-------|---|--------|
| Stainless steel | P1@2.10 | Ea | 432.00 | 76.70 | — | 508.70 |
| Acrylic         | P1@2.10 | Ea | 369.00 | 76.70 | — | 445.70 |

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

|                 |         |    |        |       |   |        |
|-----------------|---------|----|--------|-------|---|--------|
| Stainless steel | P1@2.25 | Ea | 495.00 | 82.10 | — | 577.10 |
| Acrylic         | P1@2.25 | Ea | 432.00 | 82.10 | — | 514.10 |

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

|           |         |    |        |        |   |        |
|-----------|---------|----|--------|--------|---|--------|
| Cast iron | P1@3.50 | Ea | 579.00 | 128.00 | — | 707.00 |
| Acrylic   | P1@2.25 | Ea | 254.00 | 82.10  | — | 336.10 |

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

|           |         |    |        |        |   |        |
|-----------|---------|----|--------|--------|---|--------|
| Cast iron | P1@2.75 | Ea | 501.00 | 100.00 | — | 601.00 |
| Acrylic   | P1@2.00 | Ea | 176.00 | 73.00  | — | 249.00 |



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

|              |         |    |        |       |   |        |
|--------------|---------|----|--------|-------|---|--------|
| Molded stone | P1@2.65 | Ea | 705.00 | 96.80 | — | 801.80 |
| Terrazzo     | P1@2.65 | Ea | 777.00 | 96.80 | — | 873.80 |
| Acrylic      | P1@2.35 | Ea | 543.00 | 85.80 | — | 628.80 |

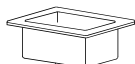
## Plumbing Fixtures



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

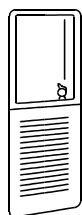
**Slop sink, enameled cast iron with P-trap, standard.** Complete with trim. Make additional allowances for rough-in.

|                             |         |    |          |        |   |          |
|-----------------------------|---------|----|----------|--------|---|----------|
| Slop sink with P-trap, std. | P1@3.50 | Ea | 1,210.00 | 128.00 | — | 1,338.00 |
|-----------------------------|---------|----|----------|--------|---|----------|



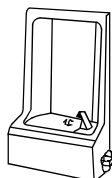
**Floor sink, recessed, enameled steel, white.** Add 40% to material prices for acid-resisting finish. Complete with strainer. Make additional allowances for rough-in.

|           |         |    |        |       |   |        |
|-----------|---------|----|--------|-------|---|--------|
| 9" x 9"   | P1@1.00 | Ea | 104.00 | 36.50 | — | 140.50 |
| 12" x 12" | P1@1.00 | Ea | 121.00 | 36.50 | — | 157.50 |
| 15" x 15" | P1@1.15 | Ea | 82.50  | 42.00 | — | 124.50 |
| 18" x 18" | P1@1.25 | Ea | 108.00 | 45.60 | — | 153.60 |
| 24" x 24" | P1@1.50 | Ea | 147.00 | 54.80 | — | 201.80 |



**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 | 1,240.00 | 73.00 | — | 1,313.00 |
| Semi-recessed  | P1@2.50 | Ea | 1,650.00 | 91.30 | — | 1,741.30 |
| Fully-recessed | P1@2.50 | Ea | 2,850.00 | 91.30 | — | 2,941.30 |
| Wall-hung      | P1@2.00 | Ea | 1,160.00 | 73.00 | — | 1,233.00 |
| Wall-hung, ADA | P1@2.50 | Ea | 2,850.00 | 91.30 | — | 2,941.30 |



**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 | 959.00   | 91.30 | — | 1,050.30 |
| Wall-hung, china | P1@2.00 | Ea | 546.00   | 73.00 | — | 619.00   |
| Recessed, S.S.   | P1@2.50 | Ea | 1,090.00 | 91.30 | — | 1,181.30 |
| Wall-hung, S.S.  | P1@2.00 | Ea | 582.00   | 73.00 | — | 655.00   |
| ADA, S.S.        | P1@2.50 | Ea | 1,000.00 | 91.30 | — | 1,091.30 |

**HVAC & Plumbing Demolition**

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

**Remove pump.** These figures include isolating and disconnecting pipe and electrical connections. Disposal costs or salvage values excluded. Equipment may be needed for some sizes and locations. Refer to the equipment rental costs at the front of this section.

|                                              |         |    |   |        |   |        |
|----------------------------------------------|---------|----|---|--------|---|--------|
| Base-mounted pump, ½-1 HP,<br>remove         | P1@1.00 | Ea | — | 36.50  | — | 36.50  |
| Base-mounted pump, 1½-3 HP,<br>remove        | P1@1.75 | Ea | — | 63.90  | — | 63.90  |
| Base-mounted pump, 5-10 HP,<br>remove        | P1@2.75 | Ea | — | 100.00 | — | 100.00 |
| Base-mounted pump, 15-25 HP,<br>remove       | P1@3.75 | Ea | — | 137.00 | — | 137.00 |
| Base-mounted pump, 30-50 HP,<br>remove       | P1@4.55 | Ea | — | 166.00 | — | 166.00 |
| In-line mounted pump, 1/12-1/3 HP,<br>remove | P1@.650 | Ea | — | 23.70  | — | 23.70  |
| In-line mounted pump, ½-1 HP,<br>remove      | P1@.750 | Ea | — | 27.40  | — | 27.40  |
| In-line mounted pump, 3-5 HP,<br>remove      | P1@1.85 | Ea | — | 67.50  | — | 67.50  |
| In-line mounted pump, 7.5-10 HP,<br>remove   | P1@2.55 | Ea | — | 93.10  | — | 93.10  |
| In-line mounted pump, 15-25 HP,<br>remove    | P1@3.90 | Ea | — | 142.00 | — | 142.00 |
| In-line mounted pump, 30-50 HP,<br>remove    | P1@4.85 | Ea | — | 177.00 | — | 177.00 |

**Remove valve.** These figures include isolation and disconnection. Disposal costs or salvage values excluded. Equipment may be needed for some sizes and locations. Refer to the equipment rental costs at the front of this section.

|                                   |         |    |   |       |   |       |
|-----------------------------------|---------|----|---|-------|---|-------|
| Soldered valve, ½"-1",<br>remove  | P1@.165 | Ea | — | 6.02  | — | 6.02  |
| Soldered valve, 1½"-2",<br>remove | P1@.225 | Ea | — | 8.21  | — | 8.21  |
| Soldered valve, 2½"-4",<br>remove | P1@.650 | Ea | — | 23.70 | — | 23.70 |
| Threaded valve, ½"-1",<br>remove  | P1@.150 | Ea | — | 5.48  | — | 5.48  |
| Threaded valve, 1½"-2",<br>remove | P1@.235 | Ea | — | 8.58  | — | 8.58  |
| Threaded valve, 2½"-4",<br>remove | P1@.680 | Ea | — | 24.80 | — | 24.80 |
| Flanged valve, ½"-1",<br>remove   | P1@.200 | Ea | — | 7.30  | — | 7.30  |
| Flanged valve, 1½"-2",<br>remove  | P1@.280 | Ea | — | 10.20 | — | 10.20 |
| Flanged valve, 2½"-4",<br>remove  | P1@.625 | Ea | — | 22.80 | — | 22.80 |
| Flanged valve, 6"-8",<br>remove   | P1@1.70 | Ea | — | 62.10 | — | 62.10 |
| Flanged valve, 10"-12",<br>remove | P1@2.65 | Ea | — | 96.80 | — | 96.80 |



## HVAC & Plumbing Demolition

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

**Remove hot water tank.** These figures include isolation and disconnection. Disposal costs or salvage values excluded. Equipment may be needed for some sizes and locations. Refer to the equipment rental costs at the front of this section.

|                                                 |         |    |   |        |   |        |
|-------------------------------------------------|---------|----|---|--------|---|--------|
| Gas-fired hot water tank, 40 gallon,<br>remove  | P1@2.00 | Ea | — | 73.00  | — | 73.00  |
| Gas-fired hot water tank, 60 gallon,<br>remove  | P1@2.50 | Ea | — | 91.30  | — | 91.30  |
| Gas-fired hot water tank, 100 gallon,<br>remove | P1@3.00 | Ea | — | 110.00 | — | 110.00 |
| Electric hot water tank, 40 gallon,<br>remove   | P1@1.60 | Ea | — | 58.40  | — | 58.40  |
| Electric hot water tank, 60 gallon,<br>remove   | P1@2.00 | Ea | — | 73.00  | — | 73.00  |
| Electric hot water tank, 100 gallon,<br>remove  | P1@2.60 | Ea | — | 94.90  | — | 94.90  |

**Remove plumbing fixture.** These figures include isolation and disconnection. Disposal costs or salvage values excluded. Equipment may be needed for some sizes and locations. Refer to the equipment rental costs at the front of this section.

|                                                  |         |    |   |        |   |        |
|--------------------------------------------------|---------|----|---|--------|---|--------|
| Floor-mount, tank-type water closet,<br>remove   | P1@.850 | ea | — | 31.00  | — | 31.00  |
| Wall-mount, tank-type water closet,<br>remove    | P1@1.35 | Ea | — | 49.30  | — | 49.30  |
| Floor-mount, flush valve water closet,<br>remove | P1@.950 | Ea | — | 34.70  | — | 34.70  |
| Wal- mount, flush valve water closet,<br>remove  | P1@1.55 | Ea | — | 56.60  | — | 56.60  |
| Wall-mount, flush valve urinal,<br>remove        | P1@1.15 | Ea | — | 42.00  | — | 42.00  |
| Wall-mount, tank-type urinal,<br>remove          | P1@1.65 | Ea | — | 60.20  | — | 60.20  |
| Kitchen sink,<br>remove                          | P1@.850 | Ea | — | 31.00  | — | 31.00  |
| Bathroom sink,<br>remove                         | P1@.850 | Ea | — | 31.00  | — | 31.00  |
| Bathtub,<br>remove                               | P1@2.25 | Ea | — | 82.10  | — | 82.10  |
| Shower stall,<br>remove                          | P1@2.00 | Ea | — | 73.00  | — | 73.00  |
| Tub and shower combination,<br>remove            | P1@2.85 | Ea | — | 104.00 | — | 104.00 |
| Laundry sink,<br>remove                          | P1@.950 | Ea | — | 34.70  | — | 34.70  |
| Mop sink,<br>remove                              | P1@1.50 | Ea | — | 54.80  | — | 54.80  |
| Slop sink,<br>remove                             | P1@1.75 | Ea | — | 63.90  | — | 63.90  |
| Drinking fountain,<br>remove                     | P1@1.40 | Ea | — | 51.10  | — | 51.10  |

**HVAC & Plumbing Demolition**

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

**Disconnect plumbing fixture.** These figures include isolation and disconnection only. Fixtures removed by others. Disposal costs or salvage values excluded. Equipment may be needed for some sizes and locations. Refer to the equipment rental costs at the front of this section.

|                                                      |         |    |   |       |   |       |
|------------------------------------------------------|---------|----|---|-------|---|-------|
| Floor-mount, tank-type water closet,<br>disconnect   | P1@.450 | Ea | — | 16.40 | — | 16.40 |
| Wall-mount, tank-type water closet,<br>disconnect    | P1@.650 | Ea | — | 23.70 | — | 23.70 |
| Floor-mount, flush valve water closet,<br>disconnect | P1@.550 | Ea | — | 20.10 | — | 20.10 |
| Wall-mount, flush valve water closet,<br>disconnect  | P1@.650 | Ea | — | 23.70 | — | 23.70 |
| Wall-mount, flush valve urinal,<br>disconnect        | P1@.650 | Ea | — | 23.70 | — | 23.70 |
| Wall-mount, tank-type urinal,<br>disconnect          | P1@.950 | Ea | — | 34.70 | — | 34.70 |
| Kitchen sink,<br>disconnect                          | P1@.450 | Ea | — | 16.40 | — | 16.40 |
| Bathroom sink,<br>disconnect                         | P1@.450 | Ea | — | 16.40 | — | 16.40 |
| Bathtub,<br>disconnect                               | P1@.650 | Ea | — | 23.70 | — | 23.70 |
| Shower stall,<br>disconnect                          | P1@.650 | Ea | — | 23.70 | — | 23.70 |
| Tub and shower combination,<br>disconnect            | P1@.650 | Ea | — | 23.70 | — | 23.70 |
| Laundry sink,<br>disconnect                          | P1@.450 | Ea | — | 16.40 | — | 16.40 |
| Mop sink,<br>disconnect                              | P1@.450 | Ea | — | 16.40 | — | 16.40 |
| Slop sink,<br>disconnect                             | P1@.750 | Ea | — | 27.40 | — | 27.40 |
| Drinking fountain,<br>disconnect                     | P1@.650 | Ea | — | 23.70 | — | 23.70 |
| Gas-fired hot water tank, 40 gallon,<br>disconnect   | P1@.900 | Ea | — | 32.90 | — | 32.90 |
| Gas-fired hot water tank, 60 gallon,<br>disconnect   | P1@1.15 | Ea | — | 42.00 | — | 42.00 |
| Gas-fired hot water tank, 100 gallon,<br>disconnect  | P1@1.35 | Ea | — | 49.30 | — | 49.30 |
| Electric hot water tank, 40 gallon,<br>disconnect    | P1@.600 | Ea | — | 21.90 | — | 21.90 |
| Electric hot water tank, 60 gallon,<br>disconnect    | P1@.900 | Ea | — | 32.90 | — | 32.90 |
| Electric hot water tank, 100 gallon,<br>disconnect   | P1@1.00 | Ea | — | 36.50 | — | 36.50 |

## HVAC & Plumbing Demolition

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

**Remove pipe insulation.** These figures assume demolished materials are piled on site. Disposal costs or salvage values excluded.

|                                                |         |    |   |       |   |      |
|------------------------------------------------|---------|----|---|-------|---|------|
| Fiberglass pipe insulation, ½"-1",<br>remove   | P1@.020 | LF | — | .73   | — | .73  |
| Fiberglass pipe insulation, 1½"-2",<br>remove  | P1@.025 | LF | — | .91   | — | .91  |
| Fiberglass pipe insulation, 2½"-4",<br>remove  | P1@.035 | LF | — | 1.28  | — | 1.28 |
| Fiberglass pipe insulation, 6"-8",<br>remove   | P1@.060 | LF | — | 2.19  | — | 2.19 |
| Fiberglass pipe insulation, 10"-12",<br>remove | P1@.090 | LF | — | 3.29  | — | 3.29 |
| Pipe insul. with canvas jacket –<br>add        | —       | %  | — | 10.00 | — | —    |
| Pipe insul. with alum.<br>jacket – add         | —       | %  | — | 20.00 | — | —    |
| Calcium silicate pipe<br>insul. – add          | —       | %  | — | 15.00 | — | —    |

**Remove duct insulation.** These figures assume demolished materials are piled on site. Disposal costs or salvage values excluded.

|                                              |         |    |   |       |   |     |
|----------------------------------------------|---------|----|---|-------|---|-----|
| Fiberglass blanket insulation,<br>remove     | S2@.020 | SF | — | .72   | — | .72 |
| Fiberglass rigid board insulation,<br>remove | S2@.025 | SF | — | .90   | — | .90 |
| Insul. with canvas jacket –<br>add           | —       | %  | — | 8.00  | — | —   |
| Insul. with alum jacket –<br>add             | —       | %  | — | 10.00 | — | —   |

**Budget Estimates for Plumbing and HVAC Work**

General contractors and owners often ask mechanical subcontractors to prepare budget cost estimates for use in planning projects. A budget estimate isn't a bid for the contract and you probably won't be paid for preparing the estimate. That's why you won't want to spend too much time on these estimates. Accuracy within 8 to 10 percent of the final bid price will usually be acceptable. Normally you'll have only preliminary architectural drawings and possibly a guide specification to work from. The tables that follow will help you prepare budget estimates for nearly any plumbing or HVAC job.

The costs in these tables are averages and will vary considerably with design requirements and by geographic area. Make it clear to the owner or architect requesting the figures that these are budget estimates and will be revised when final plans and specifications are available.

**Budget Estimates for Plumbing:** First, count the number of plumbing fixtures. Multiply the number of fixtures of each type by the price per fixture shown in the table below. These prices include all the usual labor and material for a complete average plumbing installation. Prices are based on branch piping lengths averaging 35 feet between the fixture and the main. Typical main piping is also included in the prices.

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

**Budget plumbing estimate, cast iron DWV, copper supply pipe**

|                    |         |    |          |        |   |          |
|--------------------|---------|----|----------|--------|---|----------|
| Bathtubs           | P1@15.0 | Ea | 2,460.00 | 548.00 | — | 3,008.00 |
| Showers            | P1@9.00 | Ea | 1,340.00 | 329.00 | — | 1,669.00 |
| Lavatories         | P1@11.0 | Ea | 2,300.00 | 402.00 | — | 2,702.00 |
| Kitchen sinks      | P1@12.0 | Ea | 2,410.00 | 438.00 | — | 2,848.00 |
| Service sinks      | P1@10.0 | Ea | 2,070.00 | 365.00 | — | 2,435.00 |
| Bar sinks          | P1@9.00 | Ea | 1,740.00 | 329.00 | — | 2,069.00 |
| Floor sinks        | P1@7.00 | Ea | 1,070.00 | 256.00 | — | 1,326.00 |
| Water closets      |         |    |          |        |   |          |
| Tank-type          | P1@11.0 | Ea | 1,740.00 | 402.00 | — | 2,142.00 |
| Flush valve        | P1@12.0 | Ea | 1,960.00 | 438.00 | — | 2,398.00 |
| Urinals            | P1@8.00 | Ea | 2,520.00 | 292.00 | — | 2,812.00 |
| Drinking fountains |         |    |          |        |   |          |
| (refrigerated)     | P1@12.0 | Ea | 2,910.00 | 438.00 | — | 3,348.00 |
| Wash fountains     | P1@25.0 | Ea | 6,260.00 | 913.00 | — | 7,173.00 |
| Can washers        | P1@18.0 | Ea | 3,190.00 | 657.00 | — | 3,847.00 |
| Floor drains       | P1@8.00 | Ea | 985.00   | 292.00 | — | 1,277.00 |
| Area drains        | P1@6.00 | Ea | 846.00   | 219.00 | — | 1,065.00 |
| Roof drains        | P1@18.0 | Ea | 2,240.00 | 657.00 | — | 2,897.00 |
| Overflow drains    | P1@18.0 | Ea | 2,240.00 | 657.00 | — | 2,897.00 |
| Deck drains        | P1@4.00 | Ea | 697.00   | 146.00 | — | 843.00   |
| Cleanouts          | P1@5.00 | Ea | 753.00   | 183.00 | — | 936.00   |
| Trap primers       | P1@2.00 | Ea | 382.00   | 73.00  | — | 455.00   |
| Sump pumps         | P1@6.00 | Ea | 3,720.00 | 219.00 | — | 3,939.00 |
| Water heaters      |         |    |          |        |   |          |
| Gas, 40 gal.       | P1@16.0 | Ea | 4,390.00 | 584.00 | — | 4,974.00 |
| Gas, 80 gal.       | P1@17.0 | Ea | 4,870.00 | 621.00 | — | 5,491.00 |
| Gas, 120 gal.      | P1@18.0 | Ea | 5,690.00 | 657.00 | — | 6,347.00 |

## Budget Estimating

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

### Budget plumbing estimate, plastic DWV and plastic supply pipe

|                    |         |    |          |        |   |          |
|--------------------|---------|----|----------|--------|---|----------|
| Bathtubs           | P1@12.0 | Ea | 1,960.00 | 438.00 | — | 2,398.00 |
| Showers            | P1@7.00 | Ea | 950.00   | 256.00 | — | 1,206.00 |
| Lavatories         | P1@9.00 | Ea | 1,810.00 | 329.00 | — | 2,139.00 |
| Kitchen sinks      | P1@10.0 | Ea | 2,020.00 | 365.00 | — | 2,385.00 |
| Service sinks      | P1@8.00 | Ea | 1,630.00 | 292.00 | — | 1,922.00 |
| Bar sinks          | P1@7.00 | Ea | 1,380.00 | 256.00 | — | 1,636.00 |
| Floor sinks        | P1@6.00 | Ea | 826.00   | 219.00 | — | 1,045.00 |
| Water closets      |         |    |          |        |   |          |
| Tank-type          | P1@8.00 | Ea | 1,270.00 | 292.00 | — | 1,562.00 |
| Flush valve        | P1@9.00 | Ea | 1,530.00 | 329.00 | — | 1,859.00 |
| Urinals            | P1@6.00 | Ea | 2,060.00 | 219.00 | — | 2,279.00 |
| Drinking fountains |         |    |          |        |   |          |
| (refrigerated)     | P1@10.0 | Ea | 2,400.00 | 365.00 | — | 2,765.00 |
| Wash fountains     | P1@22.0 | Ea | 5,460.00 | 803.00 | — | 6,263.00 |
| Can washers        | P1@15.0 | Ea | 2,680.00 | 548.00 | — | 3,228.00 |
| Floor drains       | P1@7.00 | Ea | 683.00   | 256.00 | — | 939.00   |
| Area drains        | P1@5.00 | Ea | 559.00   | 183.00 | — | 742.00   |
| Roof drains        | P1@16.0 | Ea | 1,910.00 | 584.00 | — | 2,494.00 |
| Overflow drains    | P1@16.0 | Ea | 1,910.00 | 584.00 | — | 2,494.00 |
| Deck drains        | P1@3.00 | Ea | 475.00   | 110.00 | — | 585.00   |
| Cleanouts          | P1@4.00 | Ea | 580.00   | 146.00 | — | 726.00   |
| Trap primers       | P1@2.00 | Ea | 288.00   | 73.00  | — | 361.00   |
| Sump pumps         | P1@5.00 | Ea | 3,350.00 | 183.00 | — | 3,533.00 |
| Water heaters      |         |    |          |        |   |          |
| Gas, 40 gal.       | P1@15.0 | Ea | 4,050.00 | 548.00 | — | 4,598.00 |
| Gas, 80 gal.       | P1@16.0 | Ea | 4,430.00 | 584.00 | — | 5,014.00 |
| Gas, 120 gal.      | P1@17.0 | Ea | 5,140.00 | 621.00 | — | 5,761.00 |

## Budget Estimating

**Budget Estimates for HVAC Work:** Budget estimates for heating, ventilating and air conditioning work are figured by the square foot of floor. Multiply the area of conditioned space by the cost per square foot in the table that follows. The result is the estimated cost including a complete heating, ventilating and air conditioning system and 20 percent overhead and profit. The table also shows average heating and cooling requirements for various types of buildings.

| Description                 | Cooling  | Heating  | Total Selling Price (\$) |           |
|-----------------------------|----------|----------|--------------------------|-----------|
|                             | (Btu/SF) | (Btu/SF) | Per SF                   | Per Ton   |
| Apartments and condominiums | 25       | 25       | 14.10                    | 5,180.00  |
| Auditoriums                 | 40       | 40       | 36.00                    | 8,280.00  |
| Banks                       | 45       | 30       | 37.30                    | 8,260.00  |
| Barber shops                | 40       | 40       | 36.80                    | 8,430.00  |
| Beauty shops                | 60       | 30       | 43.70                    | 6,680.00  |
| Bowling alleys              | 40       | 40       | 28.70                    | 6,590.00  |
| Churches                    | 35       | 35       | 31.20                    | 8,130.00  |
| Classrooms                  | 45       | 40       | 56.70                    | 11,500.00 |
| Cocktail lounges            | 70       | 30       | 39.40                    | 5,180.00  |
| Computer rooms              | 145      | 20       | 80.20                    | 5,080.00  |
| Department stores           | 35       | 30       | 25.20                    | 6,640.00  |
| Laboratories                | 60       | 45       | 69.80                    | 10,700.00 |
| Libraries                   | 45       | 35       | 41.70                    | 8,500.00  |
| Manufacturing plants        | 40       | 35       | 16.20                    | 3,720.00  |
| Medical buildings           | 35       | 35       | 27.50                    | 7,260.00  |
| Motels                      | 30       | 30       | 19.30                    | 5,890.00  |
| Museums                     | 35       | 40       | 30.70                    | 8,070.00  |
| Nursing homes               | 45       | 35       | 35.40                    | 7,290.00  |
| Office buildings, low-rise  | 35       | 35       | 28.00                    | 7,370.00  |
| Office buildings, high-rise | 40       | 30       | 38.20                    | 8,730.00  |
| Residences                  | 20       | 30       | 8.61                     | 3,980.00  |
| Retail shops                | 45       | 30       | 28.70                    | 5,850.00  |
| Supermarkets                | 30       | 30       | 15.00                    | 4,570.00  |
| Theaters                    | 40       | 40       | 28.00                    | 6,480.00  |

Note that these are budget estimates and can vary widely with conditions which may be unique to the job site. Many of these conditions are identified below. Avoid submitting even a budget estimate without either a site walk-through, a conference with the consulting engineer or architect or a careful review of the plans.

Be alert to any of the following conditions. Any of these can have a major impact on cost:

1. Do HVAC unit dimensions exceed the size of available openings?
2. If a crane is required, is there ample clearance for crane operations?
3. Will any doors, permanent ladders, scaffolding or load-bearing supports obstruct installation?
4. Do the plans show all vents, drains and cleanouts required by the code? Many items like these are not specified by the engineer but will be required by the inspector.
5. For retrofit work, consider carefully problems associated with demolition, including removal of the existing HVAC system, structural modifications and any encased asbestos that may be present.
6. In retrofit jobs, the type and size of HVAC equipment is limited by the window area and installed insulation.
7. How will available power, gas and water lines be extended to the new HVAC equipment?



The following pages contain business forms and letters most plumbing and HVAC contractors can use.

Change Orders  
Change Estimate Takeoff  
Change Estimate Worksheet  
Change Estimate Summary  
Change Order Log

Subcontract Forms  
Standard Form Subcontract  
Subcontract Change Order

Purchase Order  
Construction Schedule  
Letter of Intent  
Submittal Data Cover Sheet  
Submittal Index  
Billing Breakdown Worksheet

An explanation is provided on how the forms function in the contractor's office, how to fill them out, and a sample provided. Where appropriate, a blank copy of the form is provided for your use.

Permission is hereby given by the publisher for the duplication of any of the blank forms on a copy machine or at a printer, provided they are for your own use and not to be sold at a cost exceeding the actual printing and paper cost.

Space has been provided at the top of the forms so you can add your own letterhead or logo.

## Change Estimates

Very few projects are completed without some changes to the original plans. Most changes in the scope of work are a result of either errors by the designer or requests by the owner.

Here's the usual sequence in handling changes.

- 1) The project architect usually initiates a change by sending a Request for Quotation (R.F.Q.) to the general contractor with a detailed description of the work to be modified.
- 2) The general contractor prepares a Change Estimate (C.E.) if the work is to be done by the general.
- 3) The subcontractor prepares a change estimate which shows the work to be added to or deleted from the contract and the cost of changes, including markup. The general contractor reviews the change estimate and forwards a summary to the architect for decision.
- 4) If the decision is to go ahead with the change, the architect issues a Change Order (C.O.) to the general contractor. This change order is authorization to proceed with the change at the price quoted.

Your costs for making changes will normally be higher than your costs for similar items on the original estimate. Here's why:

Equipment and materials for changes are almost always purchased in smaller quantities. Volume discounts are seldom available.

Special handling and delivery of small orders will further increase equipment and material costs.

Scheduled work will be disrupted.

Overhead costs will be higher because special purchase orders or subcontracts will be required.

Vendor restocking charges for deleted items will range from 20 to 50 percent of the original cost.

Large change orders may require additional manpower, which usually results in decreased efficiency.

The cumulative effect of change orders will be to increase overhead costs if the project completion date is extended.

To compensate for these higher costs, most estimators use a higher markup on change estimates:

Add an extra 10 percent markup to equipment and material costs to cover increased overhead and handling costs, prior to adding final Overhead and Profit markup.

Increase competitive labor units (manhours required to perform a specific task) by 15 percent to compensate for inefficiencies such as disruptions in the work schedule, extra handling of equipment and material, and additional manpower.

Mark up subcontractor prices by 10 percent.

Figure overhead and profit markup at 15/10 or 10/10.

By following these suggestions, the mathematical gross profit will appear to be 40 to 45 percent, but the true gross will be closer to 25 percent because your costs for change order work are higher, as listed above.

## Change Estimate Example

Let's assume that the general contractor on your job has sent a R.F.Q. to your attention. The extra work is a run of hot water piping that will connect to equipment being furnished and set by others. The first step is to list all material and labor required to do the work. Notice the items entered on the Change Estimate Take-off form on page 440.

When the take-off is complete, transfer the manhour total to the Change Estimate Worksheet on page 441. To complete this form:

- 1) Multiply manhours by the cost per hour.
- 2) Add the cost of supervision.
- 3) Total direct labor cost.
- 4) Add the cost of preparing the change order estimate (C.E.).
- 5) Add equipment and tool costs.
- 6) Add subcontract costs.

Then bring totals forward to the Change Estimate Summary on page 442:

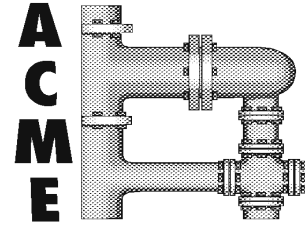
- 1) Enter the material cost total from the Change Estimate Take-off form on page 444.
- 2) Enter direct and indirect labor cost totals from the Change Estimate Worksheet.
- 3) Enter equipment, tool and subcontract cost totals from the Change Estimate Worksheet.

Notice the additional bond charge on line M of the Change Estimate Summary. This is the extra premium charged by the bonding company to cover the increase in contract value. The next line, Service Reserve, is the allowance for service work (if any is required) during the warranty period. A sample Change Order Log, used to record the status of changes, is also included on page 443.

# ACME

## Mechanical Contractors

7600 Oak Avenue - Smallville, U.S.A. 12345-6789  
Voice 1-234-5678 / FAX 1-234-5680



### Change Estimate Take-off

Project CBC Bank Building

C. E. Number One

Take-off by DCO

Job No 7777

Date 2-2-19

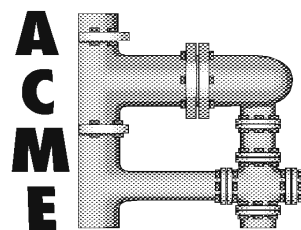
| Equipment and Material |                             |          | Material \$ |        | Labor Manhours |       |
|------------------------|-----------------------------|----------|-------------|--------|----------------|-------|
| Item                   | Description                 | Quantity | Unit        | Total  | Unit           | Total |
| 1                      | 1" Type L hard copper pipe  | 40 LF    | 3.87        | 154.80 | .038           | 1.52  |
| 2                      | 1" 90 degree copper ell     | 6 Ea     | 4.21        | 25.26  | .23            | 1.38  |
| 3                      | 1" copper coupling          | 4 Ea     | 2.54        | 10.16  | .24            | .96   |
| 4                      | 1" bronze ball valve        | 2 Ea     | 17.30       | 34.60  | .36            | .72   |
| 5                      | 2" x 1" reducing copper tee | 2 Ea     | 20.60       | 41.20  | .40            | .80   |
| 6                      | 1" copper union             | 2 Ea     | 19.10       | 38.20  | .26            | .52   |
| 7                      | 1" pipe hanger              | 8 Ea     | 4.33        | 34.64  | .25            | 2.00  |
| 8                      | Miscellaneous material      | 1 Ea     | LS          | 50.00  | 1.78           | 1.78  |
|                        |                             |          |             |        |                |       |
|                        |                             |          |             |        |                |       |
|                        |                             |          |             |        |                |       |
|                        |                             |          |             |        |                |       |
|                        |                             |          |             |        |                |       |
|                        |                             |          |             |        |                |       |
|                        |                             |          |             |        |                |       |
|                        |                             |          |             |        |                |       |
|                        |                             |          |             |        |                |       |
|                        |                             |          |             |        |                |       |
|                        |                             |          |             |        |                |       |
|                        |                             | Totals   |             | 388.86 |                | 9.68  |



# ACME

## Mechanical Contractors

7600 Oak Avenue - Smallville, U.S.A. 12345-6789  
Voice 1-234-5678 / FAX 1-234-5680



### Change Estimate Summary

**Quotation to** ABC General Contractors, Inc. **Date** 2-3-19  
**Address** 380 First Street **Change Order No.** One  
**Address** \_\_\_\_\_ **Job Number** 7777  
**City / State / Zip** Smallville, CA 63876  
**Attention:** Mr. J.H. Smith  
**Job Name** CBC Bank Building  
**Reference:** Your R.F.O. No. 7 Labor and Material to furnish and install additional hot water piping.

|                                                               |            |               |                                    |
|---------------------------------------------------------------|------------|---------------|------------------------------------|
| A. Materials and equipment:                                   | \$         | <u>388.86</u> |                                    |
| B. Sales tax: <u>7%</u>                                       | \$         | <u>27.22</u>  |                                    |
| C. Direct labor:                                              | \$         | <u>450.11</u> |                                    |
| D. Indirect costs:                                            | \$         | <u>40.00</u>  |                                    |
| E. Equipment and tools:                                       | \$         | <u>39.50</u>  |                                    |
| F.                                                            |            |               | <b>Subtotal \$</b> <u>945.69</u>   |
| G. Overhead at : <u>15%</u> of line F:                        | \$         | <u>141.85</u> |                                    |
| H. Subcontracts:                                              | \$         | <u>100.00</u> |                                    |
| I. Overhead at : <u>10%</u> of line H:                        | \$         | <u>10.00</u>  |                                    |
| J.                                                            |            |               | <b>Subtotal \$</b> <u>1,197.54</u> |
| K. Profit at <u>10%</u> of line J:                            | \$         | <u>119.75</u> |                                    |
| L.                                                            |            |               | <b>Subtotal \$</b> <u>1,317.29</u> |
| M. Bond premium at 1% of line L:                              | \$         | <u>13.17</u>  |                                    |
| N. Service reserve at 0.5% of line L:                         | \$         | <u>6.59</u>   |                                    |
| O. <b>Total cost estimate, lines L thru N:</b>                | Add Deduct |               | <b>\$</b> <u>1,337.05</u>          |
| P. Exclusions from this estimate: <u>Per Base</u>             |            |               |                                    |
| Q. This quotation is valid for <u>30</u> days                 |            |               |                                    |
| R. We require <u>1</u> day(s) extension of the contract time. |            |               |                                    |
| S. We are proceeding with this work per your authorization.   |            |               |                                    |
| T. Please forward your confirming change order.               |            |               |                                    |

Signed by: \_\_\_\_\_  
Project Manager

## Change Order Log

**Job Name** \_\_\_\_\_ **Job Number** \_\_\_\_\_

[illegible]





Use this space to insert your company logo and letterhead.

## Change Estimate Worksheet

Estimated by \_\_\_\_\_

C. E. Number \_\_\_\_\_

Date \_\_\_\_\_

Job No \_\_\_\_\_

### Direct Labor Expense (including benefits)

|                                  |                            |                     |
|----------------------------------|----------------------------|---------------------|
| Plumber or pipefitter journeyman | _____ manhours at \$ _____ | per hour = \$ _____ |
| Plumber or pipefitter supervisor | _____ manhours at \$ _____ | per hour = \$ _____ |
| Sheet metal journeyman           | _____ manhours at \$ _____ | per hour = \$ _____ |
| Sheet metal supervisor           | _____ manhours at \$ _____ | per hour = \$ _____ |
| Laborer journeyman               | _____ manhours at \$ _____ | per hour = \$ _____ |
| _____                            | _____ manhours at \$ _____ | per hour = \$ _____ |

**Total Direct Labor Cost** \$ \_\_\_\_\_

### Indirect Costs

|             |       |          |
|-------------|-------|----------|
| Travel      | _____ | \$ _____ |
| Subsistence | _____ | \$ _____ |
| Labor       | _____ | \$ _____ |

**Total Indirect Cost** \$ \_\_\_\_\_

### Equipment and Tool Costs

|       |          |
|-------|----------|
| _____ | \$ _____ |
| _____ | \$ _____ |

**Total Equipment and Tool Cost** \$ \_\_\_\_\_

### Subcontract Costs

|       |          |
|-------|----------|
| _____ | \$ _____ |
| _____ | \$ _____ |

**Total Subcontract Cost** \$ \_\_\_\_\_

Use this space to insert your company logo and letterhead.

---

## Change Estimate Summary

|                          |                        |
|--------------------------|------------------------|
| Quotation to _____       | Date _____             |
| Address _____            | Change Order No. _____ |
| Address _____            | Job Number _____       |
| City / State / Zip _____ |                        |
| Attention: _____         |                        |
| Job Name _____           |                        |
| Reference: _____         |                        |
| _____                    |                        |
| _____                    |                        |

|                                                             |            |                          |
|-------------------------------------------------------------|------------|--------------------------|
| A. Materials and equipment:                                 | \$ _____   |                          |
| B. Sales tax: _____                                         | \$ _____   |                          |
| C. Direct labor:                                            | \$ _____   |                          |
| D. Indirect costs:                                          | \$ _____   |                          |
| E. Equipment and tools:                                     | \$ _____   |                          |
| F.                                                          |            | <b>Subtotal \$</b> _____ |
| G. Overhead at _____ of line F:                             | \$ _____   |                          |
| H. Subcontracts:                                            | \$ _____   |                          |
| I. Overhead at _____ of line H:                             | \$ _____   |                          |
| J.                                                          |            | <b>Subtotal \$</b> _____ |
| K. Profit at _____ of line J:                               | \$ _____   |                          |
| L.                                                          |            | <b>Subtotal \$</b> _____ |
| M. Bond premium at 1% of line L:                            | \$ _____   |                          |
| N. Service reserve at 0.5% of line L:                       | \$ _____   |                          |
| O. <b>Total cost estimate, lines L thru N:</b>              | Add Deduct | <b>\$</b> _____          |
| P. Exclusions from this estimate:                           | _____      |                          |
| Q. This quotation is valid for _____ days                   |            |                          |
| R. We require _____ day(s) extension of the contract time.  |            |                          |
| S. We are proceeding with this work per your authorization. |            |                          |
| T. Please forward your confirming change order.             |            |                          |

Signed by: \_\_\_\_\_  
Project Manager

Another term for the general contractor is *prime contractor*. Subcontractors working directly for the prime contractor are called *second-tier subcontractors*. Contractors working for these second-tier subs are usually known as *third-tier subcontractors*. On a large job, many second-tier subs may hire third-tier subs to perform specialized work such as insulation, fireproofing, test and balance, water treatment, instrumentation and trenching.

If a portion of your work will be subcontracted to others, I recommend drawing up a subcontract agreement for that work. Any subcontractors who furnish both material and labor for a job should have a written contract.

Most larger plumbing, heating and A/C subcontractors use a two-part *Standard Form Subcontract* published by the Associated General Contractors of America. This two-part form is used to write the base subcontract. The A.G.C. also publishes a *Subcontract Change Order* form which is used when adding or deleting items after the base subcontract is signed. These forms are sold at modest cost at most A.G.C. offices.

The first section of page one of the Standard Form Subcontract identifies the two contractors entering into the agreement. The party issuing the subcontract is the *contractor*. Recipient of the agreement is the *subcontractor*.

Under *Recitals*, the contractor must affirm the right to issue a subcontract by declaring that a legal contract exists with the *owner* (general contractor).

Section 1 - Entire Contract describes the contract documents: the project plans, specifications and addenda. This list of documents should always be the same as the documents identified in the second-tier subcontractor's contract with the general contractor.

Section 2 - Scope describes the specific scope of work to be performed.

Section 3 - Contract Price. Complete this section by inserting the agreed-upon price for doing the work described.

Section 4 - Payment Schedule on page two should show the same payment terms as your contract with the general contractor.

Section 7 - Special Provisions is used to list any special agreements or exclusions.

When the contract is typed, do not sign it. Instead, forward it to the third-tier subcontractor with instructions to sign it and return it intact. When the signed contract is received, sign it and send a copy to the third-tier subcontractor.

For contracts that comply with your state's regulations, please visit [www.constructioncontractwriter.com](http://www.constructioncontractwriter.com)

## Standard Form Subcontract

Subcontract No. 7777-1

**THIS AGREEMENT**, made and entered into at Smallville, CA. this 3rd day of May, 2019, by and between Acme Mechanical Contractors hereinafter called **CONTRACTOR**, with principal office at 7600 Oak Avenue, Smallville, California, and Quikrap Insulation Co., 320 Maple Blvd., Smallville, CA hereinafter called a **SUBCONTRACTOR**.

### RECITALS

On or about the 2nd day of January, 2019, CONTRACTOR entered into a prime contract with

ABC General Contractors, Inc. hereinafter called OWNER, whose address is 380 First Street, Smallville, California to perform the following construction work: The installation of all mechanical and plumbing systems for the proposed Mile-Hi office building to be located at 2600 Second, North, Smallville, California.

Said work is to be performed in accordance with the prime contract and the plans and specifications. Said plans and specifications have been prepared by or on behalf of Quik-Draw and Associates, Smallville, California, **ARCHITECT**

### SECTION 1 - ENTIRE CONTRACT

SUBCONTRACTOR certifies and agrees that he is fully familiar with all of the terms, conditions and obligations of the Contract Documents, as hereinafter defined, the location of the job site, and the conditions under which the work is to be performed, and that he enters into this Agreement based upon his investigation of all of such matters and is in no way relying upon any opinions or representations of CONTRACTOR. It is agreed that this Agreement represents the entire agreement. It is further agreed that the Contract Documents are incorporated in this Agreement by this reference, with the same force and effect as if the same were set forth at length herein, and that SUBCONTRACTOR and his subcontractors will be and are bound by any and all of said Contract Documents insofar as they relate in any part or in any way, directly or indirectly to the work covered by this Agreement. SUBCONTRACTOR agrees to be bound to CONTRACTOR in the same manner and to the same extent as CONTRACTOR is bound to OWNER under the Contract Documents, to the extent of the work provided for in this Agreement, and that where, in the Contract Documents, reference is made to CONTRACTOR and the work or specification therein pertains to SUBCONTRACTOR'S trade, craft, or type of work, then such work or specification shall be interpreted to apply to SUBCONTRACTOR instead of CONTRACTOR. The phrase "Contract Documents" is defined to mean and include:

Drawing Nos. A-1 thru A-17, C-1 thru C-4, S-1 thru S-7, E-1 thru E-6 and M-1 thru M-7, all dated 10-4-2018, Specifications dated 10-2-18 and Addendum No. 1 dated 10-18-18.

### SECTION 2 - SCOPE

SUBCONTRACTOR agrees to furnish all labor, services, materials, installation, cartage, hoisting, supplies, insurance, equipment, scaffolding, tools and other facilities of every kind and description required for the prompt and efficient execution of the work described herein and to perform the work necessary or incidental to complete thermal insulation for all plumbing, HHW, CHW and condensate piping systems, including pumps P-1, P-2 and P-3 for the project in strict accordance with the Contract Documents and as more particularly, though not exclusively, specified in:

Division 15, Section 400 entitled "Thermal Insulation systems" and General Conditions, as applicable.

### SECTION 3 - CONTRACT PRICE

CONTRACTOR agrees to pay SUBCONTRACTOR for the strict performance of his work, the sum of:

Forty-two thousand, three hundred dollars (\$42,300.00), subject to additions and deductions for changes in the work as may be agreed upon, and to make payment in accordance with the Payment Schedule, Section 4.

### SECTION 4 - PAYMENT SCHEDULE

CONTRACTOR agrees to pay SUBCONTRACTOR in monthly payments of 90 % of labor and materials which have been placed in position and for which payment has been made by OWNER to CONTRACTOR. The remaining 10 % shall be retained by CONTRACTOR until he receives final payment from OWNER, but not less than thirty-five days after the entire work required by the prime contract has been fully completed in conformity with the Contract Documents and has been delivered and accepted by OWNER, ARCHITECT, and CONTRACTOR. Subject to the provisions of the next sentence, the retained percentage shall be paid SUBCONTRACTOR promptly after CONTRACTOR receives his final payment from OWNER. SUBCONTRACTOR agrees to furnish, if and when required by CONTRACTOR, payroll affidavits, receipts, vouchers, release of claims for labor, material and subcontractors performing work or furnishing materials under this Agreement, all in form satisfactory to CONTRACTOR, and it is agreed that no payment hereunder shall be made, except at CONTRACTOR'S option, until and unless such payroll affidavits, receipts, vouchers or release; or any or all of them, have been furnished. And payment made hereunder prior to completion and acceptance of the work, as referred to above, shall not be construed as evidence of acceptance of any part of SUBCONTRACTOR'S work.

## SECTION 5 - GENERAL SUBCONTRACT PROVISIONS

General Subcontract Provisions on back of Pages 1 and 2 are an integral part of this Agreement.

## SECTION 6 - GENERAL PROVISIONS

1. **SUBCONTRACTOR** agrees to begin work as soon as instructed by the **CONTRACTOR**, and shall carry on said work promptly, efficiently and at a speed that will not cause delay in the progress of the **CONTRACTOR'S** work or work of other subcontractors. If, in the opinion of the **CONTRACTOR**, the **SUBCONTRACTOR** falls behind in the progress of the work, the **CONTRACTOR** may direct the **SUBCONTRACTOR** to take such steps as the **CONTRACTOR** deems necessary to improve the rate of progress, including, without limitation, requiring the **SUBCONTRACTOR** to increase the number of shifts, personnel, overtime operations, days of work, equipment, amount of plant, or other remedies and to submit to **CONTRACTOR** for **CONTRACTOR'S** approval an outline schedule demonstrating the manner in which the required rate of progress will be regained, without additional cost to the **CONTRACTOR**. **CONTRACTOR** may require **SUBCONTRACTOR** to prosecute, in preference to other parts of the work, such part or parts of the work as **CONTRACTOR** may specify.

The **SUBCONTRACTOR** shall complete the work as required by the progress schedule prepared by the **CONTRACTOR**, which may be amended from time to time. The progress schedule may be reviewed in the office of the **CONTRACTOR** and sequence of construction will be as directed by the **CONTRACTOR**.

The **SUBCONTRACTOR** agrees to have an acceptable representative (an officer of **SUBCONTRACTOR** if requested by the **CONTRACTOR**) present at all job meetings and to submit weekly progress reports in writing if requested by the **CONTRACTOR**. Any job progress schedules are hereby made a part of and incorporated herein by reference.

### 2. **Reserved Gate Usage**

**SUBCONTRACTOR** shall notify in writing, and assign its employees, material men and suppliers, to such gates or entrances as may be established for their use by **CONTRACTOR** and in accordance with such conditions and at such times as may be imposed by **CONTRACTOR**. Strict compliance with **CONTRACTOR'S** gate usage procedures shall be required by the **SUBCONTRACTOR** who shall be responsible for such gate usage by its employees, material men, suppliers, subcontractors, and their material men and suppliers.

### 3. **Staggered Days and Hours of Work and for Deliveries**

**SUBCONTRACTOR** shall schedule the work and the presence of its employees at the jobsite and any deliveries of supplies or materials by its material men and suppliers to the jobsite on such days, and at such times and during such hours, as may be directed by **CONTRACTOR**. **SUBCONTRACTOR** shall assume responsibility for such schedule compliance not only for its employees but for all its material men, suppliers and subcontractors, and their material men and suppliers.

## SECTION 7 - SPECIAL PROVISIONS

1. Pipe hanger inserts will be furnished and installed by Contractor.
2. All trash pickup by Subcontractor; haul-away will be by General Contractor.

**Contractors are required by law to be licensed and regulated by the Contractors' State License Board. Any questions concerning a contractor may be referred to the registrar of the board whose address is:**

**Contractors' State License Board -- P. O. Box 26000, Sacramento, California 95826**

**IN WITNESS WHEREOF:** The parties hereto have executed this Agreement for themselves, their heirs, executors, successors, administrators, and assignees on the day and year first above written.

| <b>SUBCONTRACTOR</b>                                                                                              |       | <b>CONTRACTOR</b>                    |       |
|-------------------------------------------------------------------------------------------------------------------|-------|--------------------------------------|-------|
| <u>Quikrap Insulation Company</u>                                                                                 |       | <u>Acme Mechanical Contractors</u>   |       |
| By _____                                                                                                          |       | By _____                             |       |
| Name                                                                                                              | Title | Name                                 | Title |
| <input type="checkbox"/> Corporation <input type="checkbox"/> Partnership <input type="checkbox"/> Proprietorship |       |                                      |       |
| (Seal)                                                                                                            |       |                                      |       |
| Contractor's State License No. _____                                                                              |       | Contractor's State License No. _____ |       |

Revised 5-09

Published by AGC San Diego  
Page 2 of 2

For contracts that comply with your state's regulations, please visit [www.constructioncontractwriter.com](http://www.constructioncontractwriter.com)

## Subcontract Change Order

Number One

Date 6-11-19

Subcontract Number 7777-1

To Quickrap Insulation Co.

Our Job Number \_\_\_\_\_

Our Proposal Number \_\_\_\_\_

Architect's C.O. Number \_\_\_\_\_

Effective Date of Charge 6-17-19

*Subject to all the provisions of this Change Order, you are hereby directed to make the following change(s)*

Delete HHW and CHW piping insulation located above Room No. 322 per ABC General Contractor's Change Order No. 18, dated 6-5-19.

The following change(s) will alter the price provided in your subcontract by the deduction of \$ 465.00

| *Surety Consent                                                                                                   |                                                  |              |
|-------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|--------------|
| <b>This Change is Approved</b> <b>Date</b> _____<br><b>Name:</b> _____<br><b>By:</b> _____<br><b>Title:</b> _____ | Adjusted Subcontract Price Through C.O. Number 0 | \$ 42,300.00 |
|                                                                                                                   | Amount this C.O. Number:                         | \$ (465.00)  |
|                                                                                                                   | Current Adjusted Subcontract Price:              | \$ 41,835.00 |

When this Change Order is signed by both parties (and by Subcontractor's surety is subcontract is bonded), it constitutes their agreement:

(A) That the subcontract price is adjusted as shown above and that no further adjustment in that price by reason of the change(s) provided herein shall be made; and (B) That all the terms and conditions of the subcontract, except as modified by this and any previous changes, shall remain in full force and effect and apply to the work as so changed.

|                                                         |                                   |                    |
|---------------------------------------------------------|-----------------------------------|--------------------|
| <b>Accepted and Agreed:</b>                             |                                   | <b>Date:</b> _____ |
| <b>By</b> _____<br>Authorized Signature – Subcontractor | <b>By</b> _____                   |                    |
|                                                         | Authorized Signature – Contractor |                    |
| <b>Title</b> _____                                      | <b>Title</b> _____                |                    |

\* Subcontractor: Sign pink copy and return immediately. If subcontract is bonded, obtain consent of surety endorsed thereon.  
 No payments on account of this Change Order will be made until you have complied with the foregoing.

Published by San Diego Chapter A.G.C.



A purchase order is a legal document used to order equipment and materials from a vendor, with the implied promise to pay for these goods within a specified time after receipt of the items. Purchase orders are sometimes used to write subcontracts whose value does not exceed one or two thousand dollars. Refer to the sample purchase order on page 452.

While most of the purchase order is self-explanatory, certain items need to be emphasized:

“Description” should include all pertinent data such as model numbers, arrangements, performance requirements, applicable standards, electrical characteristics and so on.

“Tag” is used to identify a particular piece of equipment to facilitate unloading it at the proper location at the jobsite. Tag numbers for all major equipment can usually be found on the contract drawings.

“48 hour delivery notice”: This can be very important if the material or equipment being delivered is too heavy to be unloaded by hand. Time will be required to arrange for a crane or forklift to unload the truck.

“Sales tax” is the current state sales tax which must be included unless the goods are to be delivered and installed at a project located out-of-state.

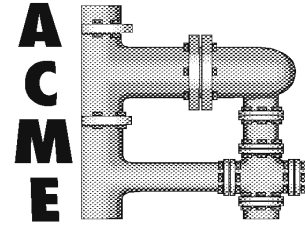
“Terms”: The usual payment terms are “Net 30” which means the entire amount of the purchase order must be paid within thirty days after receipt of all goods, undamaged. If items are received damaged, payment should be withheld until satisfactory repair or replacement is made.

SAMPLE

# ACME

## Mechanical Contractors

7600 Oak Avenue - Smallville, U.S.A. 12345-6789  
Voice 1-234-5678 / FAX 1-234-5680



### Purchase Order

P.O. Number: 7777-36

Date: 1-6-19

Job: CBC Bank Building

Job No: 7777

**Seller:** Smallville Industrial Sales Co.  
3657 Third Avenue Northwest  
Smallville, CA 63876

**Ship to:** Acme Mechanical Contractors  
c/o CBC Bank Building  
465 Commercial Street  
Smallville, CA 63876

Attn: Mr. L.H. Seller

By: RJS

Delivery date: 2-28-19

**24 Hr. Delivery Notice Required**

Payment terms: Net 30

| Quantity | Description                                                                                                    | Unit     | Total    |
|----------|----------------------------------------------------------------------------------------------------------------|----------|----------|
| Two      | Big-Blo Model No. 1JN 86-13 centrifugal fans with 480/3/60 one-half H.P., O.D.P. motor. 3250 CFM @ 0.50 T.S.P. | \$443.00 | \$886.00 |
|          | Tag one EF-13 and one EF-23                                                                                    |          |          |
|          |                                                                                                                |          |          |
|          |                                                                                                                |          |          |
|          |                                                                                                                |          |          |
|          |                                                                                                                |          |          |
|          |                                                                                                                |          |          |

Number of copies of operation and maintenance manuals required 2.

All shipments are to be F.O.B. jobsite or shop unless otherwise noted.

|                  |          |
|------------------|----------|
| Total before tax | \$886.00 |
| Sales tax        | \$62.02  |
| Freight          | Included |
| Total Order      | \$948.02 |

Buyer: RJS

Acceptance by seller \_\_\_\_\_ Date \_\_\_\_\_

The general contractor's construction schedule may range from a simple bar chart to a complicated computer-generated CPM (Critical Path Method) diagram. More complex jobs require more complete and detailed schedules. On larger jobs, lower-tier subcontractors may be required to prepare a bar chart showing their construction schedule.

If you have to prepare a construction schedule, make conservative estimates of the time required to complete each part of the job. A slower schedule makes it possible to use smaller crews which are usually more efficient.

You can't schedule your own work until the general contractor has supplied a schedule for the balance of the project. When you have that schedule, prepare a list of tasks your crews will perform. Show this list to the general contractor to be certain there are no conflicts with the master schedule.

When the list of tasks to be performed has been approved, begin recording the manhours required for each task. Take these manhours from your estimate. When the duration for each task has been determined, figure the crew sizes required.

For example, suppose the estimate shows that it will take 1,040 manhours to install the underground plumbing for a project. The work must be completed in two months. Assuming one worker averages 173 hours of work in one month, how many workers will be required to meet the schedule? Here's the solution:

$$\frac{1,040 \text{ manhours}}{173 \text{ MH / Mo.} \times 2 \text{ months}} = 3 \text{ workers}$$

The first of the two bar charts on the following pages shows the schedule a general contractor might expect to receive from a plumbing and HVAC subcontractor. The chart on page 454 is intended for use by the subcontractor. It includes information a mechanical subcontractor needs to determine proper crew sizes for each task. The *Cumulative Manhours* line shows the budgeted manhours for each month of the project. If labor costs are to be kept within budget, actual hours should not exceed estimated hours. Monitor labor costs each month by comparing the line *Actual MH Used* (actual manhours used) with the line *Cumulative MH* (estimated cumulative manhours).

## Construction Schedule

**Company:** Acme Mechanical Contractors **Project:** Mile-Hi Office Bldg **Job Number:** 7777 **Date:** 6/8/19

[illegible]

## Construction Schedule

Company: Acme Mechanical Contractors Project: Mile-Hi Office Bldg Job Number: 7777 Date: 6/8/19

| Activity        | 2019 |     |     |      |      |      | 2020 |      |      |      |     | Crew Sizes                |
|-----------------|------|-----|-----|------|------|------|------|------|------|------|-----|---------------------------|
|                 | Jul  | Aug | Sep | Oct  | Nov  | Dec  | Jan  | Feb  | Mar  | Apr  | May |                           |
| Submittals      |      |     |     |      |      |      |      |      |      |      |     | N/A                       |
| Purchasing      |      |     |     |      |      |      |      |      |      |      |     | N/A                       |
| U/G Plumbing    |      |     |     |      |      |      |      |      |      |      |     | 1040 MH ÷ (173 x 2) = 3   |
| A/G Plumbing    |      |     |     |      |      |      |      |      |      |      |     | 2075 MH ÷ (173 x 4) = 3   |
| Fin. Plumbing   |      |     |     |      |      |      |      |      |      |      |     | 130 MH ÷ (173 x .5) = 1.5 |
| HVAC Piping     |      |     |     |      |      |      |      |      |      |      |     | 2760 MH ÷ (173 x 4) = 4   |
| HVAC Ducting    |      |     |     |      |      |      |      |      |      |      |     | 2790 MH ÷ (173 x 4) = 4   |
| Equipment       |      |     |     |      |      |      |      |      |      |      |     | 690 MH ÷ (173 x 2) = 2    |
| Insulation      |      |     |     |      |      |      |      |      |      |      |     | Subcontract               |
| Temp. Controls  |      |     |     |      |      |      |      |      |      |      |     | Subcontract               |
| Start-up        |      |     |     |      |      |      |      |      |      |      |     | 85 MH ÷ (173 x .5) = 1    |
|                 |      |     |     |      |      |      |      |      |      |      |     |                           |
|                 |      |     |     |      |      |      |      |      |      |      |     |                           |
|                 |      |     |     |      |      |      |      |      |      |      |     |                           |
|                 |      |     |     |      |      |      |      |      |      |      |     |                           |
| Crew size/month |      |     | 3   | 6    | 11   | 11   | 11   | 11.5 | 2    | 1    |     |                           |
| Cumulative MH*  |      |     | 520 | 1159 | 3466 | 5373 | 7280 | 9143 | 9448 | 9573 |     | MH Estimated = 9573       |
| Actual MH used  |      |     |     |      |      |      |      |      |      |      |     |                           |
|                 |      |     |     |      |      |      |      |      |      |      |     |                           |
| *Per estimate   |      |     |     |      |      |      |      |      |      |      |     |                           |
| *Rounded        |      |     |     |      |      |      |      |      |      |      |     |                           |

On most large projects the contractor is required to submit drawings and technical data to the owner's representative for approval before work actually begins. Most of these submittals will be prepared by your suppliers and third-tier subs. Vendors and subs may be reluctant to prepare these documents without some assurance that they've been selected to do the work. That's the purpose of a letter of intent. It notifies a proposed vendor or subcontractor that you plan to contract with them when the owner approves the information submitted.

A letter of intent isn't a contract. It's an expressed intention to make a contract, which isn't a contract at all. But a vendor who gets your letter of intent and supplies all the information requested should get the contract. If you place the order with a different vendor, obviously, your letter of intent was worthless. That first vendor may be very reluctant to cooperate in the future.

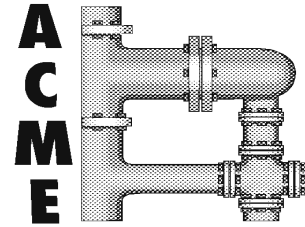
A sample letter of intent follows this page.

SAMPLE

# ACME

## Mechanical Contractors

7600 Oak Avenue - Smallville, U.S.A. 12345-6789  
Voice 1-234-5678 / FAX 1-234-5680



December 20, 2018

Quikrap Insulation Company  
320 Maple Boulevard  
Smallville, U.S.A. 12345-6789

Attn: Mr. R. S. Quikrap

Dear Mr. Quikrap:

Acme Mechanical Contractors has been issued a subcontract to furnish and install the mechanical and plumbing systems for the proposed Mile-Hi Office Building to be located at 2600 Second Street in Smallville.

It is my intention to award your firm a subcontract to provide the thermal insulation for these systems in accordance with your proposal dated 12-13-18 in the amount of \$42,300.00.

Please prepare ten copies of your submittal data and forward them to me no later than January 15, 2019. Upon approval of your submittal, I will mail you the subcontract for your review and signature.

Thank you,

Bobby Thompson  
Project Manager

CC: Project file



The construction specifications may require that you submit manufacturer's technical data on certain equipment you plan to install. You may have to submit six to ten copies of this technical data for approval before buying the equipment or contracting with third-tier subcontractors.

First, find out how many submittal copies will be required. Request that number of copies plus at least two additional sets for your use. A subcontractor who provides only services (no materials) may have to submit a detailed written explanation of the work to be done.

The second step is to label each submittal with the paragraph number of the specification where that equipment, material or service is described. Type or write this number in the upper right corner of each submittal sheet. From this set of numbered submittals, prepare a submittal index, a list of submittals identified by title and paragraph number. This index should be arranged in specification paragraph order. A blank submittal index form follows this section.

I prefer to use a three-ring binder to hold submittals. That makes it easier to add and delete sections as needed. Be sure to include a cover sheet, usually on company letterhead, which identifies the project, job number and scope of work being submitted. A sample submittal cover sheet follows this section.

Purchase orders and subcontracts should not be written until an approved copy of the submittal brochure has been received.

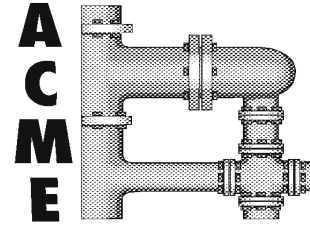
SAMPLE

# ACME

## Mechanical Contractors

7600 Oak Avenue - Smallville, U.S.A. 12345-6789  
Voice 1-234-5678 / FAX 1-234-5680

---



### Division 15

Heating, Ventilating, Air Conditioning and Plumbing Systems

Submittal Data for  
Mile-Hi Office Building  
2600 Second Street  
Smallville, U.S.A.

---

SAMPLE



The format to be used for monthly progress billings is seldom specified in the contract documents. In any case, your bill has to include enough detail to satisfy the owner and the lender.

Before preparing your bill, ask the general contractor how much detail is required. Some general contractors will want detailed cost breakdowns showing costs for each system on each building floor. Others will require much less detail.

Find out if billings can include the cost of equipment and materials delivered and stored either on site or off site but not yet installed. If billings can include materials stored off site, do these materials have to be stored in a bonded warehouse? Do vendor's invoices have to accompany progress billings?

When you understand what's required for monthly progress billings, prepare a billing breakdown worksheet. A sample worksheet follows this section.

**Column one, Activity** Lists each work item in the order work will be performed. The first item listed will usually be mobilization. This includes the cost of the job site trailer, electrical and telephone hookups, office furniture and supplies and initial labor costs. Billings for mobilization costs are sometimes denied by the lender. Many contractors minimize these costs to increase the chance of approval. It's better to receive partial payment for these costs than none at all.

**Column two, Cost (\$)** Lists the actual contractor's costs for each activity, including labor, material, equipment and sales taxes. Markup for overhead and profit are not included.

**Column three, Factor** This column shows the markup assigned to each activity. Activities scheduled to be completed first are usually assigned the highest markups. This is called front loading and is common in the construction industry. Most bills won't be paid for 30 to 60 days. When the bill is paid, the amount received probably won't include the percentage allowed for retention. Generally, retention is 10 percent and isn't released until the project is complete and accepted by the owner.

Front loading helps contractors carry the financial burden of work in progress. Few subcontractors have enough cash to pay all their bills when due and still wait months to collect for work that's been completed. Employees have to be paid in full and on time. Assigning a higher markup to work completed first accelerates the payment schedule and helps spread payments more evenly over the entire project. Front loading is routine with subcontractors and unpopular with owners and lenders. In practice, subcontractors have no choice but to place a higher price or higher markup on work completed first.

Note that figures in the Factor column are less than 1.0 for work done near the end of the project. That's because front loading doesn't change the contract price. It changes only when that money is received.

**Column four, Sell (\$)** Values for this column are the product of the cost and factor columns. Use the figures in this column when submitting monthly progress invoices.



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