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2019 NATIONAL ELECTRICAL ESTIMATOR

By Mark C. Tyler

Edited by Richard Pray

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How to Use This Book

This manual is a guide to the cost of installing electrical work in buildings. It lists costs to the electrical subcontractor for a wide variety of electrical work.

Before using any estimate in this book, you should understand one important point about estimating electrical construction costs. Estimating is an art, not a science. There's no estimate that fits all work. The manhour estimates in this book will be accurate for many jobs, but remember that no two jobs are identical. And no two crews complete all tasks in exactly the same amount of time. That's why electrical cost estimating requires exercising good judgment. Every estimate has to be custom-made for the specific job, crew and contractor. No estimating reference, computerized cost estimating system or estimating service can take into consideration all the variables that make each job unique.

This book isn't meant to replace well-informed decisions. But when supplemented with an estimator's professional evaluation, the figures in this manual will be a good aid in developing a reliable cost of electrical systems.



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

Labor Costs

The labor costs listed in this manual will apply to most jobs where the hourly wage in effect is the same or similar to the following rates:

Journeyman Electrician

Base Wage.....	\$30.65 per hr.
Taxable Fringe Benefits at 5.49%.....	\$1.68 per hr.
Taxes & Insurance at 19.71%.....	\$6.37 per hr.
Non-taxable Fringe Benefits at 4.85%.....	\$1.49 per hr.
Total Labor Cost.....	\$40.19 per hr.

The total hourly cost includes the basic wage, taxable fringe benefits (vacation pay), workers' compensation insurance, liability insurance, taxes (state and federal unemployment, Social Security and

Medicare), and typical nontaxable fringe benefits such as medical insurance.

If your hourly labor cost is much lower or higher, costs of installation can be expected to be proportionately lower or higher than the installation costs listed in this book. If your total hourly labor cost is 25 percent less, for example, reduce the labor figures in the cost tables by 25 percent to find your local cost.

The Craft@Hrs column shows the recommended crew and manhours per unit for installation. For example, L2 in the Craft@Hrs column means that we recommend a crew of two electricians. L1 means that a crew of one electrician is recommended. Costs in the Labor Cost column are the result of multiplying the manhours per unit by the rate of \$40.19 per hour.

For example, if the Craft@Hrs column shows L2@.250, the Labor Cost column will show \$10.05. That's .250 manhours multiplied by \$40.19 per man-hour and rounded to the nearest penny.

Divide the manhours per unit into 8 to find the number of units one electrician can install in one 8-hour day: 8 divided by .250 equals 32 units per day. Multiply that amount by the number of crew members to find the number of units the crew is likely to install in an 8-hour day. For example, if the crew is two electricians, multiply 32 by 2 to find that the crew can be expected to install 64 units in an 8-hour day.

Some tasks require less labor under certain conditions. For example, when conduit is run in groups, less labor is required for each 100 linear feet. It's the estimator's responsibility to identify conditions likely to require more or less labor than the standard for the type of work being estimated.

This book lists both the labor cost per installed unit and the manhours required for installation. Manhours are listed in hundredths of an hour rather than minutes, making it easier to calculate units.

Material Costs

Material prices in this book are based on actual costs in late 2018, with projections to mid-2019 based on the editor's judgment. Prices are neither "retail" nor "wholesale" costs. Instead, they're intended to reflect typical costs to electrical contractors who buy at electrical supply houses in mid-2019. Volume purchases may cost less because many dealers offer quantity discounts to good customers. Expect prices to vary with location, terms demanded, services offered, and competitive conditions.

Prices in this manual are not representative of shelf prices for electrical materials at big box building

material retailers – and for good reason. Most electrical contractors don't buy from big box retailers. They buy from specialized electrical material dealers who offer the selection, service and terms that electrical contractors expect. Big box retailers stock limited quantities, no more than a few hundred electrical SKUs, specialize in commodity-grade merchandise and are generally not set up to meet the needs of professional electrical contractors.

Material costs in this book include normal waste. If waste of materials or breakage is expected to exceed 3 to 5 percent of the materials used on the job, include a separate allowance for excessive waste.

Material delivery cost to the job site isn't included in this book. When delivery cost is significant and can be identified, add that cost to these figures.

Please note that the cost of some electrical materials is highly volatile. For example, copper wire prices have been known to fluctuate 10 percent or more in one month. There's no reliable way to forecast price movements like this. If you're bidding on a project that has a quantity of copper products, you may want to add a qualification to your bid proposal which would allow you to pass on a pricing increase (or decrease), based upon the actual materials pricing at the time of purchase. This way, you can use the current price quoted at the time of your bid, but still leave the door open to any major pricing fluctuations.

Add Sales Tax

No state or local sales tax is included in material prices listed here. Sales tax varies from area to area and may not be applicable on purchases for some types of projects. Add at the appropriate rate when sales tax is charged on materials bought for the job.

Add Overhead and Profit

To complete the estimate, add your overhead and expected profit. Many contractors add an additional 10 to 15 percent for profit to yield an acceptable return on the money invested in the business. But no profit percentage fits all jobs and all contractors. Profit should be based on the current market in each user's local area.

For some electrical contractors, overhead may add as little as 10 percent to the labor and material cost. But routinely adding 10 percent for overhead is poor estimating practice. Overhead should be based on each user's built-in costs. It's the estimator's responsibility to identify all overhead costs and include them in the estimate, either as a lump sum or as a percentage of the total labor and material cost.

Other Costs to Add

A few other costs are excluded from the figures in this manual: electrical building permits, special hoist-

ing costs, freight costs not absorbed by the supplier, utility company charges for installation and service, special insurance and bonds, power equipment other than small tools, mobilization to remote sites, demobilization, nonproductive labor, and nonworking supervisors. If these costs are significant and can be determined, add them to your estimate. If not, you should exclude them and specify clearly that they're not a part of your bid.

All Tables Assume "Good" Conditions

This means that there are few or no unusual conditions to delay production. Conditions are good when work is performed during usual working hours in relatively clean surroundings and in readily accessible areas not over 12 feet above the finish floor. The temperature is between 50 and 85 degrees F. Electricians are working no more than 8 hours a day, 5 days a week.

Good conditions require that all tools and materials be available on the job site when needed. Tools, including power tools, are assumed to be in good working order. Where power tools are appropriate, it's assumed that temporary power is provided. Add the cost of temporary power when it's furnished at your expense.

Proper supervision makes a big difference in labor productivity. The tables assume there is adequate supervision but make no allowance for nonproductive labor — supervisors who direct but do no installation. If you plan to have nonproductive supervision on the job, add that cost to the figures in this manual.

Conditions are seldom "good" when the work area is confined, or when a short construction schedule makes it necessary for many trades to work at the same time. The usual result will be stacks of material obstructing the work space and several tradesmen competing for access at the point of installation.

If the conditions on the job you're estimating aren't expected to be "good," adjust the labor figures in this book as appropriate. Occasionally, larger jobs can be done faster because specialized equipment or crews can be used to good advantage. This will usually reduce the installation cost. More often, conditions are less than "good." In that case, labor costs will be higher.

There's no accepted way to decide how much "bad" conditions will increase the labor hours needed. But it's accepted estimating practice to assign a cost multiplier of more than 1.0 to a job that can be expected to require more than the usual amount of labor per unit installed. For example, if conditions are less than "good" only in minor respects, you might multiply labor costs by 1.10. If conditions are very poor, a multiplier of 1.50 or more may be appropriate.

Other Factors That Affect Productivity

This book's tables assume that the crew used for the job is the smallest crew appropriate for the work at hand. Usually this means that the crew is one journeyman electrician.

Most experts on the productivity of construction trades agree that the smallest crew that can do the job is usually the most efficient. For example, it's foolish to have two men working together setting duplex receptacles — one handing tools and material to the other as needed. Only one of them would be working at any given time. It's more productive to use two one-man crews, each working independently.

Of course, there are exceptions. Sometimes a crew of one takes twice as long as a crew of two. When pulling feeder cable or setting floor-standing switchboards or motor control centers, more help usually cuts the labor cost per installed unit. Some jobs simply can't be done by a crew of one.

When work is done on a scaffold, someone should be on the ground to chase parts and equipment and prepare lighting fixtures for hanging. It wastes manpower to have an electrician leave the scaffold and return when parts or tools are needed. Scaffold

installers should install one fixture while the "grunt" below prepares the next. Conduit should be prefabricated on the ground from measurements taken by the electricians on the scaffold. The assistant should bend the conduit and hand it up to the installer.

These labor savings are obvious to anyone who's done this type of work, and are assumed in this book's labor tables.

The Electrician

This book's labor hours are typical of what a trained and motivated journeyman electrician with 5 years of experience will do on most jobs. It's assumed that the installer can read and follow plans and specifications and has the ability to lay out the work to code.

It shouldn't make any difference whether the work is in a hospital, a grocery store, a wood mill or a small convenience store. An experienced journeyman electrician should be able to handle the work at the rates shown here even though the materials and code requirements differ. But you'll have to make allowances if your installers are only familiar with residential work, and the job at hand is something else.

Improving Estimating Accuracy & Profits

It's been said that electrical estimators learn by making mistakes. The best estimators are the ones who've made the most mistakes. Once you've made every mistake possible, you're a real expert.

I can't subscribe 100 percent to that theory, but I know that there are plenty of pitfalls for unsuspecting electrical estimators. This section is intended to suggest ways to spot potential problems before they become major losses. It'll also recommend steps you can take to increase the profit on most jobs.

Labor Productivity

Improving output even slightly can result in major cost savings. Cutting only a minute or two off the installation time for each duplex receptacle or handy box can reduce the labor cost by several hundred to a thousand dollars a job. Getting better productivity from your electricians should be a primary concern for every electrical contractor.

Assuming your electricians are experienced, well-trained, and have all the tools and materials they need to complete the work, the most significant increase in productivity will probably be through motivation.

The best form of motivation for most electricians is to encourage pride in the work they do. Every alert supervisor knows the value of recognizing a job well done. Acknowledging good work builds confidence and encourages extra effort in the future.

Labor Availability

Labor in each locale may not always be readily available. Prior to bidding any project, make an evaluation of the available work force. You may need to make staffing or salary adjustments for the duration of that project. Your work force evaluation will help you prepare for adding another workman, or adjusting a current employee's salary and benefits to compete with rates in your area.

Handling Inspections

The on-site supervisor or foreman should be responsible for dealing with all inspectors. Don't let others circumvent the supervisor's or foreman's authority.

An inspector's only job is to see that the installation complies with the code. They aren't supervisors and don't direct the work. They can and do interpret the code and sometimes make mistakes. Encourage the foreman or supervisor to take issue promptly with a questionable interpretation. Ask the inspector to cite a specific code as his reference. If the inspector insists that his interpretation is correct, and if you believe it's wrong, call the building official to initiate an appeal. Your trade association or the National Electrical Contractors' Association may also be able to persuasively argue in your favor.

Some inspectors have a reputation for being impossible to deal with. Aggressive enforcement of questionable code interpretations can severely hurt project productivity. Following the code carefully will keep you out of most compliance arguments. Every electrician and electrical supervisor must know the code. Code classes are taught at continuation schools in many communities. You can take code classes to both understand how the code is applied and to remain current on code changes.

Mobilization and Demobilization

Many electrical subcontractors have job shacks and lockup boxes that can be moved onto the job for storing tools and materials. Some larger firms have trailers that can be moved from job to job. No matter what type of on-site storage you use, setting up takes time. The bigger the job, the more time will probably be needed.

Usually the first step is getting permission to set up your storage area on the site. Sometimes storage space is at a premium. Some city projects literally have no storage space until parts of the building are completed and can then be used. Occasionally tools and equipment will have to be stored off site. This can require daily mobilization and demobilization, which increases your labor cost substantially. Be sure your estimate includes these costs.

Demobilization usually takes less time and costs less than mobilization. Removing the surplus material, tools and equipment can be done by helpers or material handlers rather than electricians.

One important item in mobilization is temporary electrical service. Be sure you know who pays for installation of temporary power and who pays for power used on site during construction. It's common for the electrical contractor to cover the cost of electrical distribution and service. Installation is usually done by your electricians and will have to pass inspection.

Most communities require temporary electrical permits prior to starting work. Before applying for the permit, contact the electric utility provider and request a meeting with whoever coordinates extensions of service — usually the planner. Before your meeting, determine what size service you need. The planner will tell you what voltage is available and where the point of connection will be. Don't end this meeting with the planner until you've covered every requirement and procedure imposed by the electric utility.

Job Cleanup

Trash and debris that obstructs access to (and on) the job site can make good production next to impossible. That alone should be encouragement to regularly dispose of accumulated waste. Most specifications require that subcontractors remove unused materials, cartons, wrappers and discarded equip-

ment. On many jobs, the general contractor has the right to backcharge subs for removal of their discards if they don't clean the site themselves.

Encourage your crews to do their cleanup while installation is in progress. For example, each time a fixture is removed from a carton, the tradesman should collapse the carton and throw it on the discard pile. It takes slightly more time to dispose of trash this way, but cleanup is less likely to be forgotten.

Some contractors and subcontractors have a reputation for running a dirty job. You've probably seen sites that are so cluttered that you can't understand how anyone could work efficiently. Of course, as the electrical contractor, you can't dictate to the general contractor or the other subcontractors. But the work habits of others affect your productivity, and consequently, your profit.

I believe that if accumulated debris is slowing progress on the job, it's within your rights to discuss it with the general and the other subs. Request a meeting, right in the middle of the clutter. That alone may do the trick.

If you don't insist on a clean site, the fire department probably will. A clean job is more efficient and safer. A cluttered job costs everyone time and money.

Production

No matter how simple and quick you anticipate them to be, most jobs will have some production problems. Every job is unique. Every job brings together skilled tradesmen with varying preferences and habits. Some have never worked together before. Yet each must coordinate the work he does with those who precede him and those who follow. It's normal to expect that some adjustments will be needed before cooperation becomes routine.

Of course, the general contractor is the key to cooperation among the trades. A general who schedules trades properly will have fewer problems and will help all subcontractors earn the profit they're hoping for. This isn't automatic. And some general contractors never learn how to schedule properly. From an estimating prospective, it's more expensive to work for a contractor who has scheduling problems than it is to work for a contractor who's efficient at job coordination. If you anticipate production problems like this on a job, your estimate should reflect it.

Good supervision helps avoid most production problems. Try to schedule material deliveries in a timely manner. Have the right tools on hand when needed. Keep crews as small as possible. Don't work your crews more than 40 hours a week unless absolutely necessary. Too many bodies and too many hours will erode production.

If you're using a larger crew, don't have everyone work at the same time. Instead, break the crew into two units and encourage friendly competition between the two. Offer a reward for the winning crew.

Corrections

This book's tables assume that little or no time is spent making corrections after the work is done. Electrical contractors should have very few callbacks.

If you're called back often to replace faulty materials or correct defective workmanship, one of four things is happening. First, you could be working for some very particular contractors or owners, or handling some very sensitive work. In that case, callbacks could be part of the job and should be included in each estimate. Second, you could be installing substandard materials. Third, your electricians could be doing haphazard work. Finally, your installation procedure could be omitting fixture and circuit tests that could locate problems before the owner finds them.

When qualified electricians install quality materials, the risk of a callback is small. Occasionally a ballast will fail after 10 or 20 hours in use. And sometimes an owner's negligence will damage a circuit or switch. When this happens, accept the service work as routine. Complete it promptly at no extra charge. Consider it cheap advertising — a chance to establish your reputation with the owner. You could turn the service call into some extra work later.

Your Type of Work

Most electrical contractors prefer to handle specific types of work. Only a few have the capital, equipment and skills needed to handle the largest jobs. Most will do residential wiring because that's the most plentiful work available. Some prefer private work with as little government interference as possible. Others bid only government jobs.

The most profitable electrical contractors specialize in one type of work or customer. The electrical construction field is too broad to do everything well. Select an area that you feel comfortable with, and concentrate on doing it as well or better than anyone else. Of course, some of the older and larger electrical shops will do almost any type of work. But nearly every electrical contractor prefers some class of job over all others — and would take only that work if there was enough available to stay busy.

Observe the electrical contractors in your area. Notice the companies that seem to be busiest and most profitable. See what class of customers they service or what type of work they do most. It's probably easier to follow the success of another contractor who's found a winning formula than it is to invent a new formula yourself.

Specialization lets you hire electricians who are specialists, too. That tends to improve productivity, keep costs down, and improve profits — as long as you're handling work that's within your specialty.

Coordination is easier and the profits will usually be higher if you work for a limited number of general contractors. Some contractors seem to be masters at putting a project together. These same contractors probably pay promptly and treat their subs fairly. That makes your job easier and tends to fatten your bottom line. If you've found several contractors who make life more pleasant for you, keep them supplied with competitive bids that'll bring more work into both your shop and theirs.

Most electrical contractors don't bid government work. It's a specialty that requires specific knowledge: complying with detailed general conditions, observing regulations, anticipating inspection criteria and following administrative procedures. And every branch of federal, state and local government has its own requirements. Those who've mastered the procedures usually do quite well when work is plentiful. But government work is a tide that rises and falls just like that of general construction.

Bid Shopping

Many contractors prefer projects that require subcontractor listings. The general contractor must list the subcontractors he plans to use, and has to use the subs he lists. When listing of subs isn't required, in some cases the general contractor shops for lower subcontract bids right up to the time work begins. Even if the general has to list his subs in the contract with the owner, he'll still usually have a month or two to shop bids after the contract is awarded.

When a general contractor uses your bid to land a job, it's normal to expect that your company will get the contract. Giving all your competition a second look at the job is in no one's interest but the general contractor's. It's a waste of time to bid for general contractors who shop their sub bids. Nor is it good practice to undercut another electrical contractor whose estimate was used by the winning general contractor. Support the effort of reputable subcontractors who promote subcontractor listing at bid time.

Need More Help?

This book is concerned primarily with labor and material costs for electrical construction. You'll find only limited information here on how to compile an estimate. If you need a detailed explanation on how to make a material take-off and complete the bid, another book by this publisher may be helpful. You can read about and purchase *Estimating Electrical Construction Revised* using the order form bound into the back of this book.

Section 1: Conduit and Fittings

Every electrical estimator should be familiar with the *National Electrical Code*®. Nearly all inspection authorities follow *NEC*® recommendations on what is and what is not good electrical construction practice. Most inspection authorities accept electrical materials that comply with *NEC* standards. But some cities and counties have special requirements that supplement the current *NEC*. Others are still following an older edition of the *NEC*. The *NEC* is revised every three years to incorporate changes deemed necessary to keep the code up-to-date.

Be aware of the version of the *NEC* that applies at each job you're estimating, and stay current on special requirements that the inspection authority may impose.

Job specifications usually state that all work must comply with the *NEC*. But on many jobs the *NEC* sets only the minimum standard. Job specifications may prohibit what the *NEC* permits. For example, job specs might require specific installation methods or mandate specification grade fixtures.

The *National Electrical Code* classifies all enclosed channels intended to carry electrical conductors as "raceway." This includes conduit, busway and wireway. The most common raceway is electrical conduit. The code identifies the size and number of conductors that can be run through each size of conduit.

Conduit is intended to serve two purposes. First, it's a protective shield for the conductor it carries. It reduces the chance of accidental damage to the wire or insulation. Second, it protects people and property from accidental contact with the conductors. A ground or short is both a safety and a fire hazard.

Conduit is generally required in commercial and industrial buildings, hospitals, hotels, office buildings, stores and underground facilities. It's not generally used in wiring homes and apartments.

Several types of electrical conduit have been approved for electrical construction. Each is designed for a specific purpose or use. All conduit used in electrical construction as a raceway for conductors must bear a label issued by the Underwriter's Laboratories. The UL label indicates that the product has been approved for use under the *National Electrical Code*.

The *NEC* permits a maximum of four bends totaling 360 degrees between terminations in a run

of conduit. Exposed conduit should be installed horizontal or vertical and should run parallel to building members. Concealed conduit should be run in the shortest direct line to reduce the length of run. Long runs waste materials, require excessive labor and, if long enough, can reduce the voltage available at the load end.

Electrical Metallic Tubing

EMT is also known as **thin wall** or **steel tube**. EMT conduit is nonferrous steel tubing sold in 10-foot lengths. Unlike water pipe, the ends aren't threaded. The conduit has a corrosion-resistant coating inside and outside. This coating may be hot-dipped galvanizing, electroplating, or some other material. The conduit sizes are $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1", $1\frac{1}{4}$ ", $1\frac{1}{2}$ ", 2", $2\frac{1}{2}$ ", 3", $3\frac{1}{2}$ " and 4".

Many types of EMT fittings are available. There are elbows, compression, set screw, indent and drive-on fittings which may be made of steel or die cast. Couplings and connectors are sold separately and not included in the price of the conduit. Various types of connectors may be purchased with or without insulated throats. The locknuts for the connectors are included in the cost of the connector.

Couplings are available for joining EMT to rigid metal conduit and to flexible conduit. These couplings are available in compression, set screw and drive-on type and are made of steel or die cast.

EMT conduit is sold without couplings. You have to figure the number of couplings needed and price them separately. To figure the number needed, allow one coupling for each 10 feet of conduit. Then add one coupling for each factory-made elbow.

EMT should be bent with a special conduit bender. The bender has a shoe that fits over and around about half of the conduit to keep the conduit from collapsing as it bends. With a bender it's easy to produce smooth, consistent bends up to 90 degrees. Hand benders are used on sizes from $\frac{1}{2}$ " to $1\frac{1}{4}$ ". EMT bending machines are available for all sizes of conduit. There are manual, hydraulic and electrically driven machines.

Offsets are made to take EMT conduit around obstructions, and when needed, to align the conduit at a box or cabinet. You can make offsets with a hand bender on sizes up to $1\frac{1}{4}$ ". Offsets in EMT conduit over $1\frac{1}{4}$ " should be made with a machine.

In smaller sizes, conduit can be cut with a tubing cutter. Cut larger diameters with a hacksaw or by machine. Cut ends must be reamed to remove the burrs made while cutting. Burrs can damage insulation when wire is pulled through the conduit. Ream with a pocket knife or pliers on smaller sizes and with a metal file or pipe reamer on larger sizes.

EMT must be supported so it doesn't deflect on longer runs. Straps and nailers are the most common way of supporting EMT. Straps usually have one or two holes for securing to the building. Most inspection authorities won't let you support EMT on plumber's perforated metal tape. Straps come in thin steel, heavy duty steel or malleable types. There are special straps made of spring steel for supporting small sizes of EMT to hanger rods or drop ceiling wires.

EMT conduit should be supported at least every 10 feet with a strap or hanger and within 18 inches of every junction box or cabinet.

Other supports include beam clamps for attaching conduit to structural steel members and straps for mounting EMT on steel channel strut. These two-piece straps or clamps are inserted into the strut and bolted together to hold the conduit in place.

EMT can be installed inside or outside, in concrete or masonry, exposed or concealed in walls, floors or ceilings. But be sure to use the correct fittings in wet locations. EMT is not approved for most types of hazardous locations. Some specs limit the use of EMT to dry areas and don't allow placement in masonry or concrete. Conduit placed in concrete floor slab is generally placed below the reinforcing bar curtain or between curtains when two curtains are used. Tie the conduit to the rebar to prevent shifting as the concrete is placed.

Where conduit is turned up above the surface of the concrete, the radius of the turn must be concealed. Part of it can be concealed in a wall, but none should be visible after the building finish has been installed.

As with all types of conduit, EMT should be installed with a minimum of damage to the structure. Keep it clear of heating, ventilating and air conditioning ducts, fire sprinkler systems, plumbing lines, access doors, etc. When necessary, the installer will have to make offsets and bends so the conduit fits into devices, electrical boxes and cabinets.

Flexible Metal Conduit

There are several types of flex conduit: standard wall steel flex, reduced wall steel flex, and aluminum flex. It comes in diameters from $\frac{3}{8}$ " to 4" and is coiled in rolls of 100 feet in the small sizes and 25 feet in the larger sizes. Flex is usually used

in concealed locations but never underground or in concrete. It's cut with a special flex cutter, a hand hacksaw, or with a power cutter such as a portable band saw. The inside cut edge must be reamed to remove cutting burrs which would damage insulation when wire is pulled through conduit.

Flex connectors are available with set screw, screw-in, clamp type, straight, or angled connectors. They're made of steel or die cast. Insulated connectors are also available. Die cast flex couplings are available for joining flex to flex, flex to EMT, or flex to threaded conduit. Support flex with conduit straps or nailers.

Most inspection authorities require that a bonding conductor be installed when electrical wiring is run in flex. Bonding ensures that there's electrical continuity in the flex from one end to the other.

Some specifications restrict the use of flex to short connections to equipment that is subject to vibration (such as motors and machinery) and for built-ins, recessed lighting, and lay-in lighting fixtures.

Flex conduit is popular in remodeling work where wiring in raceway has to be run through an existing cavity wall or in a ceiling cavity. With a little effort, your installer can fish the flex from point to point without opening the wall or ceiling.

Polyvinyl Chloride Conduit

PVC conduit is approved by the *NEC* for many types of applications. But there are some situations where it cannot replace metallic conduit. It's not approved for hazardous locations or in return air plenums. Check with the inspection authority for other restrictions. The standard length is 10 feet and sizes range from $\frac{1}{2}$ " to 6". Schedule 40 PVC is the standard weight. Schedule 80 has a heavier wall. PVC can be installed directly underground, concrete encased underground, exposed, in concrete walls, and in unit masonry.

One coupling is furnished with each length of conduit and is usually attached to the conduit. PVC must be bent with a special hot box which heats the conduit until it becomes pliable. Once heated to the right temperature, the tube is bent and then allowed to cool. PVC fittings fit both Schedule 40 and 80 conduit. Couplings, terminal adapters, female adapters, expansion fittings, end bells, caps, conduit bodies, pull boxes, outlet boxes and elbows require a special cement. The glue is air-drying and comes in half-pints, pints, quarts, and gallon containers. The smaller containers have a brush attached to the cap for applying the cement to the conduit or fittings. PVC conduit can join other types of conduit if you use the right fittings to tie the two types together.

PVC is nonconductive. That makes a bonding conductor necessary to ensure electrical continuity

from the device to the service panel. You probably won't need a bonding conductor when PVC is used as communications conduit or in some application that doesn't include electrical wiring. When installed exposed, PVC requires extra support to keep it from sagging.

Some job specs restrict use of PVC to specific locations. One common restriction is to limit PVC to underground installations encased in a concrete envelope. Many specifications restrict its use to certain applications.

PVC conduit can be cut with a hand hacksaw, a wood crosscut saw, or with a power cutting machine. The inside cut edge should be reamed to remove the cutting burr. Use a pocket knife or a file.

Power and communications duct is usually called **P&C duct**. It's made of PVC in 25-foot lengths and in diameters from 1" to 6". There are two types of P&C duct. One is called **EB** for encased burial. The other is **DB** for direct burial. Fittings for P&C duct include couplings (one is furnished with each length), end bells, caps and plugs, terminal adapters, female adapters, elbows, and expansion fittings. The elbows are available in various shapes and with either long or short radii. Fittings can be used either on type EB or DB. Use a special cement to weld the fittings to the conduit.

Bend P&C duct with a hot box. It can be cut with the same tools as PVC conduit. The inside cut edge must be reamed to remove the cutting burr.

P&C duct is used for underground systems only, never above ground.

ABS underground duct is used and installed the same as PVC P&C duct. It requires a special ABS cement to weld the fittings to the conduit. The job specifications or the utility company may require either P&C, ABS or PVC duct, depending on the specific use.

Galvanized Rigid Conduit

GRS or **RSC** (for rigid steel conduit) is made with nonferrous metal and has a corrosion-resistant coating on the inside. The outer coating is either hot-dipped galvanizing or electroplate. It comes in diameters from ½" to 6" and in 10-foot lengths with a thread on each end. A coupling is furnished on one end of each length. GRS can be cut with a hand hacksaw, a pipe cutter, or with a cutting machine. The inner cut edge must be reamed to remove the burr. Use a pipe reamer or a file.

After the pipe has been cut and reamed, it can be threaded. Use a hand die for threading on a small job. Where there's more cutting and threading to be done, use a threading machine. Several types are available. Small portable electric threading tools cut sizes up to 2". Larger threading machines can cut, ream and thread conduit

diameters up to 6". Another good choice for GRS up to 6" is a threading set that uses a tripod vise stand and a threading head that clamps to the pipe in the vise stand. The threading head is turned with a universal joint connected to a power vise. Another set uses a tripod vise stand to hold the conduit. The threading head clamped on the conduit is turned with a reduction gear assembly powered by an electric drill. This rig works well on diameters over 2".

Use enough cutting oil to keep the die cool and lubricated during thread cutting. Cutting oil comes in clear or dark and in small cans, gallons and barrels. Use an oil can to keep a film of oil ahead of the dies. Commercial oiling units hold about a gallon of cutting oil and recirculate oil back to the cutting teeth as oil drips into the catch basin. Most threading machines have automatic oilers that filter the oil as it's reused.

Elbows are available for all sizes of GRS. Long radius bends are available for the larger sizes. Some specifications require concentric bends for all exposed conduit installed parallel on a common hanging assembly or trapeze.

GRS fittings include couplings, locknuts, bushings, one-hole straps, two-hole straps, heavy duty two-hole straps, expansion fittings, threadless compression couplings, threadless set-screw couplings, threadless compression connectors, threadless set-screw connectors, three-piece union-type couplings, strut clamps, beam clamps, hanger clamps, condulets, split couplings, caps, and plugs.

Galvanized rigid conduit is bent about the same way as EMT except that the bender is made for bending rigid conduit. Hand benders are used on conduit up to 1". There are hand benders for 1¼" and 1½" rigid steel conduit, but it takes a lot of effort to make the bend. Power benders can be used on all sizes of conduit, even the ½".

There are three common types of rigid steel benders: one-shot benders create a single standard radius arc. Segment benders must be moved along the conduit as each few degrees of bend are made. The electric sidewinder bender has up to three bending shoes in place ready to bend any of three sizes of conduit. The sidewinder saves labor on larger rigid conduit jobs.

Supports for rigid conduit must be no more than 10 feet apart from support to support and within 18 inches of junction boxes or cabinets.

Trapeze hangers are often used to carry multiple runs of GRS conduit. Trapeze hangers can be made from strut, angle iron, or channel iron. The trapeze is supported from the structural frame of the building with threaded rod — usually either 3/8" or ½" diameter. The upper part of the rod is attached to beam clamps or concrete anchors. The lower portion of the rod is run through the trapeze and is secured with double nuts and flat washers.

Like other hangers, trapezes have to be placed within 10 feet of each other and should be sized to support the total weight of the conduit and all cable. Trapeze hangers can be stacked one over the other with conduit clamped on each one.

IMC Conduit

Intermediate metal conduit (IMC) has a thinner wall than GRS. It comes in the same sizes and uses the same fittings as GRS. The same tools can be used for cutting, threading, and bending. It's made about the same way as GRS, comes in 10-foot lengths and is galvanized for corrosion resistance. The difference is that IMC is lighter and easier to install than GRS. Some specifications restrict its use to specific applications.

PVC Coated Conduit

Both GRS and IMC conduit come with a PVC coating for use in highly corrosive locations. Aluminum tubing also comes with a PVC coating, but applications are restricted to specific uses. The PVC coating is either 10, 20 or 40 mils thick, and is bonded directly to the conduit wall. Most fittings made for use with GRS are available with a PVC coating.

To thread PVC coated conduit, the PVC coating must be cut back away from the end to be threaded. When PVC coated conduit is put in a vise, be sure the coating is protected from the vise jaws. Also be careful when you're bending PVC coated conduit not to damage the coating. If the coating is damaged, patching material is available to restore the surface. The material comes in a spray can. Apply several thin layers to repair worn spots.

Conduit Take-Off

Here's how to calculate conduit quantities. First, scan the specs that cover conduit and conduit installation. Absorb all the information that relates to conduit. Then review the drawings for anything about conduit. The symbol list may include the engineer's design notations. Notes on the drawings or in the specs may set specific minimum conduit sizes. It's common for an engineer to require a minimum size conduit in the home run to the panel or cabinets or to specify a minimum size of $\frac{3}{4}$ " throughout the job. It's also common practice to limit the maximum size of EMT to 2". Ignoring a note like that can be expensive.

For your quantity take-off, use any ruled $8\frac{1}{2}$ " by 11" tablet. Draw a pencil line down the left side of the sheet about an inch from the edge. Begin by looking for the smallest diameter of EMT. Write "EMT" at the top left of your take-off sheet. On the next line down, to the left of the vertical line, list the smallest EMT size found in the project — probably $\frac{1}{2}$ ". To the right of the vertical line and on the

same horizontal line as the size, you're going to list lengths of EMT of that diameter. Then you'll go to the next larger diameter, listing quantities until all EMT on the plans has been covered.

Check the plan scale before you start measuring conduit. If the plan has been reduced photographically to save paper, the scale will be inaccurate. Once you're sure of the correct scale, select the appropriate map measure or rule to compute conduit lengths.

Measure the length of each run of $\frac{1}{2}$ " EMT. Add enough conduit to include the run down to the wall switch, receptacle or panel. Write down the calculated length. As each run is listed on your take-off sheet, put a check mark on the plan over the line you just measured. Use an erasable color pencil and let each color stand for a particular conduit type. For example, red might be for GRS conduit. Follow the same color code on all estimates to avoid mistakes.

If there are more than two or three plan sheets, it's good practice to calculate the length of $\frac{1}{2}$ " EMT on each plan sheet and list that number separately on your take-off form. When you've finished taking off $\frac{1}{2}$ " EMT on the first plan sheet, list that quantity, and at the top of the column write in the plan sheet number. Then draw a vertical line to the right of that column and start accumulating lengths from the next plan sheet. As each plan page is taken off, enter the total and write the plan sheet number at the top of the column. Figure 1-1 shows what your take-off might look like if conduit and fittings are found on plan sheets E3 to E11.

When all of the smallest-diameter EMT has been listed, go on to the next larger size. Follow the same procedure.

After listing all EMT, begin with the fittings. Below the last horizontal line used for conduit, and to the left of the vertical line, write the word "Connectors." Below that, list all sizes of connectors needed for the job, again working from the smallest size to the largest. Don't bother to list the couplings. They'll be figured later from the total conduit length — one for each 10 feet and one for each elbow.

Count each connector needed for each conduit run on each plan sheet. Enter the total on your take-off form. When all connectors are counted, count EMT elbows from $1\frac{1}{4}$ " to the largest size needed.

Follow this system for all estimates and for each item on every estimate. Keep it simple and uniform to avoid mistakes and omissions. When finished, your conduit and fitting take-off form might look like Figure 1-1. The right column is the sum of the columns to the left.

Work Sheet				Estimate No.: M351						
Conduit / Fittings										
	E3	E4	E5	E6	E7	E8	E9	E10	E11	Total
½" EMT	550	420	200	90	290	130	190	320		2190
¾"	20		30	20	80					150
1"			3		5		50			58
1¼"			30							30
1½"									90	90
2"					4				16	20
½" Conn	76	52	124	47	48	16	14	18		395
¾"	4		26	4	19	2				55
1"			4		5	2	2			13
1¼"			2							2
1½"									4	4
2"					2				4	6
1¼" Elb			2							2
1½"									3	3
2"									3	3
½" PVC			310	380	50					740
¾"			120	100	220	50				490
1"			40		320	40				400
1¼"						180				180
1½"				60					75	135
2"				10	25			70	75	180
4"								150		150
½" FA			45	30	4					79
¾"			4	4	12	2				22
1"			2		17	2				21
1¼"										0
1½"				4					2	6
2"			2	2					2	6
½" TA			5							5
¾"					4					4
1"					1					1
½" Elb			50	30	4					84
¾"			2	2	16	2				22

Figure 1-1

Many jobs limit the use of EMT to dry locations. So your EMT take-off will probably start with the lighting plans or the lighting portion of the plan.

Taking Off the Wire

Next, compute the quantity of wire needed. Head up another take-off form with the word "Wire" at the top. Put a vertical line down the left side of the page about an inch from the left edge. In this margin, list wire sizes from the smallest to the largest. To the right of the vertical line you'll list lengths for each wire gauge, on each plan sheet.

Start by measuring the length of ½" EMT with two #12 wires. Multiply by 2 to find the wire length. Then measure the length of ½" EMT with three #12 wires and multiply by 3. Keep following this proce-

dure until the wire needed in all EMT has been computed. But watch for changes in the wire size on long runs. Sometimes the engineer will decide that a larger wire size is needed in the first portion of a run to reduce the voltage drop at the end of the line. This is common where the last device or fixture on a circuit is a long way from the panel.

Follow the same procedure for all conduit and wire. Record all of the measurements on the work sheets. Don't worry about waste of conduit or wire at this point. We'll include an allowance for waste after the totals are added and before figures are transferred to the pricing sheets.

Sometimes the specifications or a note on the plans will allow the use of aluminum feeder wire over a certain size, providing the ampacity of the

wire is maintained and the conduit size is increased to accommodate the larger wire size. Be sure to observe these restrictions.

Taking Off Other Conduit

Some specifications permit the use of aluminum conduit in certain locations. The aluminum conduit is made in the same sizes as GRS. The fittings are identical except that they're made of aluminum instead of steel. Most specs prohibit the use of dissimilar metals in a conduit run and don't allow placing of aluminum conduit in concrete. Aluminum conduit saves time because it's lighter and easier to handle. But large wire sizes may be a little more difficult to pull in aluminum conduit. The insulation of the wire, the length of the conduit run, and the pulling lubricant used have an effect on pulling resistance.

When taking off the underground conduit, start a separate work sheet for trenching, surface cutting, breaking, and patching. List all excavation for underground pull boxes, handholes, manholes, poles, and light pole bases. Be sure the trenches are big enough for the number of duct they have to carry. If the specifications require concrete or sand encasement around underground duct, calculate the amount of concrete or sand as you compute measurements for each trench.

Be systematic. Follow the same procedure consistently on every take-off. If there are other estimators in your office, be sure they are using the same procedures. Being consistent reduces errors, minimizes omissions, and makes the work easier for others to check.

We've covered all common conduit. But some other types are used occasionally for special purposes:

Fiber duct is a paper and creosote duct. Type 1 is intended for concrete encasement and Type 2 is used for direct burial. Sizes range from 2" to 5". Lengths can be 5, 8 or 10 feet. End fittings are tapered. Ends that have been cut must be tapered with a duct lathe.

Transite duct is cement asbestos duct. Type 1 is for concrete encasement and Type 2 is for direct burial. Sizes range from 2" to 6". It's made in 5, 8 and 10-foot lengths. Transite is harder to cut and must have tapered ends for fittings.

Soapstone duct is made from a soapstone-like material in sizes from 2" to 4".

Wrought iron pipe comes in sizes from 2" to 4". It's used only for certain types of underground communications lines and has to be threaded on each end to accept fittings.

Clay conduit comes in sizes from 2" to 4". It's used for underground communication runs only.

These types of conduit are seldom specified today. You'll see them used only when an old duct line has to be extended. It may be hard to find a fitting that will join an existing duct system made with one type of duct to a new run of duct made from some other material. Sometimes an oversize plastic coupling can be used. In some cases an inside plastic coupling can be inserted into the old conduit. Then new conduit can be joined to start the new run.

Before extending an old underground duct system, check the old conduit with a mandrel to be sure the line is clean and clear. Old fiber duct that's been under water for a long time will swell, making the inside diameter too small to pull new cable.

Silicon-bronze conduit comes in sizes from ½" to 4". It's threaded like GRS and uses similar fittings, except that fittings are silicon-bronze also. It's used in extremely corrosive locations. This type of conduit will be available from your dealer on special request only. It's harder to bend, but can be bent with standard rigid bending tools. It threads very well with the standard threading tools and cutting oil.

Liquid-tight flexible metal conduit comes in sizes from ½" to 4". It's used to extend conduit to electrical equipment in damp or wet locations. Special fittings are available for connecting electrical systems and devices with this conduit. Your dealer probably stocks a limited supply of liquid-tight flex and will quote prices on request. The conduit can be cut with a hacksaw. Be sure to remove the cutting burr. Special connectors with grips are available to support the conduit and prevent any pulling strain.

Liquid-tight flexible non-metallic conduit comes in sizes from ½" to 1½". It's used in place of flexible metal conduit in concealed locations. Special fittings are available for making connections. Your dealer may have a limited supply in stock.

Flexible metallic tubing is available only in sizes from ⅜" to ¾". Special fittings are available for making connections. The tubing can be bent by hand and is cut with a hacksaw. The cutting burr must be removed before connectors are installed.

Other UL-approved raceways for electrical systems are covered in other sections of this book. See the sections on surface metal raceway, underfloor ducts, header ducts, cable tray, and wireway.

Using the Conduit Tables

The labor tables that follow are for conduit runs that average 50 feet. You'll note that there is no modification in the tables for shorter runs or longer runs of conduit. I agree that it takes more time per linear foot to install a 5-foot run of conduit than it does to install a 95-foot run of conduit. But I don't

recommend that you tally shorter runs and longer runs separately and then compute labor separately for each. There's an easier way.

On most jobs the conduit runs average 50 feet. There will usually be about as many runs under 50 feet as there are runs over 50 feet. It's safe then, to use a 50-foot run as our benchmark. As long as the conduit runs on a job average close to 50 feet, there's no need to modify the figures in these tables. If conduit runs average well over 50 feet, consider reducing the cost per linear foot slightly. Increase the cost slightly if conduit runs average less than 50 feet.

The labor costs that follow include the labor needed to bore holes in wood stud walls. Where holes have to be cut through concrete or unit masonry, add these costs separately.

Typical conduit bending is included in the tables that follow. Usually you will have a bend or offset about every 20 feet. Labor needed to make bends and offsets is minor when installing the smaller sizes of conduit.

Concealed conduit is installed where it will be inaccessible once the structure or finish of the building is completed. **Exposed conduit** is attached to the surface where access is possible even after the building is completed. It's usually faster to run concealed conduit through wall and ceiling cavities that will be covered later by finish materials. Installing conduit on surfaces that won't be covered later usually takes more time.

If only a small percentage of the conduit is to be installed exposed, the cost difference will be minor and probably can be ignored. But if most of the job is exposed, add about 20 percent to the labor cost.

The conduit tables that follow assume that electricians are working from ladders and lifts up to 12 feet above the floor. Add to the labor cost for heights beyond 12 feet. If a large quantity of conduit has to be installed at 18 feet above the floor, for example, add 15 percent to the labor cost.

If there are conduit runs over 20 feet above the floor, check your labor contract for a **high time clause**. Some agreements require that electricians be paid time and one-half for heights from 20 to 50 feet and double time for heights beyond 50 feet. If high time must be paid, be sure the extra cost is covered in your bid.

Job Size Modifiers

It's seldom necessary to estimate lower productivity just because the job is small. If you're figuring a very small job with only four or five conduit runs, each with only a strap or two, you might want to use a higher hourly labor rate. On any other job

that takes from two days to several years, you can use the labor units in the tables that follow. Of course, you'll still have to modify the figures for other than "good" conditions. And if you have long runs of feeder conduit with parallel runs on a common trapeze, you can reduce those labor units by as much as 40 percent.

Pitfalls

The most common error when estimating conduit is failing to read the plans and specs. Read carefully! Your profit depends on it. It's easy to miss a little note where the designer sets the minimum size for conduit at $\frac{3}{4}$ " and 1" for all home runs to the panel. Look for a note on the plans that requires stub ups to ceiling cavities from power and lighting panels. The designer may require one $\frac{3}{4}$ " conduit run for each three spare circuit breakers in a panel!

It's common for rigid conduit to be installed in a concrete floor slab. Where GRS is stubbed up out of the concrete for a wall switch, it's easier and cheaper to use EMT for the wall extension. The NEC permits making that extension in EMT. But some specs don't! Others require that a junction box be used to separate the two types of conduit. Failing to catch that note can be an expensive mistake.

You'll find all sorts of restrictions in specs and notes on the plans. That's why it's so important to read the plans and specs carefully. It's elementary, but it's so often overlooked.

Waste of Material

There will always be some waste on a job. Rounding off the conduit and wire needed to the next even 100 feet will usually allow enough extra material to cover all waste. But there are some cases where you can anticipate a waste problem. For example, suppose there will be 2 feet of waste for every 20 feet of conduit installed because of an unusual lighting pattern. Or suppose a row of junction boxes is spaced at 9 feet. Then a 10 percent waste allowance may be called for. That's almost certainly true if your job is installing the lighting only. There may be no chance to use waste materials on another part of the job.

Allowances

Be sure to make allowances for the vertical portion of every conduit run that stubs up or down in a wall. The floor plan doesn't show the 4 or 5 feet needed to run from the slab to the wall switch or panel. Even worse, if the job is a warehouse, the stub up to a switch or panel may be 15 to 20 feet. That's a wide miss! Watch for stub up.

Electrical Metallic Tubing

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
EMT conduit in floor slab or multiple runs on a trapeze					
1/2"	L1@3.25	CLF	30.20	131.00	161.20
3/4"	L1@3.50	CLF	57.10	141.00	198.10
1"	L1@4.00	CLF	96.00	161.00	257.00
1-1/4"	L1@4.50	CLF	146.00	181.00	327.00
1-1/2"	L1@5.50	CLF	180.00	221.00	401.00
2"	L1@7.00	CLF	219.00	281.00	500.00
2-1/2"	L1@9.00	CLF	358.00	362.00	720.00
3"	L1@10.0	CLF	439.00	402.00	841.00
3-1/2"	L1@11.0	CLF	637.00	442.00	1,079.00
4"	L1@12.0	CLF	647.00	482.00	1,129.00



EMT conduit in concealed areas, walls and closed ceilings

1/2"	L1@3.50	CLF	30.20	141.00	171.20
3/4"	L1@3.75	CLF	57.10	151.00	208.10
1"	L1@4.25	CLF	96.00	171.00	267.00
1-1/4"	L1@5.00	CLF	146.00	201.00	347.00
1-1/2"	L1@6.00	CLF	180.00	241.00	421.00
2"	L1@8.00	CLF	219.00	322.00	541.00
2-1/2"	L1@10.0	CLF	358.00	402.00	760.00
3"	L1@12.0	CLF	439.00	482.00	921.00
3-1/2"	L1@14.0	CLF	637.00	563.00	1,200.00
4"	L1@16.0	CLF	647.00	643.00	1,290.00



EMT conduit installed in exposed areas

1/2"	L1@3.75	CLF	30.20	151.00	181.20
3/4"	L1@4.00	CLF	57.10	161.00	218.10
1"	L1@4.50	CLF	96.00	181.00	277.00
1-1/4"	L1@6.00	CLF	146.00	241.00	387.00
1-1/2"	L1@8.00	CLF	180.00	322.00	502.00
2"	L1@10.0	CLF	219.00	402.00	621.00
2-1/2"	L1@12.0	CLF	358.00	482.00	840.00
3"	L1@14.0	CLF	439.00	563.00	1,002.00
3-1/2"	L1@16.0	CLF	637.00	643.00	1,280.00
4"	L1@18.0	CLF	647.00	723.00	1,370.00



Use these figures to estimate the cost of EMT conduit installed in a building under the conditions described on pages 5 and 6. Costs listed are for each 100 linear feet installed. The crew is one electrician working at a labor cost of \$40.19 per manhour. These costs include typical bending, boring out wood studs and joists (in concealed locations only), layout, material handling, and normal waste. Add for connectors, couplings, straps, boxes, wire, sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit. Note: Conduit runs are assumed to be 50' long. Shorter runs will take more labor and longer runs will take less labor per linear foot.

EMT Hand Benders are on page 27.

EMT Fittings

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
EMT 45 degree elbows					
1"	L1@0.06	Ea	4.39	2.41	6.80
1-1/4"	L1@0.08	Ea	5.51	3.22	8.73
1-1/2"	L1@0.08	Ea	9.30	3.22	12.52
2"	L1@0.10	Ea	11.80	4.02	15.82
2-1/2"	L1@0.15	Ea	28.80	6.03	34.83
3"	L1@0.20	Ea	43.10	8.04	51.14
3-1/2"	L1@0.20	Ea	57.10	8.04	65.14
4"	L1@0.25	Ea	67.70	10.00	77.70

EMT 90 degree elbows

1"	L1@0.08	Ea	5.61	3.22	8.83
1-1/4"	L1@0.10	Ea	6.98	4.02	11.00
1-1/2"	L1@0.10	Ea	8.04	4.02	12.06
2"	L1@0.15	Ea	11.80	6.03	17.83
2-1/2"	L1@0.15	Ea	28.80	6.03	34.83
3"	L1@0.20	Ea	43.10	8.04	51.14
3-1/2"	L1@0.20	Ea	57.10	8.04	65.14
4"	L1@0.25	Ea	67.70	10.00	77.70

Use these figures to estimate the cost of EMT elbows installed on EMT conduit in a building under the conditions described on pages 5 and 6. Costs listed are for each elbow installed. The crew is one electrician working at a labor cost of \$40.19 per manhour. These costs are for factory-made elbows and include layout, material handling, and normal waste. Add for field bending, couplings and connectors at the end of the run, sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit. Note: Material costs assume purchase of full box quantities.

Conduit weight per 100 feet (in pounds)

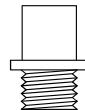
Diameter	EMT steel	ENT plastic	PVC 40	Rigid steel	Intermediate rigid steel	Rigid aluminum
1/2"	30	11	18	79	57	30
3/4"	46	14	23	105	78	40
1"	66	20	35	153	112	59
1-1/4"	96	—	48	201	114	80
1-1/2"	112	—	57	249	176	96
2"	142	—	76	334	230	129
2-1/2"	230	—	125	527	393	205
3"	270	—	164	690	483	268
3-1/2"	350	—	198	831	561	321
4"	400	—	234	982	625	382
5"	—	—	317	1344	—	522
6"	—	—	412	1770	—	678

EMT Connectors

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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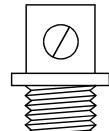
Indent EMT connectors

1/2"	L1@0.05	Ea	.37	2.01	2.38
3/4"	L1@0.06	Ea	.68	2.41	3.09



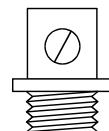
Die cast set screw EMT connectors

1/2"	L1@0.05	Ea	.23	2.01	2.24
3/4"	L1@0.06	Ea	.37	2.41	2.78
1"	L1@0.08	Ea	.72	3.22	3.94
1-1/4"	L1@0.10	Ea	1.25	4.02	5.27
1-1/2"	L1@0.10	Ea	1.71	4.02	5.73
2"	L1@0.15	Ea	2.27	6.03	8.30
2-1/2"	L1@0.15	Ea	5.16	6.03	11.19
3"	L1@0.20	Ea	6.27	8.04	14.31
3-1/2"	L1@0.20	Ea	7.43	8.04	15.47
4"	L1@0.25	Ea	9.35	10.00	19.35



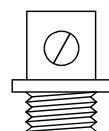
Insulated die cast set screw EMT connectors

1/2"	L1@0.05	Ea	.37	2.01	2.38
3/4"	L1@0.06	Ea	.58	2.41	2.99
1"	L1@0.08	Ea	1.04	3.22	4.26
1-1/4"	L1@0.10	Ea	2.08	4.02	6.10
1-1/2"	L1@0.10	Ea	2.54	4.02	6.56
2"	L1@0.15	Ea	3.41	6.03	9.44
2-1/2"	L1@0.15	Ea	9.25	6.03	15.28
3"	L1@0.20	Ea	10.80	8.04	18.84
3-1/2"	L1@0.20	Ea	13.70	8.04	21.74
4"	L1@0.25	Ea	15.20	10.00	25.20



Steel set screw EMT connectors

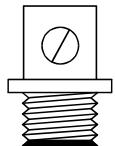
1/2"	L1@0.05	Ea	.57	2.01	2.58
3/4"	L1@0.06	Ea	.93	2.41	3.34
1"	L1@0.08	Ea	1.62	3.22	4.84
1-1/4"	L1@0.10	Ea	3.38	4.02	7.40
1-1/2"	L1@0.10	Ea	4.91	4.02	8.93
2"	L1@0.15	Ea	6.98	6.03	13.01
2-1/2"	L1@0.15	Ea	22.90	6.03	28.93
3"	L1@0.20	Ea	27.00	8.04	35.04
3-1/2"	L1@0.20	Ea	35.40	8.04	43.44
4"	L1@0.25	Ea	40.60	10.00	50.60



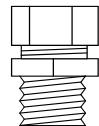
Use these figures to estimate the cost of EMT connectors installed on EMT conduit under the conditions described on pages 5 and 6. Costs listed are for each connector or expanded elbow installed. The crew is one electrician working at a labor cost of \$40.19 per manhour. These costs include the connector locknut, removing the knockout, layout, material handling, and normal waste. Add for insulated bushings, sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit. Note: Material costs assume purchase of full box quantities.

Indenter tools are on page 22.

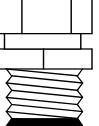
EMT Connectors



Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
Insulated steel set screw EMT connectors					
1/2"	L1@0.05	Ea	.76	2.01	2.77
3/4"	L1@0.06	Ea	1.22	2.41	3.63
1"	L1@0.08	Ea	2.03	3.22	5.25
1-1/4"	L1@0.10	Ea	4.06	4.02	8.08
1-1/2"	L1@0.10	Ea	5.96	4.02	9.98
2"	L1@0.15	Ea	8.64	6.03	14.67
2-1/2"	L1@0.15	Ea	38.70	6.03	44.73
3"	L1@0.20	Ea	48.20	8.04	56.24
3-1/2"	L1@0.20	Ea	64.70	8.04	72.74
4"	L1@0.25	Ea	70.80	10.00	80.80



1/2"	L1@0.05	Ea	.37	2.01	2.38
3/4"	L1@0.06	Ea	.67	2.41	3.08
1"	L1@0.08	Ea	1.09	3.22	4.31
1-1/4"	L1@0.10	Ea	1.80	4.02	5.82
1-1/2"	L1@0.10	Ea	2.36	4.02	6.38
2"	L1@0.15	Ea	3.74	6.03	9.77
2-1/2"	L1@0.15	Ea	7.99	6.03	14.02
3"	L1@0.20	Ea	9.71	8.04	17.75
3-1/2"	L1@0.20	Ea	12.80	8.04	20.84
4"	L1@0.25	Ea	15.10	10.00	25.10

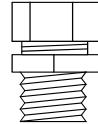


1/2"	L1@0.05	Ea	.50	2.01	2.51
3/4"	L1@0.06	Ea	.87	2.41	3.28
1"	L1@0.08	Ea	1.35	3.22	4.57
1-1/4"	L1@0.10	Ea	2.53	4.02	6.55
1-1/2"	L1@0.10	Ea	3.12	4.02	7.14
2"	L1@0.15	Ea	4.60	6.03	10.63
2-1/2"	L1@0.15	Ea	13.50	6.03	19.53
3"	L1@0.20	Ea	16.00	8.04	24.04
3-1/2"	L1@0.20	Ea	19.90	8.04	27.94
4"	L1@0.25	Ea	23.30	10.00	33.30

Use these figures to estimate the cost of EMT connectors installed on EMT conduit under the conditions described on pages 5 and 6. Costs listed are for each connector installed. The crew is one electrician working at a labor cost of \$40.19 per manhour. These costs include the connector locknut, removing the knockout, layout, material handling, and normal waste. Add for insulated bushings, sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit. Note: Material costs assume purchase of full box quantities.

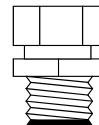
EMT Connectors

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
Steel compression EMT connectors, raintight					
1/2"	L1@0.05	Ea	.07	2.01	2.08
3/4"	L1@0.06	Ea	.11	2.41	2.52
1"	L1@0.08	Ea	.15	3.22	3.37
1-1/4"	L1@0.10	Ea	.33	4.02	4.35
1-1/2"	L1@0.10	Ea	.48	4.02	4.50
2"	L1@0.15	Ea	.68	6.03	6.71
2-1/2"	L1@0.15	Ea	3.28	6.03	9.31
3"	L1@0.20	Ea	4.55	8.04	12.59
3-1/2"	L1@0.20	Ea	6.87	8.04	14.91
4"	L1@0.25	Ea	7.03	10.00	17.03



Insulated steel compression EMT connectors, raintight

1/2"	L1@0.05	Ea	.08	2.01	2.09
3/4"	L1@0.06	Ea	.12	2.41	2.53
1"	L1@0.08	Ea	.20	3.22	3.42
1-1/4"	L1@0.10	Ea	.42	4.02	4.44
1-1/2"	L1@0.10	Ea	.62	4.02	4.64
2"	L1@0.15	Ea	.89	6.03	6.92
2-1/2"	L1@0.15	Ea	5.51	6.03	11.54
3"	L1@0.20	Ea	7.13	8.04	15.17
3-1/2"	L1@0.20	Ea	10.40	8.04	18.44
4"	L1@0.25	Ea	10.70	10.00	20.70



Die cast indent offset EMT connectors

1/2"	L1@0.10	Ea	1.17	4.02	5.19
3/4"	L1@0.10	Ea	1.61	4.02	5.63



Die cast set screw offset EMT connectors

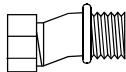
1/2"	L1@0.10	Ea	1.47	4.02	5.49
3/4"	L1@0.10	Ea	2.12	4.02	6.14
1"	L1@0.15	Ea	3.06	6.03	9.09



Use these figures to estimate the cost of EMT connectors installed on EMT conduit under the conditions described on pages 5 and 6. Costs listed are for each connector installed. The crew is one electrician working at a labor cost of \$40.19 per manhour. These costs include the connector locknut, removing the knockout, layout, material handling, and normal waste. Add for insulated bushings, sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit. Note: Material costs assume purchase of full box quantities.

Indenter tools are on page 22.

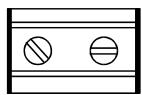
EMT Connectors and Couplings



Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
Steel compression offset EMT connectors, raintight					
1/2"	L1@0.10	Ea	2.24	4.02	6.26
3/4"	L1@0.10	Ea	3.25	4.02	7.27
1"	L1@0.15	Ea	3.61	6.03	9.64

Indent EMT couplings

1/2"	L1@0.05	Ea	.39	2.01	2.40
3/4"	L1@0.06	Ea	.76	2.41	3.17



Die cast set screw EMT couplings

1/2"	L1@0.05	Ea	.25	2.01	2.26
3/4"	L1@0.06	Ea	.39	2.41	2.80
1"	L1@0.08	Ea	.67	3.22	3.89
1-1/4"	L1@0.10	Ea	1.16	4.02	5.18
1-1/2"	L1@0.10	Ea	1.77	4.02	5.79
2"	L1@0.15	Ea	2.36	6.03	8.39
2-1/2"	L1@0.15	Ea	4.51	6.03	10.54
3"	L1@0.20	Ea	5.16	8.04	13.20
3-1/2"	L1@0.20	Ea	5.96	8.04	14.00
4"	L1@0.25	Ea	7.28	10.00	17.28



Indenter tools

With jaws for 1/2" EMT	—	Ea	23.90	—	23.90
With jaws for 3/4" EMT	—	Ea	33.30	—	33.30
Replacement points, 1/2" EMT	—	Ea	1.81	—	1.81
Replacement points, 3/4" EMT	—	Ea	1.88	—	1.88

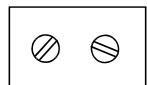
Use these figures to estimate the cost of EMT connectors and couplings installed on EMT conduit under the conditions described on pages 5 and 6. Costs listed are for each coupling or connector installed. The crew is one electrician working at a labor cost of \$40.19 per manhour. These costs include the connector or coupling, layout, material handling, and normal waste. Add for conduit, sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit. Note: Drive-on EMT fittings are rated as raintight and are also concrete tight. They are threaded with a standard electrical pipe thread and can be adapted easily to rigid conduit or other threaded fittings. Material costs assume purchase of full box quantities.

EMT Couplings

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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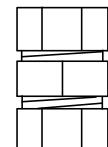
Set screw steel EMT couplings

1/2"	L1@0.05	Ea	.14	2.01	2.15
3/4"	L1@0.06	Ea	.18	2.41	2.59
1"	L1@0.08	Ea	.28	3.22	3.50
1-1/4"	L1@0.10	Ea	.58	4.02	4.60
1-1/2"	L1@0.10	Ea	.87	4.02	4.89
2"	L1@0.15	Ea	1.14	6.03	7.17
2-1/2"	L1@0.15	Ea	2.49	6.03	8.52
3"	L1@0.20	Ea	2.78	8.04	10.82
3-1/2"	L1@0.20	Ea	3.41	8.04	11.45
4"	L1@0.25	Ea	3.71	10.00	13.71



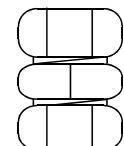
Die cast compression EMT couplings, raintight

1/2"	L1@0.05	Ea	.21	2.01	2.22
3/4"	L1@0.06	Ea	.27	2.41	2.68
1"	L1@0.08	Ea	.43	3.22	3.65
1-1/4"	L1@0.10	Ea	.81	4.02	4.83
1-1/2"	L1@0.10	Ea	1.25	4.02	5.27
2"	L1@0.15	Ea	1.54	6.03	7.57
2-1/2"	L1@0.15	Ea	5.96	6.03	11.99
3"	L1@0.20	Ea	6.37	8.04	14.41
3-1/2"	L1@0.20	Ea	7.78	8.04	15.82
4"	L1@0.25	Ea	8.14	10.00	18.14



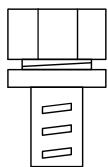
Steel compression EMT couplings, raintight

1/2"	L1@0.05	Ea	.21	2.01	2.22
3/4"	L1@0.06	Ea	.30	2.41	2.71
1"	L1@0.08	Ea	.45	3.22	3.67
1-1/4"	L1@0.10	Ea	.83	4.02	4.85
1-1/2"	L1@0.10	Ea	1.20	4.02	5.22
2"	L1@0.15	Ea	1.65	6.03	7.68
2-1/2"	L1@0.15	Ea	6.77	6.03	12.80
3"	L1@0.20	Ea	8.64	8.04	16.68
3-1/2"	L1@0.20	Ea	12.40	8.04	20.44
4"	L1@0.25	Ea	12.70	10.00	22.70



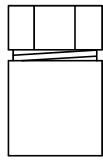
Use these figures to estimate the cost of EMT couplings installed on EMT conduit under the conditions described on pages 5 and 6. Costs listed are for each coupling installed. The crew is one electrician working at a labor cost of \$40.19 per manhour. These costs include the coupling, layout, material handling, and normal waste. Add for conduit, sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit. Note: Compression fittings are raintight and can be used in concrete. Material costs assume purchase of full box quantities.

EMT Couplings and Straps



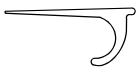
Die cast EMT to flex couplings

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
1/2"	L1@0.05	Ea	1.08	2.01	3.09
3/4"	L1@0.05	Ea	1.45	2.01	3.46
1"	L1@0.06	Ea	2.02	2.41	4.43



Steel EMT to GRS compression couplings, raintight

1/2"	L1@0.05	Ea	1.66	2.01	3.67
3/4"	L1@0.06	Ea	2.36	2.41	4.77
1"	L1@0.08	Ea	3.58	3.22	6.80
1-1/4"	L1@0.10	Ea	6.22	4.02	10.24
1-1/2"	L1@0.10	Ea	7.63	4.02	11.65
2"	L1@0.15	Ea	15.20	6.03	21.23



Steel EMT nail straps

1/2"	L1@0.02	Ea	.07	.80	.87
3/4"	L1@0.03	Ea	.07	1.21	1.28
1"	L1@0.05	Ea	.09	2.01	2.10



Steel one hole EMT straps

1/2"	L1@0.03	Ea	.03	1.21	1.24
3/4"	L1@0.04	Ea	.05	1.61	1.66
1"	L1@0.05	Ea	.08	2.01	2.09
1-1/4"	L1@0.06	Ea	.13	2.41	2.54
1-1/2"	L1@0.06	Ea	.20	2.41	2.61
2"	L1@0.10	Ea	.24	4.02	4.26
2-1/2"	L1@0.10	Ea	.92	4.02	4.94
3"	L1@0.15	Ea	1.13	6.03	7.16
3-1/2"	L1@0.15	Ea	1.76	6.03	7.79
4"	L1@0.15	Ea	2.22	6.03	8.25

Use these figures to estimate the cost of EMT couplings and EMT straps installed on EMT conduit under the conditions described on pages 5 and 6. Costs listed are for each coupling and strap installed. The crew is one electrician working at a labor cost of \$40.19 per manhour. These costs include cutting the EMT conduit, layout, material handling, and normal waste. Add the cost of conduit, sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit. Note: Material costs assume purchase of full box quantities.

EMT Straps

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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One hole heavy duty steel EMT straps

1/2"	L1@0.03	Ea	.12	1.21	1.33
3/4"	L1@0.04	Ea	.15	1.61	1.76
1"	L1@0.05	Ea	.27	2.01	2.28
1-1/4"	L1@0.06	Ea	.37	2.41	2.78
1-1/2"	L1@0.06	Ea	.56	2.41	2.97
2"	L1@0.10	Ea	.84	4.02	4.86



One hole malleable EMT straps

1/2"	L1@0.03	Ea	.17	1.21	1.38
3/4"	L1@0.04	Ea	.25	1.61	1.86
1"	L1@0.05	Ea	.36	2.01	2.37
1-1/4"	L1@0.06	Ea	.71	2.41	3.12
1-1/2"	L1@0.06	Ea	.81	2.41	3.22
2"	L1@0.10	Ea	1.60	4.02	5.62
2-1/2"	L1@0.10	Ea	3.45	4.02	7.47
3"	L1@0.15	Ea	4.36	6.03	10.39
3-1/2"	L1@0.15	Ea	5.68	6.03	11.71
4"	L1@0.15	Ea	12.60	6.03	18.63



Two hole steel EMT straps

1/2"	L1@0.03	Ea	.11	1.21	1.32
3/4"	L1@0.04	Ea	.15	1.61	1.76
1"	L1@0.05	Ea	.24	2.01	2.25
1-1/4"	L1@0.06	Ea	.35	2.41	2.76
1-1/2"	L1@0.06	Ea	.42	2.41	2.83
2"	L1@0.10	Ea	.70	4.02	4.72
2-1/2"	L1@0.10	Ea	1.04	4.02	5.06
3"	L1@0.15	Ea	1.22	6.03	7.25
3-1/2"	L1@0.15	Ea	1.26	6.03	7.29
4"	L1@0.15	Ea	1.50	6.03	7.53



Use these figures to estimate the cost of EMT straps installed on EMT conduit under the conditions described on pages 5 and 6. Costs listed are for each strap installed. The crew is one electrician working at a labor cost of \$40.19 per manhour. These costs include cutting the EMT conduit, layout, material handling, and normal waste. Add the cost of conduit, screws or nails to hold the straps, sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit. Note: Material costs assume purchase of full box quantities.

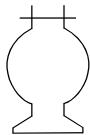
EMT Straps, Hangers and Clips

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
Two hole heavy duty steel EMT straps					
1"	L1@0.05	Ea	.11	2.01	2.12
1-1/4"	L1@0.06	Ea	.15	2.41	2.56
1-1/2"	L1@0.06	Ea	.22	2.41	2.63
2"	L1@0.10	Ea	.36	4.02	4.38
2-1/2"	L1@0.10	Ea	.42	4.02	4.44
3"	L1@0.10	Ea	.60	4.02	4.62
3-1/2"	L1@0.15	Ea	.89	6.03	6.92
4"	L1@0.15	Ea	1.52	6.03	7.55



Steel EMT conduit hangers with bolt

1/2"	L1@0.03	Ea	.27	1.21	1.48
3/4"	L1@0.04	Ea	.30	1.61	1.91
1"	L1@0.05	Ea	.36	2.01	2.37
1-1/4"	L1@0.06	Ea	.44	2.41	2.85
1-1/2"	L1@0.06	Ea	.54	2.41	2.95
2"	L1@0.10	Ea	.67	4.02	4.69
2-1/2"	L1@0.10	Ea	.76	4.02	4.78
3"	L1@0.15	Ea	1.00	6.03	7.03
3-1/2"	L1@0.15	Ea	1.18	6.03	7.21
4"	L1@0.15	Ea	3.14	6.03	9.17



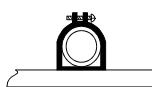
Beam clamp EMT conduit hanger assembly

1/2"	L1@0.05	Ea	.54	2.01	2.55
3/4"	L1@0.06	Ea	.62	2.41	3.03
1"	L1@0.08	Ea	.72	3.22	3.94
1-1/4"	L1@0.10	Ea	.86	4.02	4.88
1-1/2"	L1@0.10	Ea	1.08	4.02	5.10
2"	L1@0.15	Ea	1.33	6.03	7.36



EMT Strut Clamp

1/2"	L1@0.06	Ea	.40	2.41	2.81
3/4"	L1@0.08	Ea	.41	3.22	3.63
1"	L1@0.10	Ea	.47	4.02	4.49
1-1/4"	L1@0.10	Ea	.53	4.02	4.55
1-1/2"	L1@0.10	Ea	.64	4.02	4.66
2"	L1@0.15	Ea	.67	6.03	6.70



Use these figures to estimate the cost of EMT straps, hangers and clips installed on EMT conduit under the conditions described on pages 5 and 6. Costs listed are for each strap, hanger or clip installed. The crew is one electrician working at a labor cost of \$40.19 per manhour. These costs include cutting the EMT conduit, layout, material handling, and normal waste. Add the cost of conduit, screws or nails to hold the straps, sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit. Note: Material costs assume purchase of full box quantities.

EMT Clips, Adapters, Elbows, Caps and Benders

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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EMT clips for rod, wire, or steel flange

1/2"	L1@0.04	Ea	.13	1.61	1.74
3/4"	L1@0.05	Ea	.14	2.01	2.15
1"	L1@0.06	Ea	.16	2.41	2.57
1-1/4"	L1@0.08	Ea	.20	3.22	3.42

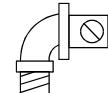


EMT split adapters

1/2"	L1@0.08	Ea	1.14	3.22	4.36
3/4"	L1@0.10	Ea	1.01	4.02	5.03
1"	L1@0.15	Ea	1.40	6.03	7.43

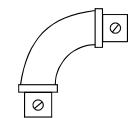
Die cast 90 degree EMT elbows

1/2"	L1@0.10	Ea	2.22	4.02	6.24
3/4"	L1@0.10	Ea	3.48	4.02	7.50
1"	L1@0.15	Ea	4.82	6.03	10.85
1-1/4"	L1@0.15	Ea	24.00	6.03	30.03
1-1/2"	L1@0.15	Ea	31.20	6.03	37.23



90 degree EMT short elbows

1/2"	L1@0.10	Ea	1.98	4.02	6.00
3/4"	L1@0.10	Ea	2.77	4.02	6.79
1"	L1@0.15	Ea	4.87	6.03	10.90
1-1/4"	L1@0.15	Ea	19.30	6.03	25.33



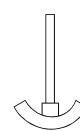
Slip-fitter EMT entrance caps

1/2"	L1@0.10	Ea	3.28	4.02	7.30
3/4"	L1@0.10	Ea	3.83	4.02	7.85
1"	L1@0.15	Ea	4.51	6.03	10.54
1-1/4"	L1@0.15	Ea	5.06	6.03	11.09



EMT hand benders

1/2"	—	Ea	16.60	—	16.60
3/4"	—	Ea	36.00	—	36.00
1"	—	Ea	40.20	—	40.20



Use these figures to estimate the cost of items shown above installed on EMT conduit under the conditions described on pages 5 and 6. Costs listed are for each item installed. The crew is one electrician working at a labor cost of \$40.19 per manhour. These costs include the connector locknut, removing the knockout when required, layout, material handling, and normal waste. Add for conduit boxes, insulated bushings, sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit. Note: Material costs assume purchase of full box quantities.

Flexible Conduit

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
Flex steel conduit					
3/8"	L1@2.50	CLF	16.20	100.00	116.20
1/2"	L1@2.75	CLF	14.40	111.00	125.40
3/4"	L1@3.00	CLF	19.60	121.00	140.60
1"	L1@3.25	CLF	35.80	131.00	166.80
1-1/4"	L1@3.50	CLF	46.00	141.00	187.00
1-1/2"	L1@3.75	CLF	75.30	151.00	226.30
2"	L1@4.00	CLF	92.00	161.00	253.00
2-1/2"	L1@4.25	CLF	111.00	171.00	282.00
3"	L1@4.50	CLF	194.00	181.00	375.00
3-1/2"	L1@4.75	CLF	276.00	191.00	467.00
4"	L1@5.00	CLF	250.00	201.00	451.00

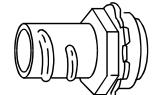
Flex aluminum conduit

3/8"	L1@2.25	CLF	17.70	90.40	108.10
1/2"	L1@2.50	CLF	14.70	100.00	114.70
3/4"	L1@2.75	CLF	20.20	111.00	131.20
1"	L1@3.00	CLF	38.00	121.00	159.00
1-1/4"	L1@3.25	CLF	50.60	131.00	181.60
1-1/2"	L1@3.50	CLF	91.00	141.00	232.00
2"	L1@3.75	CLF	96.60	151.00	247.60
2-1/2"	L1@4.00	CLF	155.00	161.00	316.00
3"	L1@4.25	CLF	253.00	171.00	424.00
3-1/2"	L1@4.50	CLF	292.00	181.00	473.00
4"	L1@4.75	CLF	326.00	191.00	517.00

Use these figures to estimate the cost of flexible conduit installed in a building, and for equipment hookup under the conditions described on pages 5 and 6. Costs listed are for each 100 linear feet installed. The crew is one electrician working at a labor cost of \$40.19 per manhour. These costs include boring or notching wood studs and joists (in concealed locations), cutting flex conduit, layout, material handling, and normal waste. Add for connectors, couplings, straps, boxes, wire, bonding wire, sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit. Note: Conduit runs are assumed to be 25' long. Labor costs per linear foot will be higher on shorter runs and lower on longer runs.

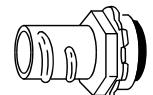
Flexible Conduit Connectors

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
Die cast screw-in flex connectors					
3/8"	L1@0.03	Ea	.12	1.21	1.33
1/2"	L1@0.03	Ea	.16	1.21	1.37
3/4"	L1@0.05	Ea	.28	2.01	2.29
1"	L1@0.06	Ea	.63	2.41	3.04
1-1/4"	L1@0.10	Ea	1.20	4.02	5.22
1-1/2"	L1@0.10	Ea	1.68	4.02	5.70
2"	L1@0.15	Ea	2.03	6.03	8.06



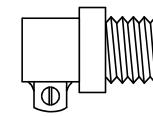
Insulated die cast screw-in flex connectors

3/8"	L1@0.03	Ea	.25	1.21	1.46
1/2"	L1@0.03	Ea	.29	1.21	1.50
3/4"	L1@0.05	Ea	.37	2.01	2.38
1"	L1@0.06	Ea	.81	2.41	3.22
1-1/4"	L1@0.10	Ea	1.87	4.02	5.89
1-1/2"	L1@0.10	Ea	2.21	4.02	6.23
2"	L1@0.15	Ea	2.56	6.03	8.59



Die cast squeeze flex connectors

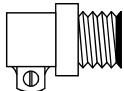
3/8"	L1@0.05	Ea	.50	2.01	2.51
1/2"	L1@0.05	Ea	.57	2.01	2.58
3/4"	L1@0.06	Ea	.64	2.41	3.05
1"	L1@0.08	Ea	1.25	3.22	4.47
1-1/4"	L1@0.10	Ea	2.73	4.02	6.75
1-1/2"	L1@0.10	Ea	5.16	4.02	9.18
2"	L1@0.15	Ea	8.75	6.03	14.78



Use these figures to estimate the cost of flexible conduit connectors installed on flex conduit under the conditions described on pages 5 and 6. Costs listed are for each connector installed. The crew is one electrician working at a labor cost of \$40.19 per manhour. These costs include the locknut, removing the knockout, layout, material handling, and normal waste. Add for connectors, couplings, straps, boxes, wire, bonding wire, sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit. Note: Material costs assume purchase of full boxes.

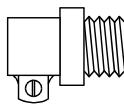
Squeeze Flexible Conduit Connectors

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
Insulated die cast squeeze flex connectors					
1/2"	L1@0.05	Ea	.87	2.01	2.88
3/4"	L1@0.06	Ea	.88	2.41	3.29
1"	L1@0.08	Ea	1.07	3.22	4.29
1-1/4"	L1@0.10	Ea	2.60	4.02	6.62
1-1/2"	L1@0.10	Ea	4.26	4.02	8.28
2"	L1@0.15	Ea	6.47	6.03	12.50



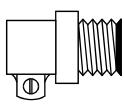
Malleable squeeze flex connectors

3/8"	L1@0.05	Ea	.49	2.01	2.50
1/2"	L1@0.05	Ea	.72	2.01	2.73
3/4"	L1@0.06	Ea	.58	2.41	2.99
1"	L1@0.08	Ea	2.10	3.22	5.32
1-1/4"	L1@0.10	Ea	3.31	4.02	7.33
1-1/2"	L1@0.10	Ea	4.51	4.02	8.53
2"	L1@0.15	Ea	6.32	6.03	12.35
2-1/2"	L1@0.15	Ea	12.30	6.03	18.33
3"	L1@0.20	Ea	17.10	8.04	25.14



Insulated malleable squeeze flex connectors

3/8"	L1@0.05	Ea	.98	2.01	2.99
1/2"	L1@0.05	Ea	1.04	2.01	3.05
3/4"	L1@0.06	Ea	1.16	2.41	3.57
1"	L1@0.08	Ea	2.10	3.22	5.32
1-1/4"	L1@0.10	Ea	4.51	4.02	8.53
1-1/2"	L1@0.10	Ea	6.62	4.02	10.64
2"	L1@0.15	Ea	10.00	6.03	16.03
2-1/2"	L1@0.15	Ea	19.60	6.03	25.63
3"	L1@0.20	Ea	25.80	8.04	33.84
3-1/2"	L1@0.25	Ea	71.30	10.00	81.30
4"	L1@0.25	Ea	83.90	10.00	93.90



Use these figures to estimate the cost of flexible conduit connectors installed on flex conduit under the conditions described on pages 5 and 6. Costs listed are for each connector installed. The crew is one electrician working at a labor cost of \$40.19 per manhour. These costs include the locknut, removing the knockout, layout, material handling, and normal waste. Add for conduit boxes, insulated bushings, sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit. Note: Material costs assume purchase of full boxes.

Steel Surface Raceway

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
One-piece steel surface raceway					
1/2" x 11/32"	L1@3.00	CLF	75.70	121.00	196.70
3/4" x 17/32"	L1@3.50	CLF	82.30	141.00	223.30
3/4" x 21/32"	L1@3.75	CLF	92.60	151.00	243.60
Two-piece steel surface raceway, base only					
1-9/32" x 3/4"	L1@3.50	CLF	86.90	141.00	227.90
1-1/4" x 7/8"	L1@3.75	CLF	130.00	151.00	281.00
2-3/8" x 3/4"	L1@4.00	CLF	130.00	161.00	291.00
2-3/4" x 1-17/32"	L1@5.00	CLF	212.00	201.00	413.00
4-3/4" x 1-3/4"	L1@6.00	CLF	362.00	241.00	603.00
4-3/4" x 3-9/16"	L1@6.50	CLF	672.00	261.00	933.00
Two-piece steel surface raceway, cover only					
1-1/4" x 7/8"	L1@2.00	CLF	82.30	80.40	162.70
2-3/8" x 3/4"	L1@2.25	CLF	78.00	90.40	168.40
2-3/4" x 1-17/32"	L1@2.50	CLF	112.00	100.00	212.00
4-3/4" x 1-3/4"	L1@3.00	CLF	209.00	121.00	330.00
4-3/4" x 3-9/16"	L1@3.25	CLF	230.00	131.00	361.00
Overfloor steel surface raceway					
1-9/16" x 11/32"	L1@4.50	CLF	174.00	181.00	355.00
2-7/32" x 23/32"	L1@6.00	CLF	267.00	241.00	508.00
Overfloor steel surface raceway fittings, 1-9/16" x 11/32"					
Reinforcing member	L1@2.75	CLF	429.00	111.00	540.00
Wire clip	L1@0.05	Ea	.27	2.01	2.28
Fiber bushing	L1@0.05	Ea	.57	2.01	2.58
Two-hole strap	L1@0.05	Ea	.52	2.01	2.53
Station tubing bracket	L1@0.10	Ea	1.34	4.02	5.36
Flat elbow, 90 degree	L1@0.20	Ea	4.53	8.04	12.57
Internal elbow, 90 degree	L1@0.25	Ea	4.53	10.00	14.53
External elbow, 90 degree	L1@0.25	Ea	5.71	10.00	15.71
Adapter fitting	L1@0.15	Ea	5.81	6.03	11.84
Telephone outlet	L1@0.25	Ea	9.51	10.00	19.51
Narrow tel outlet	L1@0.25	Ea	9.18	10.00	19.18
Utility box	L1@0.25	Ea	8.44	10.00	18.44
Narrow junction box	L1@0.25	Ea	11.70	10.00	21.70
Combination connector	L1@0.20	Ea	5.72	8.04	13.76

Use these figures to estimate the cost of surface metal raceway installed in a building under the conditions described in the chapter text. Costs listed are for each 100 linear feet installed. The crew size is one electrician working at a labor cost of \$40.19 per manhour. These costs include typical surface installation and layout for walls, ceiling, laboratory counters, work stations and overfloor, material handling and normal waste. Add for various fittings, boxes, sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit. Note: Raceway runs are 100' long. Shorter runs will take more labor and longer runs will take less labor per linear foot.

Steel Surface Raceway Fittings

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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Fittings for one-piece steel 1/2" x 11/32" surface raceway

Coupling	L1@0.05	Ea	.36	2.01	2.37
Bushing	L1@0.05	Ea	.28	2.01	2.29
Supporting clip	L1@0.05	Ea	.31	2.01	2.32
One hole strap	L1@0.05	Ea	.25	2.01	2.26
Connection cover	L1@0.05	Ea	.39	2.01	2.40
Flat elbow, 90 degree	L1@0.15	Ea	1.55	6.03	7.58
Internal elbow, 90 degree	L1@0.15	Ea	2.95	6.03	8.98
Internal twisted 90 degree	L1@0.15	Ea	3.89	6.03	9.92
External elbow, 90 degree	L1@0.15	Ea	2.48	6.03	8.51
Adjustable J-box	L1@0.20	Ea	7.49	8.04	15.53
Extension adapter	L1@0.15	Ea	5.55	6.03	11.58
Reducing adapter	L1@0.15	Ea	3.06	6.03	9.09



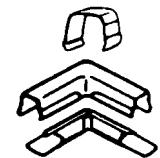
Fittings for one-piece steel 3/4" x 17/32" surface raceway

Bushing	L1@0.05	Ea	.23	2.01	2.24
One-hole strap	L1@0.05	Ea	.25	2.01	2.26
Connector cover	L1@0.05	Ea	.31	2.01	2.32
Flat elbow, 90 degree	L1@0.15	Ea	1.28	6.03	7.31
Flat elbow, 45 degree	L1@0.15	Ea	3.74	6.03	9.77
Internal elbow, 90 degree	L1@0.15	Ea	1.60	6.03	7.63
External elbow, 90 degree	L1@0.15	Ea	1.50	6.03	7.53
Internal corner coupling	L1@0.15	Ea	1.81	6.03	7.84



Fittings for one-piece steel 3/4" x 17/32" or 3/4" x 21/32" surface raceway

Flexible section, 18"	L1@0.20	Ea	14.70	8.04	22.74
Coupling	L1@0.05	Ea	.31	2.01	2.32
Supporting clip	L1@0.05	Ea	.35	2.01	2.36
Ground clamp	L1@0.05	Ea	3.91	2.01	5.92
Internal twist. elbow	L1@0.15	Ea	3.71	6.03	9.74
Tee	L1@0.20	Ea	3.08	8.04	11.12
Internal pull elbow	L1@0.20	Ea	10.20	8.04	18.24
Internal elbow, 90 degree	L1@0.15	Ea	2.51	6.03	8.54
Corner box	L1@0.20	Ea	10.70	8.04	18.74



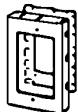
Overfloor steel boxes for 1-9/16" x 11/32" surface raceway

4" dia junction box	L1@0.25	Ea	7.47	10.00	17.47
Duplex recept & box	L1@0.35	Ea	14.20	14.10	28.30
Box for single recept	L1@0.25	Ea	8.93	10.00	18.93
Box for duplex recept	L1@0.25	Ea	11.40	10.00	21.40
Telephone outlet	L1@0.25	Ea	11.10	10.00	21.10

Use these figures to estimate the cost of surface metal raceway and fittings installed in a building under the conditions described in the chapter text. The crew size is one electrician working at a labor cost of \$40.19 per manhour. These costs include layout, material handling and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Steel Surface Raceway Fittings

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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Steel boxes for 1/2" x 11/32" or 3/4" x 17/32" surface raceway

Single pole sw & box	L1@0.35	Ea	10.00	14.10	24.10
Duplex recept. & box	L1@0.25	Ea	11.80	10.00	21.80
Utility box	L1@0.20	Ea	6.68	8.04	14.72

Steel boxes for 3/4" x 17/32" or 3/4" x 21/32" surface raceway

Corner box, small	L1@0.25	Ea	7.96	10.00	17.96
Corner box, large	L1@0.25	Ea	11.40	10.00	21.40
Utility box, 3" dia.	L1@0.25	Ea	6.68	10.00	16.68
Blank cover	L1@0.05	Ea	3.58	2.01	5.59
Extension box, 3"	L1@0.20	Ea	8.09	8.04	16.13
Utility box, 4"	L1@0.25	Ea	7.19	10.00	17.19
Distribution box, 4"	L1@0.25	Ea	8.09	10.00	18.09
Blank cover, 4"	L1@0.05	Ea	3.58	2.01	5.59
Extension box, 4"	L1@0.20	Ea	8.77	8.04	16.81
Extension box, 5-1/2"	L1@0.25	Ea	8.93	10.00	18.93
Fixture box, 4-3/4"	L1@0.25	Ea	8.13	10.00	18.13
Fixture box, 5-1/2"	L1@0.30	Ea	8.25	12.10	20.35
Fixture box, 6-3/8"	L1@0.30	Ea	9.68	12.10	21.78
Device box, 1-3/8" deep	L1@0.25	Ea	5.48	10.00	15.48
Device box, 2 gang, 2-3/4"	L1@0.30	Ea	9.76	12.10	21.86
Device box, 3 gang, 2-3/4"	L1@0.40	Ea	24.60	16.10	40.70
Device box, 4 gang, 2-3/4"	L1@0.50	Ea	39.80	20.10	59.90
Device box, 5 gang, 2-3/4"	L1@0.65	Ea	68.00	26.10	94.10
Device box, 6 gang, 2-3/4"	L1@0.75	Ea	71.60	30.10	101.70

Steel fittings for 3/4" x 17/32" or 3/4" x 21/32" surface raceway

1/2" male box conn.	L1@0.05	Ea	2.37	2.01	4.38
3/4" male box conn.	L1@0.06	Ea	6.64	2.41	9.05
1/2" female box conn.	L1@0.05	Ea	2.43	2.01	4.44
3/4" female box conn.	L1@0.06	Ea	7.70	2.41	10.11
1/2" male elbow box	L1@0.20	Ea	7.65	8.04	15.69
1/2" female elbow box	L1@0.20	Ea	7.65	8.04	15.69
Combination connector	L1@0.10	Ea	2.72	4.02	6.74
Adjust. offset conn.	L1@0.10	Ea	7.43	4.02	11.45
Kick plate	L1@0.10	Ea	11.00	4.02	15.02
Armored cable conn.	L1@0.05	Ea	2.51	2.01	4.52

Use these figures to estimate the cost of surface metal raceway and fittings installed in a building under the conditions described in the chapter text. The crew size is one electrician working at a labor cost of \$40.19 per manhour. These costs include layout, material handling and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Surface Metal Raceway, Fittings, Tools and Assemblies

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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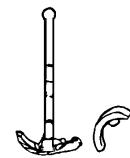
Overfloor steel fittings for 2-7/32" x 23/32" surface raceway

Wire clip	L1@0.05	Ea	.55	2.01	2.56
Fiber bushing	L1@0.05	Ea	.86	2.01	2.87
Flat elbow, 90 degree	L1@0.25	Ea	7.16	10.00	17.16
Telephone elbow	L1@0.25	Ea	15.70	10.00	25.70
Tel service fit small	L1@0.25	Ea	13.00	10.00	23.00
Telephone service fit	L1@0.25	Ea	15.70	10.00	25.70
Junction box	L1@0.25	Ea	11.00	10.00	21.00



Tools for 1/2" and 3/4" steel surface raceway

Bender	--	Ea	71.30	--	71.30
Bender adapter	--	Ea	14.00	--	14.00
Cutting box	--	Ea	75.30	--	75.30
Wire pulley	--	Ea	27.30	--	27.30
Cover removal tool	--	Ea	14.00	--	14.00
Canopy cutter	--	Ea	374.00	--	374.00
Shear for 2-3/8"	--	Ea	247.00	--	247.00



Enamel spray paint for steel surface raceway

Buff	--	Ea	13.20	--	13.20
Gray	--	Ea	13.20	--	13.20
Putty	--	Ea	13.20	--	13.20



Two-piece 1-9/32" x 3/4" surface metal raceway assembly, with cord

24" with 3 outlets	L1@0.15	Ea	61.70	6.03	67.73
36" with 6 outlets	L1@0.20	Ea	69.20	8.04	77.24
60" with 6 outlets	L1@0.25	Ea	77.20	10.00	87.20
72" with 6 outlets	L1@0.30	Ea	81.20	12.10	93.30



Two-piece surface metal raceway, 1-9/32" x 3/4", prewired, single circuit, grounding

12" long, 2 outlets	L1@0.30	Ea	28.10	12.10	40.20
36" long, 6 outlets	L1@0.40	Ea	26.90	16.10	43.00
60" long, 5 outlets	L1@0.50	Ea	30.90	20.10	51.00
60" long, 10 outlets	L1@0.60	Ea	41.70	24.10	65.80
72" long, 4 outlets	L1@0.50	Ea	29.20	20.10	49.30
72" long, 6 outlets	L1@0.60	Ea	33.20	24.10	57.30
72" long, 8 outlets	L1@0.70	Ea	39.50	28.10	67.60
72" long, 12 outlets	L1@0.80	Ea	42.60	32.20	74.80



Use these figures to estimate the cost of surface metal raceway, assemblies and fittings installed in a building under the conditions described in the chapter text. The crew size is one electrician working at a labor cost of \$40.19 per manhour. These costs include layout, material handling and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Surface Metal Raceway Assemblies and Fittings

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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Two-piece surface metal raceway, 1-9/32" x 3/4", prewired, 1 circuit, 3-wire

	12" long, 2 outlets 36" long, 6 outlets 60" long, 5 outlets 60" long, 10 outlets 72" long, 4 outlets 72" long, 6 outlets 72" long, 8 outlets 72" long, 12 outlets	L1@0.35 L1@0.45 L1@0.55 L1@0.65 L1@0.55 L1@0.65 L1@0.75 L1@0.85	Ea	30.10 62.80 32.90 83.50 33.10 38.90 42.20 51.70	14.10 18.10 22.10 26.10 22.10 26.10 30.10 34.20	44.20 80.90 55.00 109.60 55.20 65.00 72.30 85.90
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Two-piece surface metal raceway, 1-9/32" x 3/4" prewired, 2 circuit, 3-wire

	60" long, 5 outlets 72" long, 4 outlets 72" long, 6 outlets 72" long, 8 outlets	L1@0.60 L1@0.60 L1@0.70 L1@0.80	Ea	36.20 40.40 48.60 63.10	24.10 24.10 28.10 32.20	60.30 64.50 76.70 95.30
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Surface metal raceway, 2 circuit, 4-wire, grounding, outlets alternately wired

	60" long, 5 outlets 72" long, 4 outlets 72" long, 6 outlets 72" long, 8 outlets	L1@0.65 L1@0.65 L1@0.75 L1@0.85	Ea	38.90 39.80 46.20 48.60	26.10 26.10 30.10 34.20	65.00 65.90 76.30 82.80
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Two-piece 1-9/32" x 3/4" surface metal raceway assembly fittings

	Flat elbow, 90 degree Splice cover Tee Internal corner coupling External corner coupling Ivory receptacle cap Single pole switch Flush plate adapter Side reducing conn. End reducing conn. Wire clip Coupling Supporting clip Cover clip T-bar clip Ground clip End entrance fitting End entr. fit. long Blank end fitting	L1@0.30 L1@0.05 L1@0.35 L1@0.10 L1@0.10 L1@0.05 L1@0.35 L1@0.20 L1@0.10 L1@0.05 L1@0.05 L1@0.05 L1@0.05 L1@0.05 L1@0.10 L1@0.05 L1@0.05 L1@0.15 L1@0.20 L1@0.05	Ea	3.67 2.31 9.51 1.20 2.72 .43 13.30 7.26 8.85 2.84 .32 .44 1.55 .85 3.74 3.42 4.03 13.40 .63	12.10 2.01 14.10 4.02 4.02 2.01 14.10 8.04 4.02 2.01 2.01 2.01 2.01 2.01 4.02 2.01 2.01 6.03 8.04 2.01	15.77 4.32 23.61 5.22 6.74 2.44 27.40 15.30 12.87 4.85 2.33 2.45 3.56 2.86 7.76 5.43 10.06 21.44 2.64
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Use these figures to estimate the cost of surface metal raceway assemblies and fittings installed in a building under the conditions described in the chapter text. The crew size is one electrician working at a labor cost of \$40.19 per manhour. These costs include typical layout material handling and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Surface Metal Raceway Assemblies and Fittings

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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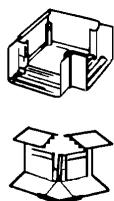
Stainless steel surface raceway, 1-9/32" x 3/4", prewired, 1 circuit, 3-wire, with ends & couplings

36" long, 6 outlets	L1@0.50	Ea	62.80	20.10	82.90
60" long, 5 outlets	L1@0.60	Ea	75.50	24.10	99.60
60" long, 10 outlets	L1@0.70	Ea	83.50	28.10	111.60
72" long, 6 outlets	L1@0.70	Ea	94.30	28.10	122.40



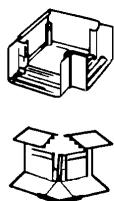
Two-piece steel surface raceway, 2-3/8" x 3/4", prewired receptacles, single circuit, 3-wire

60" long, 1 outlet	L1@0.55	Ea	27.50	22.10	49.60
60" long, 2 outlets	L1@0.60	Ea	27.70	24.10	51.80
72" long, 4 outlets	L1@0.65	Ea	30.90	26.10	57.00



Fittings for 2-3/8" x 3/4" steel surface raceway with prewired receptacles

Coupling	L1@0.05	Ea	2.03	2.01	4.04
Wire clip	L1@0.05	Ea	.81	2.01	2.82
Cover clip	L1@0.05	Ea	1.17	2.01	3.18
End blank fitting	L1@0.05	Ea	1.25	2.01	3.26
End trim fitting	L1@0.05	Ea	10.70	2.01	12.71
End entrance fitting	L1@0.30	Ea	12.60	12.10	24.70
End reducing fitting	L1@0.10	Ea	5.89	4.02	9.91
Internal coupling	L1@0.25	Ea	5.84	10.00	15.84
External coupling	L1@0.25	Ea	12.20	10.00	22.20
Flat elbow, 90 degree	L1@0.30	Ea	25.30	12.10	37.40
Wall box connector	L1@0.30	Ea	8.77	12.10	20.87
Single pole switch 15A	L1@0.25	Ea	14.80	10.00	24.80
Three-way switch 15A	L1@0.30	Ea	20.50	12.10	32.60
Single recept. cover	L1@0.15	Ea	8.93	6.03	14.96



Use these figures to estimate the cost of surface metal raceway assemblies and fittings installed in a building under the conditions described in the chapter text. The crew size is one electrician working at a labor cost of \$40.19 per manhour. These costs include typical layout material handling and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

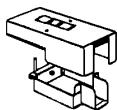
Overhead Steel Channel Wiring System and Fittings



Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
Overhead steel channel system, 1-5/8" x 1-5/8"					
10' lengths	L1@4.00	CLF	514.00	161.00	675.00
20' lengths	L1@3.75	CLF	514.00	151.00	665.00

Overhead steel channel flat wire, 600 volt

#10 stranded	L1@8.00	MLF	434.00	322.00	756.00
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Overhead steel channel system fittings

Fixture hanger	L1@0.15	Ea	7.64	6.03	13.67
End cap, insulated	L1@0.15	Ea	10.80	6.03	16.83
Coupling	L1@0.15	Ea	10.60	6.03	16.63
Channel hanger	L1@0.10	Ea	3.77	4.02	7.79
Splice connector	L1@0.25	Ea	5.09	10.00	15.09
Junction box	L1@0.30	Ea	29.70	12.10	41.80
Dual feed J-box	L1@0.30	Ea	46.60	12.10	58.70

Overhead steel channel system power taps and fixture hangers

Phase A, black	L1@0.20	Ea	17.40	8.04	25.44
Phase A-B, bk & red	L1@0.20	Ea	17.40	8.04	25.44
Phase B, red	L1@0.20	Ea	17.40	8.04	25.44
Phase B-C, red & blue	L1@0.20	Ea	17.40	8.04	25.44
Phase C, blue	L1@0.20	Ea	17.40	8.04	25.44
Phase A-C, bk & blue	L1@0.20	Ea	17.40	8.04	25.44

Overhead steel channel system power taps with box & locking receptacle

Phase A, black	L1@0.20	Ea	73.90	8.04	81.94
Phase B, red	L1@0.20	Ea	73.90	8.04	81.94
Phase C, blue	L1@0.20	Ea	73.90	8.04	81.94

Overhead steel channel system tools

Cable pulling leader	--	Ea	47.50	--	47.50
Cable pull-in guide	--	Ea	73.50	--	73.50

Use these figures to estimate the cost of surface metal raceway and fittings and installed in a building under the conditions described in the chapter text. The crew size is one electrician working at a labor cost of \$40.19 per manhour. These costs include layout, material handling and normal waste. Add sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Overhead Distribution Systems

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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Two-piece overhead steel raceway lateral 1-9/32" x 3/4", wired with one 125 volt circuit

24" outlet spacing	L1@6.00	CLF	546.00	241.00	787.00
30" outlet spacing	L1@6.00	CLF	473.00	241.00	714.00



Two-piece overhead steel raceway lateral 1-9/32" x 3/4", wired with one 277 volt circuit

24" outlet spacing	L1@6.00	CLF	546.00	241.00	787.00
30" outlet spacing	L1@6.00	CLF	473.00	241.00	714.00



Two-piece overhead steel raceway lateral 1-9/32" x 3/4", wired with two 125 volt circuits

24" outlet spacing	L1@6.00	CLF	572.00	241.00	813.00
30" outlet spacing	L1@6.00	CLF	499.00	241.00	740.00

Two-piece lateral 2-3/4" x 1-17/32", wired with one 125 volt circuit

24" outlet spacing	L1@8.00	CLF	846.00	322.00	1,168.00
30" outlet spacing	L1@8.00	CLF	759.00	322.00	1,081.00



Two-piece lateral 2-3/4" x 1-17/32", wired with one 277 volt circuit

24" outlet spacing	L1@8.00	CLF	846.00	322.00	1,168.00
30" outlet spacing	L1@8.00	CLF	759.00	322.00	1,081.00

Two-piece lateral 2-3/4" x 1-17/32", wired with two 125 volt circuits

24" outlet spacing	L1@8.00	CLF	879.00	322.00	1,201.00
30" outlet spacing	L1@8.00	CLF	838.00	322.00	1,160.00

Two-piece lateral 2-3/4" x 1-17/32", wired with two 277 volt circuits

24" outlet spacing	L1@8.00	CLF	879.00	322.00	1,201.00
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Two-piece lateral 2-3/4" x 1-17/32", wired with two 125/277 volt circuits alternating

24" outlet spacing	L1@8.25	CLF	903.00	332.00	1,235.00
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Two-piece lateral 2-3/4" x 1-17/32", wired with two 125 and two 277 volt circuits alternating

24" outlet spacing	L1@8.50	CLF	1,230.00	342.00	1,572.00
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Use these figures to estimate the cost of surface metal raceway and fittings installed in a building under the conditions described in the chapter text. The crew size is one electrician working at a labor cost of \$40.19 per manhour. These costs include layout, material handling and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Overhead Distribution Systems

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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Two-piece steel raceway lateral 4-3/4" x 3-9/16", wired with four 277 volt circuits

24" outlet spacing	L1@10.0	CLF	1,000.00	402.00	1,402.00
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Two-piece lateral 4-3/4" x 3-9/16", wired with three 125 volt and four 277 volt circuits

24" outlet spacing	L1@10.3	CLF	1,190.00	414.00	1,604.00
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Two-piece lateral 4-3/4" x 3-9/16", wired with five 125 volt and six 277 volt circuits

24" outlet spacing	L1@10.5	CLF	1,300.00	422.00	1,722.00
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Fixture whips for overhead steel raceway

15A, 125V, 6' long	L1@0.20	Ea	56.80	8.04	64.84
15A, 125V, 15' long	L1@0.25	Ea	83.80	10.00	93.80
15A, 277V, 6' long	L1@0.20	Ea	49.90	8.04	57.94
15A, 277V, 15' long	L1@0.25	Ea	96.00	10.00	106.00
20A, 125V, 6' long	L1@0.20	Ea	56.80	8.04	64.84
20A, 125V, 15' long	L1@0.25	Ea	83.80	10.00	93.80

Jumper whips for overhead steel raceway

20A, 125V, 18' long	L1@0.25	Ea	117.00	10.00	127.00
Flat elbow, 90 degree	L1@0.25	Ea	92.80	10.00	102.80

Switching whips for overhead steel raceway

20A, 125V, 18' long	L1@0.25	Ea	160.00	10.00	170.00
20A, 277V, 18' long	L1@0.50	Ea	119.00	20.10	139.10



Cable adapter assemblies for overhead steel raceway

20A, 125V, 6' long	L1@0.15	Ea	56.80	6.03	62.83
20A, 125V, 12' long	L1@0.20	Ea	83.80	8.04	91.84
20A, 125V, 18' long	L1@0.25	Ea	119.00	10.00	129.00
20A, 277V, 6' long	L1@0.15	Ea	53.40	6.03	59.43

Two-piece overhead steel raceway lateral extension with wiring harness, 4-3/4" x 3-9/16"

15A, 277V, 14" long	L1@0.15	Ea	153.00	6.03	159.03
20A, 277V, 22" long	L1@0.20	Ea	158.00	8.04	166.04
20A, 277V, 36" long	L1@0.30	Ea	247.00	12.10	259.10

Use these figures to estimate the cost of surface metal raceway and fittings installed in a building under the conditions described in the chapter text. The crew size is one electrician working at a labor cost of \$40.19 per manhour. These costs include layout, material handling and normal waste. Add sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

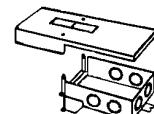
Overhead Distribution Systems and Fittings

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
Fittings for overhead steel raceway 2-3/4" x 1-17/32"					
Switch cover	L1@0.10	Ea	5.54	4.02	9.56
Sign recept cover	L1@0.10	Ea	5.54	4.02	9.56
Fixture/drop cover	L1@0.10	Ea	5.54	4.02	9.56
Tap-off fitting	L1@0.10	Ea	5.80	4.02	9.82
Single recept cover	L1@0.10	Ea	5.54	4.02	9.56
Circuit breaker box	L1@0.20	Ea	24.20	8.04	32.24
Extension adapter	L1@0.15	Ea	7.59	6.03	13.62
Take-off connector	L1@0.10	Ea	20.00	4.02	24.02
Conduit connector	L1@0.10	Ea	32.60	4.02	36.62
Panel connector	L1@0.30	Ea	7.58	12.10	19.68
End reducing conn.	L1@0.10	Ea	6.70	4.02	10.72
External corner coupl	L1@0.25	Ea	13.80	10.00	23.80
Sign recept. plate	L1@0.15	Ea	5.54	6.03	11.57
Single recept. plate	L1@0.15	Ea	5.54	6.03	11.57
Switch plate	L1@0.15	Ea	5.54	6.03	11.57
Duplex plate	L1@0.15	Ea	5.54	6.03	11.57
Utility box	L1@0.25	Ea	26.70	10.00	36.70
Deep sw box, 2-gang	L1@0.30	Ea	49.20	12.10	61.30

Fittings for overhead steel raceway 4-3/4" x 3-9/16"

Coupling	L1@0.10	Ea	5.75	4.02	9.77
"C" hanger	L1@0.20	Ea	10.80	8.04	18.84
Blank end fitting	L1@0.15	Ea	7.37	6.03	13.40
Tap-off fitting	L1@0.25	Ea	7.61	10.00	17.61
Take-off fitting	L1@0.30	Ea	51.60	12.10	63.70
Tel conn housing	L1@0.30	Ea	70.20	12.10	82.30
Cable adapt assembly	L1@0.25	Ea	25.50	10.00	35.50
Receptacle cap	L1@0.05	Ea	.51	2.01	2.52

Use these figures to estimate the cost of surface metal raceway fittings installed in a building under the conditions described in the chapter text. The crew size is one electrician working at a labor cost of \$40.19 per manhour. These costs include layout, material handling and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.



Telephone-Power Poles

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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Telephone-power pole assemblies, 1-1/4" x 1-3/4", 2 power outlets

10' pole, flush boot	L1@1.25	Ea	157.00	50.20	207.20
10'-4" pole, 2" boot	L1@1.25	Ea	148.00	50.20	198.20
12'-2" pole, 2" boot	L1@1.25	Ea	197.00	50.20	247.20
T-bar hanger clamp	L1@0.30	Ea	6.68	12.10	18.78



Telephone-power pole assemblies, 2-1/8" x 2-1/8", 4 power outlets

10'-5" pole, flush boot	L1@1.30	Ea	130.00	52.20	182.20
12'-5" pole, flush boot	L1@1.35	Ea	169.00	54.30	223.30
15'-5" pole, flush boot	L1@1.40	Ea	216.00	56.30	272.30
10'-5" pole isol gr.	L1@1.35	Ea	152.00	54.30	206.30
Cabling network adapter	L1@0.50	Ea	20.00	20.10	40.10

Telephone-power pole assemblies, 2-3/4" x 1-7/16", 2 duplex outlets

10'-5" pole, 2" foot	L1@1.30	Ea	203.00	52.20	255.20
12'-5" pole, 2" foot	L1@1.35	Ea	222.00	54.30	276.30
Cabling network adapter	L1@0.50	Ea	22.50	20.10	42.60

Telephone-power pole assemblies, 2-3/4" x 1-7/16", 4 power outlets

10'-5" pole, 2" foot	L1@1.40	Ea	184.00	56.30	240.30
12'-5" pole, 2" foot	L1@1.45	Ea	222.00	58.30	280.30
Cabling network adapter	L1@0.50	Ea	22.50	20.10	42.60

Telephone-power pole assemblies, 2-3/4" x 2-7/8", 2 duplex outlets

10'-5" pole, flush boot	L1@1.45	Ea	286.00	58.30	344.30
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Telephone-power pole assemblies, 2" x 2", 4 power outlets

10'-5" pole, adj foot	L1@1.30	Ea	291.00	52.20	343.20
10'-5" w/ lt woodgrain	L1@1.30	Ea	311.00	52.20	363.20
10'-5" w/ dk woodgrain	L1@1.30	Ea	311.00	52.20	363.20
12'-5" pole, adj foot	L1@1.40	Ea	263.00	56.30	319.30
15'-5" pole, adj foot	L1@1.50	Ea	336.00	60.30	396.30
Tel entrance fitting	L1@0.30	Ea	10.10	12.10	22.20
Cabling network adapter	L1@0.50	Ea	20.00	20.10	40.10

Use these figures to estimate the cost of telephone-power poles installed in a building under good conditions as described in the chapter text. Costs listed are for each telephone-power pole or listed fitting. The crew size is one electrician working at a labor cost of \$40.19 per manhour. These costs include typical installation and layout for office furniture, counters and work stations, material handling and normal waste. Add for various fittings, boxes, sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Section 18: Communications

This section lists many types and sizes of communications wire and cable, as well as connectors and terminators commonly used in this work. The material tables are designed to make it easy to identify the components you need to estimate costs for your project.

As usual in estimating, there are many variables. It's up to the estimator to make the necessary adjustments to fit the task at hand. A small compact job site with short runs of cabling will require more labor hours per thousand feet than a job that's spread out over many thousand square feet, with long cable runs. This section uses an average between the short and long runs of cabling, so some adjustment in manhours may be necessary.

Every estimator has studied the time it takes to do certain tasks — and they'll all arrive at slightly different manhour values. If you believe your company's crew can install the work in more or less time than is listed here, make an adjustment by splitting the difference between what's listed in this section and what you believe it should be. If you get the job, pay close attention to the performance of the installation crews. Check their actual performance against the estimated time, so you can make adjustments for future estimates. But don't change the estimated manhours too much. Just because your crew did one particular job at a better rate doesn't mean that'll happen on all your jobs. There are unique conditions on every project. The manhours in this book are averages of multiple jobs, and include the "surprises."

Cable Distribution Systems

It may take longer to install communications cable in a conduit system than it would to install the cable in an accessible ceiling space. The specifications may require at least one of the following cable distribution systems.

Surface Cabling

The communications cable is installed directly to the surface with staples or straps.

Conduit System (see Section 1)

The specifications may require the electrical contractor to install a conduit system complete with boxes for the communications devices. Sometimes the electricians are required to install a pull string in the empty conduits. This makes it easier for the

electronics technicians to pull in their cables in the conduit systems. If there's no requirement for the electrician to install a pull string, the communications tech must either install the pull string or use a *fish tape* in order to pull in the cable.

Metal Wireway (see Section 6)

The specifications may require the electrical contractor to install a metal wireway (*gutter*) system for the installation of the communications cable. The wireway could be either *screw cover* or *hinged cover*. The gutter comes in many sizes with an assortment of fittings. The communications cable is usually bundled together in the gutter and tagged for identification.

Underfloor Raceway (see Section 7)

The underfloor raceway system is usually installed by the electrical contractor during construction of the concrete floor. The raceway is connected to flush floor junction boxes for easy access. The underfloor *duct* usually has threaded hubs just below the floor surface on 2-foot centers for mounting an above-floor device or junction box. There may be at least two ducts running in parallel, one for electrical power, the other for cable. After the devices and junction boxes are mounted on the low voltage duct, the cable is then fished from the access junction box, through the duct low voltage system and to the location of the device.

Cable Tray System (see Section 9)

The cable tray system is installed by the electrical contractor during the building construction. The tray system is installed in the ceiling space or exposed overhead and may be a simple *ladder* tray, an *expanded metal* tray or *sheet metal* tray. Cable trays are made of galvanized sheet metal or aluminum. Some trays have covers to protect the cable, while others are open. The cable is bundled and tagged for identification, then laid in the cable tray.

Surface Raceway (see Section 15)

Surface raceway is usually installed by the electrical contractor during the building construction. The raceway is installed as a finish product on walls and ceilings, with junction boxes for access. Surface raceway boxes are installed for devices and may require plates to accommodate cable connections to equipment. The raceway fittings, such as elbows and tees, have removable covers for pulling in the cable. The raceway is made of either sheet metal or plastic, and is painted.

Cellular Flooring

Some buildings have cellular flooring that's installed by the iron workers as the building is being constructed. The cellular flooring, made of sheet metal, is usually installed in large office areas. The cells span the selected floor area and are connected with *header* ducts installed by the electrical contractor. Usually, a lightweight concrete floor is poured over the top of the cellular floor.

A 2-inch hole is drilled through the lightweight concrete floor and into the selected cell. Cells are designated for electrical power, communications and electronic uses. The cable is pulled from a terminal board or cabinet, through the header duct, to the cell and to the device outlet.

The header duct has removable covers for easy access to the cells.

Retrofitting

The biggest challenge is to install a communications system in an existing building without doing too much demolition. Some of the methods listed above may be the answer — or you may have to use some creativity to come up with a workable plan that will keep the owner happy.

The manufacturers seem to come up with newer and better ways to meet the needs of the retrofitter. Your first step should be to contact your supplier; they're willing to help you find the right answers.

SAMPLE

Communications Cable

Material	Craft@ Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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22 AWG stranded communications cable, unshielded twisted pair, 80 degree, PVC jacket, 150 volt

2 pairs	L2@5.50	KLF	398.00	221.00	619.00
3 pairs	L2@5.75	KLF	554.00	231.00	785.00
4 pairs	L2@6.00	KLF	712.00	241.00	953.00
5 pairs	L2@6.25	KLF	1,060.00	251.00	1,311.00
6 pairs	L2@6.50	KLF	1,430.00	261.00	1,691.00
9 pairs	L2@7.25	KLF	1,520.00	291.00	1,811.00
11 pairs	L2@7.75	KLF	3,320.00	311.00	3,631.00
12 pairs	L2@8.00	KLF	3,450.00	322.00	3,772.00
15 pairs	L2@8.75	KLF	3,570.00	352.00	3,922.00
19 pairs	L2@9.75	KLF	5,140.00	392.00	5,532.00

22 AWG solid communications cable, unshielded twisted pair, 80 degree, PVC jacket, 150 volt

1 pair	L2@5.25	KLF	185.00	211.00	396.00
2 pairs	L2@5.50	KLF	353.00	221.00	574.00
3 pairs	L2@5.75	KLF	556.00	231.00	787.00
4 pairs	L2@6.00	KLF	737.00	241.00	978.00
5 pairs	L2@6.25	KLF	938.00	251.00	1,189.00
6 pairs	L2@6.50	KLF	1,150.00	261.00	1,411.00
11 pairs	L2@7.75	KLF	2,740.00	311.00	3,051.00
13 pairs	L2@8.25	KLF	3,120.00	332.00	3,452.00
16 pairs	L2@9.00	KLF	4,150.00	362.00	4,512.00
27 pairs	L2@11.8	KLF	4,240.00	474.00	4,714.00



18 AWG stranded communications cable, unshielded twisted pair, 80 degree, PVC jacket, 300 volt

1 pair	L2@5.50	KLF	635.00	221.00	856.00
2 pairs	L2@5.75	KLF	811.00	231.00	1,042.00
3 pairs	L2@6.00	KLF	1,150.00	241.00	1,391.00
4 pairs	L2@6.25	KLF	1,500.00	251.00	1,751.00
5 pairs	L2@6.50	KLF	1,830.00	261.00	2,091.00
6 pairs	L2@6.75	KLF	2,710.00	271.00	2,981.00
8 pairs	L2@7.25	KLF	3,450.00	291.00	3,741.00
9 pairs	L2@7.50	KLF	4,280.00	301.00	4,581.00
15 pairs	L2@8.75	KLF	6,030.00	352.00	6,382.00
19 pairs	L2@10.0	KLF	8,960.00	402.00	9,362.00

Use these figures to estimate the cost of communications cable installed in conduit under the conditions described on pages 5 and 6. Costs listed are for each 1,000 linear feet installed. The crew is two technicians. The labor cost per manhour is \$40.19. These costs include terminations, reel setup, cable identification, cable testing, layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Communications Cable

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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24 AWG stranded communications cable, individually shielded twisted pair, 80 degree, PVC jacket, 300 volt, with drain wire

1 pair	L2@5.00	KLF	263.00	201.00	464.00
2 pairs	L2@5.25	KLF	348.00	211.00	559.00
3 pairs	L2@5.50	KLF	475.00	221.00	696.00
4 pairs	L2@5.75	KLF	630.00	231.00	861.00
5 pairs	L2@6.00	KLF	761.00	241.00	1,002.00
6 pairs	L2@6.25	KLF	956.00	251.00	1,207.00
7 pairs	L2@6.50	KLF	1,150.00	261.00	1,411.00
8 pairs	L2@6.75	KLF	1,280.00	271.00	1,551.00
9 pairs	L2@7.00	KLF	1,400.00	281.00	1,681.00
10 pairs	L2@7.25	KLF	1,440.00	291.00	1,731.00
15 pairs	L2@8.50	KLF	2,270.00	342.00	2,612.00
19 pairs	L2@9.50	KLF	3,490.00	382.00	3,872.00
25 pairs	L2@11.0	KLF	3,970.00	442.00	4,412.00

22 AWG stranded communications cable, individually shielded twisted pair, 80 degree, PVC jacket, 300 volt, with drain wire

2 pairs	L2@5.75	KLF	815.00	231.00	1,046.00
3 pairs	L2@6.00	KLF	1,150.00	241.00	1,391.00
4 pairs	L2@6.25	KLF	1,540.00	251.00	1,791.00
6 pairs	L2@6.75	KLF	2,410.00	271.00	2,681.00
9 pairs	L2@7.50	KLF	3,530.00	301.00	3,831.00
19 pairs	L2@10.0	KLF	7,370.00	402.00	7,772.00
27 pairs	L2@12.0	KLF	10,700.00	482.00	11,182.00

18 AWG stranded communications cable, individually shielded twisted pair, 80 degree, PVC jacket, 300 volt, with drain wire

2 pairs	L2@6.00	KLF	1,340.00	241.00	1,581.00
3 pairs	L2@6.25	KLF	1,780.00	251.00	2,031.00
4 pairs	L2@6.50	KLF	2,320.00	261.00	2,581.00
6 pairs	L2@7.00	KLF	3,630.00	281.00	3,911.00
9 pairs	L2@7.25	KLF	5,470.00	291.00	5,761.00
15 pairs	L2@9.25	KLF	9,080.00	372.00	9,452.00

Use these figures to estimate the cost of communications cable installed in conduit under the conditions described on pages 5 and 6. Costs listed are for each 1,000 linear feet installed. The crew is two technicians. The labor cost per manhour is \$40.19. These costs include terminations, reel setup, cable identification, cable testing, layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.



Communications Cable

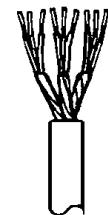
Material	Craft@ Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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22 AWG stranded communications cable, individually shielded twisted pair, 60 degree, 300 volt

3 pairs	L2@5.50	KLF	642.00	221.00	863.00
6 pairs	L2@6.25	KLF	1,240.00	251.00	1,491.00
9 pairs	L2@7.00	KLF	2,970.00	281.00	3,251.00
11 pairs	L2@7.50	KLF	3,330.00	301.00	3,631.00
12 pairs	L2@7.75	KLF	4,570.00	311.00	4,881.00
15 pairs	L2@8.50	KLF	4,550.00	342.00	4,892.00
17 pairs	L2@9.00	KLF	5,890.00	362.00	6,252.00
19 pairs	L2@9.50	KLF	5,800.00	382.00	6,182.00
27 pairs	L2@11.5	KLF	10,400.00	462.00	10,862.00

20 AWG stranded communications cable, individually shielded twisted pair, 60 degree, 350 volt, with drain wire

2 pairs	L2@5.75	KLF	827.00	231.00	1,058.00
3 pairs	L2@6.00	KLF	1,020.00	241.00	1,261.00
6 pairs	L2@6.75	KLF	2,410.00	271.00	2,681.00
9 pairs	L2@7.50	KLF	3,890.00	301.00	4,191.00
12 pairs	L2@8.25	KLF	5,060.00	332.00	5,392.00
15 pairs	L2@9.00	KLF	7,650.00	362.00	8,012.00



18 AWG stranded communications cable, individually shielded twisted pair, 60 degree, 400 volt, with drain wire

3 pairs	L2@6.25	KLF	1,440.00	251.00	1,691.00
6 pairs	L2@7.00	KLF	2,970.00	281.00	3,251.00
9 pairs	L2@7.75	KLF	4,670.00	311.00	4,981.00

22 AWG stranded multi-conductor unshielded communications cable, 80 degree, PVC jacket, 150 volt

2 pairs	L2@5.00	KLF	187.00	201.00	388.00
3 pairs	L2@5.25	KLF	248.00	211.00	459.00
4 pairs	L2@5.50	KLF	314.00	221.00	535.00
5 pairs	L2@5.75	KLF	406.00	231.00	637.00
6 pairs	L2@6.00	KLF	466.00	241.00	707.00
7 pairs	L2@6.25	KLF	507.00	251.00	758.00

Use these figures to estimate the cost of communications cable installed in conduit under the conditions described on pages 5 and 6. Costs listed are for each 1,000 linear feet installed. The crew is two technicians. The labor cost per manhour is \$40.19. These costs include terminations, reel setup, cable identification, cable testing, layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Communications Cable

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
22 AWG stranded multi-conductor unshielded communications cable, 80 degree, PVC jacket, 150 volt					
8 pairs	L2@6.50	KLF	607.00	261.00	868.00
9 pairs	L2@6.75	KLF	607.00	271.00	878.00
10 pairs	L2@7.00	KLF	711.00	281.00	992.00
12 pairs	L2@7.50	KLF	965.00	301.00	1,266.00
15 pairs	L2@8.00	KLF	1,340.00	322.00	1,662.00
20 pairs	L2@10.0	KLF	1,850.00	402.00	2,252.00
25 pairs	L2@11.3	KLF	2,100.00	454.00	2,554.00
30 pairs	L2@12.5	KLF	3,490.00	502.00	3,992.00
40 pairs	L2@15.0	KLF	4,370.00	603.00	4,973.00
50 pairs	L2@17.5	KLF	5,490.00	703.00	6,193.00
60 pairs	L2@20.0	KLF	6,030.00	804.00	6,834.00



20 AWG stranded multi-conductor unshielded communications cable, 80 degree, PVC jacket, 300 volt

2 pairs	L2@5.50	KLF	291.00	221.00	512.00
3 pairs	L2@5.75	KLF	376.00	231.00	607.00
4 pairs	L2@6.00	KLF	423.00	241.00	664.00
5 pairs	L2@6.25	KLF	589.00	251.00	840.00
6 pairs	L2@6.50	KLF	654.00	261.00	915.00
7 pairs	L2@6.75	KLF	732.00	271.00	1,003.00
8 pairs	L2@7.00	KLF	1,060.00	281.00	1,341.00
9 pairs	L2@7.25	KLF	993.00	291.00	1,284.00
10 pairs	L2@7.50	KLF	1,180.00	301.00	1,481.00
12 pairs	L2@8.00	KLF	1,400.00	322.00	1,722.00
15 pairs	L2@8.75	KLF	1,780.00	352.00	2,132.00

Use these figures to estimate the cost of communications cable installed in conduit under the conditions described on pages 5 and 6. Costs listed are for each 1,000 linear feet installed. The crew is two technicians. The labor cost per manhour is \$40.19. These costs include terminations, reel setup, cable identification, cable testing, layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Communications Cable

Material	Craft@ Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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24 AWG stranded multi-conductor foil/braid shielded communications cable, 80 degree, PVC jacket, 300 volt

2 pairs	L2@6.00	KLF	2,270.00	241.00	2,511.00
3 pairs	L2@6.25	KLF	2,570.00	251.00	2,821.00
4 pairs	L2@6.50	KLF	2,750.00	261.00	3,011.00
6 pairs	L2@7.25	KLF	3,220.00	291.00	3,511.00
8 pairs	L2@7.75	KLF	3,630.00	311.00	3,941.00
10 pairs	L2@8.25	KLF	4,010.00	332.00	4,342.00
15 pairs	L2@9.50	KLF	5,560.00	382.00	5,942.00
20 pairs	L2@10.8	KLF	7,270.00	434.00	7,704.00
25 pairs	L2@12.0	KLF	8,190.00	482.00	8,672.00
30 pairs	L2@13.3	KLF	9,840.00	535.00	10,375.00
40 pairs	L2@15.8	KLF	13,400.00	635.00	14,035.00
50 pairs	L2@17.8	KLF	16,200.00	715.00	16,915.00

24 AWG telephone cable, 60 degree, 90 volt, solid twisted pairs, tinned copper

2 pairs	L2@5.25	KLF	235.00	211.00	446.00
6 pairs	L2@6.50	KLF	590.00	261.00	851.00
10 pairs	L2@7.50	KLF	900.00	301.00	1,201.00
25 pairs	L2@11.3	KLF	2,160.00	454.00	2,614.00

24 AWG telephone cable, 60 degree, 90 volt, solid bare copper

6 pairs	L2@6.50	KLF	137.00	261.00	398.00
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22 AWG telephone cable, 60 degree, 90 volt, solid bare copper

2 pairs	L2@5.25	KLF	59.70	211.00	270.70
3 pairs	L2@5.50	KLF	78.70	221.00	299.70
4 pairs	L2@5.75	KLF	81.60	231.00	312.60
6 pairs	L2@6.25	KLF	180.00	251.00	431.00

Use these figures to estimate the cost of communications cable installed in conduit under the conditions described on pages 5 and 6. Costs listed are for each 1,000 linear feet installed. The crew is two technicians. The labor cost per manhour is \$40.19. These costs include terminations, reel setup, cable identification, cable testing, layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.



Communications Cable

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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Coaxial communications cable

6/U	18 AWG, solid	L2@7.00	KLF	535.00	281.00	816.00
6A/U	21 AWG, solid	L2@7.00	KLF	2,840.00	281.00	3,121.00
8/U	13 AWG, stranded	L2@8.00	KLF	1,340.00	322.00	1,662.00
8A/U	13 AWG, stranded	L2@8.00	KLF	1,780.00	322.00	2,102.00
11/U	18 AWG, stranded	L2@8.50	KLF	1,490.00	342.00	1,832.00
11/U	14 AWG, solid	L2@9.00	KLF	1,340.00	362.00	1,702.00
11A/U	18 AWG, stranded	L2@8.50	KLF	2,320.00	342.00	2,662.00
58/U	20 AWG, solid	L2@8.00	KLF	365.00	322.00	687.00
58A/U	20 AWG, stranded	L2@8.50	KLF	449.00	342.00	791.00
58C/U	20 AWG, stranded	L2@8.50	KLF	1,150.00	342.00	1,492.00
59/U	22 AWG, solid	L2@8.00	KLF	401.00	322.00	723.00
59/U	22 AWG, stranded	L2@8.50	KLF	741.00	342.00	1,083.00
59B/U	23 AWG, solid	L2@8.00	KLF	938.00	322.00	1,260.00
62/U	22 AWG, solid	L2@8.00	KLF	541.00	322.00	863.00
62A/U	22 AWG, solid	L2@8.00	KLF	755.00	322.00	1,077.00

Twinaxial communications cable

95 ohm	18 AWG, str	L2@9.00	KLF	3,960.00	362.00	4,322.00
100 ohm	18 AWG, str	L2@9.00	KLF	1,160.00	362.00	1,522.00
100 ohm	20 AWG, str	L2@9.00	KLF	1,120.00	362.00	1,482.00
78 ohm	20 AWG, str, data	L2@9.50	KLF	1,110.00	382.00	1,492.00
100 ohm	22 AWG, sol, data	L2@9.50	KLF	1,220.00	382.00	1,602.00
124 ohm	16 AWG, sol, data	L2@9.50	KLF	2,700.00	382.00	3,082.00
124 ohm	25 AWG, str, data	L2@9.50	KLF	603.00	382.00	985.00

Plenum-rated coaxial communications cable

11/U	14 AWG, solid	L2@8.50	KLF	5,390.00	342.00	5,732.00
58C/U	20 AWG, solid	L2@8.00	KLF	2,040.00	322.00	2,362.00
58/U	20 AWG, solid	L2@8.00	KLF	1,610.00	322.00	1,932.00
59/U	20 AWG, solid	L2@8.25	KLF	2,060.00	332.00	2,392.00
59B/U	23 AWG, solid	L2@8.25	KLF	4,210.00	332.00	4,542.00
62A/U	22 AWG, solid	L2@8.25	KLF	1,780.00	332.00	2,112.00

Plenum-rated twinaxial communications cable

78 ohm	20 AWG, str	L2@8.00	KLF	2,570.00	322.00	2,892.00
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Use these figures to estimate the cost of communications cable installed in conduit under the conditions described on pages 5 and 6. Costs listed are for each 1,000 linear feet installed. The crew is two technicians. The labor cost per manhour is \$40.19. These costs include terminations, reel setup, cable identification, cable testing, layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.



Communications Cable

Material	Craft@ Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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Local Area Network (LAN) trunk coaxial cable

6/U	18 AWG, solid	L2@9.00	KLF	716.00	362.00	1,078.00
58C/U	20 AWG, str	L2@9.50	KLF	1,070.00	382.00	1,452.00

Local Area Network (LAN) trunk - coaxial plenum cable

6/U	18 AWG, solid	L2@9.50	KLF	2,830.00	382.00	3,212.00
58C/U	20 AWG, str	L2@9.75	KLF	1,610.00	392.00	2,002.00



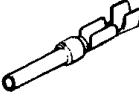
Transceiver/drop twisted pair shielded cable

4-3 pairs	22 AWG, str plus					
1 pair	20 AWG, str	L2@12.0	KLF	3,060.00	482.00	3,542.00
4 pairs	20 AWG, str	L2@7.00	KLF	3,060.00	281.00	3,341.00

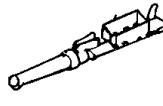
Use these figures to estimate the cost of communications cable installed in conduit under the conditions described on pages 5 and 6. Costs listed are for each 1,000 linear feet installed. The crew is two technicians. The labor cost per manhour is \$40.19. These costs include terminations, reel setup, cable identification, cable testing, layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

SAMPLE

Cable Fittings

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
Cable contacts, pins for use with plugs					
30 - 26 AWG crimp snap	L1@.100	Ea	.19	4.02	4.21
26 - 22 AWG crimp snap	L1@.100	Ea	.19	4.02	4.21
24 - 20 AWG crimp snap	L1@.100	Ea	.19	4.02	4.21
					
30 - 26 AWG HDE insl.	L1@.100	Ea	.19	4.02	4.21
26 - 22 AWG HDE Insl.	L2@.100	Ea	.19	4.02	4.21
30 - 26 AWG solder cup	L1@.150	Ea	.22	6.03	6.25
28 - 24 AWG solder cup	L1@.150	Ea	.22	6.03	6.25
26 - 22 AWG solder cup	L1@.150	Ea	.22	6.03	6.25
24 - 20 AWG solder cup	L1@.150	Ea	.22	6.03	6.25
22 - 20 AWG solder cup	L1@.150	Ea	.22	6.03	6.25

Cable contacts, sockets for use with receptacles

30 - 26 AWG crimp snap	L1@.100	Ea	.19	4.02	4.21
26 - 22 AWG crimp snap	L1@.100	Ea	.19	4.02	4.21
24 - 20 AWG crimp snap	L1@.100	Ea	.19	4.02	4.21
					
30 - 26 AWG HDE insl.	L1@.100	Ea	.21	4.02	4.23
26 - 22 AWG HDE insl.	L1@.100	Ea	.21	4.02	4.23
22 - 20 AWG HDE insl.	L1@.100	Ea	.21	4.02	4.23
30 - 26 AWG solder cup	L1@.150	Ea	.23	6.03	6.26
28 - 24 AWG solder cup	L1@.150	Ea	.23	6.03	6.26
26 - 22 AWG solder cup	L1@.150	Ea	.23	6.03	6.26
24 - 20 AWG solder cup	L1@.150	Ea	.23	6.03	6.26
22 - 20 AWG solder cup	L1@.150	Ea	.23	6.03	6.26

Cable hardware for crimp snap - HDE and solder cup contacts

Male screw retainer, yellow	L1@.100	Ea	.48	4.02	4.50
Male screw retainer, clear	L1@.100	Ea	.48	4.02	4.50
Fem. screw retainer, yellow	L1@.100	Ea	1.60	4.02	5.62
Fem. screw retainer, clear	L1@.100	Ea	1.60	4.02	5.62

Use these figures to estimate the cost of cable fittings installed under the conditions described on pages 5 and 6. The crew size is one technician. The labor cost per manhour is \$40.19. These costs include cable stripping, layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Cable Fittings

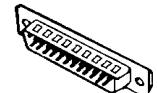
Material	Craft@ Hrs	Unit	Material Cost	Labor Cost	Installed Cost
Cable hardware for crimp snap, HDE and solder clamps					
4 - 40 slide lock post, yellow	L1@.150	Ea	1.90	6.03	7.93
2 - 56 slide lock post, clear	L1@.150	Ea	1.90	6.03	7.93
15 position slide latch	L1@.150	Ea	3.71	6.03	9.74
25 position slide latch	L1@.150	Ea	4.37	6.03	10.40

Subminiature D cable connectors, plugs - shell with contacts, zinc, crimp snap-in

24 - 20 AWG, 9 position	L1@.250	Ea	2.73	10.00	12.73
24 - 20 AWG, 15 position	L1@.300	Ea	3.56	12.10	15.66
24 - 20 AWG, 25 position	L1@.400	Ea	5.25	16.10	21.35

Subminiature D cable connectors, plugs - shell with contacts, tin with ground indents, HDE insulation displacement

26 - 22 AWG, 9 position	L1@.250	Ea	3.15	10.00	13.15
26 - 22 AWG, 15 position	L1@.300	Ea	3.98	12.10	16.08
26 - 22 AWG, 25 position	L1@.400	Ea	5.10	16.10	21.20



Subminiature D cable connectors, plugs - shell with contacts, solder cup

30 - 18 AWG, 9 position	L1@.300	Ea	1.60	12.10	13.70
30 - 18 AWG, 15 position	L1@.400	Ea	2.18	16.10	18.28
30 - 18 AWG, 25 position	L1@.500	Ea	3.02	20.10	23.12

Subminiature D cable connectors, plugs - shell with contacts, plastic, HDE insulation displacement

26 - 22 AWG, 9 position	L1@.250	Ea	2.30	10.00	12.30
26 - 22 AWG, 15 position	L1@.300	Ea	2.96	12.10	15.06
26 - 22 AWG, 25 position	L1@.400	Ea	3.71	16.10	19.81

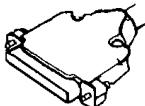
Subminiature D cable connectors, plug kits - shell with contacts - backshell & hardware, crimp snap-in

24 - 20 AWG, 9 position	L1@.250	Ea	4.77	10.00	14.77
24 - 20 AWG, 15 position	L1@.300	Ea	6.59	12.10	18.69
24 - 20 AWG, 25 position	L1@.400	Ea	7.07	16.10	23.17

Use these figures to estimate the cost of cable fittings installed under the conditions described on pages 5 and 6. The crew size is one technician. The labor cost per manhour is \$40.19. These costs include cable stripping, layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Cable Fittings

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
Subminiature D cable connectors, plug kits - shell with contacts - backshell & hardware, crimp snap-in					
26 - 20 AWG, 9 position	L1@.250	Ea	7.29	10.00	17.29
24 - 20 AWG, 15 position	L1@.300	Ea	8.05	12.10	20.15
24 - 20 AWG, 25 position	L1@.400	Ea	9.93	16.10	26.03



Subminiature D cable connectors, plug kits, shell with contacts, backshell & hardware, tin with ground indents, HDE insulation displacement

26 - 22 AWG, 9 position	L1@.250	Ea	6.71	10.00	16.71
24 - 20 AWG, 15 position	L1@.300	Ea	7.73	12.10	19.83
24 - 20 AWG, 25 position	L1@.400	Ea	8.83	16.10	24.93

Subminiature D cable connectors, plug kits, shell with contacts, backshell & hardware, tin with ground indents, solder cup

30 - 18 AWG, 9 position	L1@.300	Ea	5.95	12.10	18.05
30 - 18 AWG, 15 position	L1@.400	Ea	6.36	16.10	22.46
30 - 18 AWG, 25 position	L1@.500	Ea	7.29	20.10	27.39

Subminiature D cable connectors, plug kits, shell with contacts, backshell & hardware, tin with ground indents, plastic

26 - 22 AWG, 9 position	L1@.250	Ea	4.67	10.00	14.67
26 - 22 AWG, 15 position	L1@.300	Ea	5.95	12.10	18.05
26 - 22 AWG, 25 position	L1@.400	Ea	6.18	16.10	22.28

Subminiature D cable connectors, receptacles - shell with contacts, zinc, crimp snap-in

24 - 20 AWG, 9 position	L1@.250	Ea	2.97	10.00	12.97
24 - 20 AWG, 15 position	L1@.300	Ea	3.71	12.10	15.81
24 - 20 AWG, 25 position	L1@.400	Ea	5.26	16.10	21.36

Subminiature D cable connectors, receptacles - shell with contacts, tin with ground indents, crimp snap-in

24 - 20 AWG, 9 position	L1@.250	Ea	2.72	10.00	12.72
24 - 20 AWG, 15 position	L1@.300	Ea	3.71	12.10	15.81
24 - 20 AWG, 25 position	L1@.400	Ea	5.26	16.10	21.36

Subminiature D cable connectors, receptacles - shell with contacts, tin with ground indents, plastic

26 - 22 AWG, 9 position	L1@.250	Ea	2.46	10.00	12.46
26 - 22 AWG, 15 position	L1@.300	Ea	3.15	12.10	15.25
26 - 22 AWG, 25 position	L1@.400	Ea	4.53	16.10	20.63

Use these figures to estimate the cost of cable fittings installed under the conditions described on pages 5 and 6. The crew size is one technician. The labor cost per manhour is \$40.19. These costs include cable stripping, layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Cable Fittings

Material	Craft@ Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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Subminiature D cable connectors, receptacle kits - shell with contacts, backshell & hardware, zinc, crimp snap-in

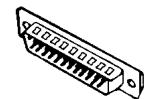
24 - 20 AWG, 9 position	L1@.250	Ea	5.10	10.00	15.10
24 - 20 AWG, 15 position	L1@.300	Ea	6.93	12.10	19.03
24 - 20 AWG, 25 position	L1@.400	Ea	7.50	16.10	23.60

Subminiature D cable connectors, receptacle kits - shell with contacts, backshell & hardware, HDE insulation displacement

26 - 22 AWG, 9 position	L1@.250	Ea	7.20	10.00	17.20
26 - 22 AWG, 15 position	L1@.300	Ea	7.89	12.10	19.99
26 - 22 AWG, 25 position	L1@.400	Ea	9.48	16.10	25.58

Subminiature D cable connectors, receptacle kits - shell with contacts, backshell & hardware, solder cap

30 - 18 AWG, 9 position	L1@.300	Ea	6.08	12.10	18.18
30 - 18 AWG, 15 position	L1@.400	Ea	6.93	16.10	23.03
30 - 18 AWG, 25 position	L1@.500	Ea	7.89	20.10	27.99



Subminiature D cable connectors, receptacle kits - shell with contacts, backshell & hardware, plastic

26 - 22 AWG, 9 position	L1@.250	Ea	4.70	10.00	14.70
26 - 22 AWG, 15 position	L1@.300	Ea	6.08	12.10	18.18
26 - 22 AWG, 25 position	L1@.400	Ea	7.20	16.10	23.30

Subminiature D cable connectors, straight exit backshells, plastic

9 position, .240 ferrules	L1@.150	Ea	1.75	6.03	7.78
15 position, .430 ferrules	L1@.150	Ea	2.97	6.03	9.00
25 position, .430 ferrules	L1@.150	Ea	3.42	6.03	9.45

Subminiature D cable connectors, straight exit backshells, metal plated plastic

9 position, .240 ferrules	L1@.150	Ea	3.42	6.03	9.45
15 position, .430 ferrules	L1@.150	Ea	3.56	6.03	9.59
25 position, .430 ferrules	L1@.150	Ea	3.71	6.03	9.74

Subminiature D cable connectors, straight exit backshells, metal

9 position, .240 ferrules	L1@.150	Ea	6.23	6.03	12.26
15 position, .430 ferrules	L1@.150	Ea	6.36	6.03	12.39
25 position, .430 ferrules	L1@.150	Ea	6.50	6.03	12.53

Use these figures to estimate the cost of cable fittings installed under the conditions described on pages 5 and 6. The crew size is one technician. The labor cost per manhour is \$40.19. These costs include cable stripping, layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Cable Fittings

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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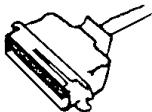
Data cable connectors, 36 position, unshielded

28 - 26 AWG, stranded wire L1@.150	Ea	3.32	6.03	9.35
26 - 24 AWG, sol or str wire L1@.150	Ea	3.32	6.03	9.35

Data cable connectors, 50 position, shielded

28 - 26 AWG, stranded wire L1@.150	Ea	5.99	6.03	12.02
26 - 24 AWG, sol or str wire L1@.150	Ea	5.99	6.03	12.02

Subminiature to modular jack adapters



25 pos. plug - 6 pos.	L1@.250	Ea	15.00	10.00	25.00
25 pos. recept - 6 pos.	L1@.250	Ea	15.00	10.00	25.00
25 pos. plug - 8 pos.	L1@.250	Ea	15.20	10.00	25.20
25 pos. recept - 8 pos.	L1@.250	Ea	15.20	10.00	25.20

Field programmable RS-232 cable connectors

Plug	L1@.150	Ea	11.20	6.03	17.23
Receptacle	L1@.150	Ea	11.20	6.03	17.23

Centerline clamp cable connectors .085, plug type

With snap-on cable clamp	L1@.050	Ea	2.75	2.01	4.76
W/ ratcheted cable clamp	L1@.100	Ea	3.16	4.02	7.18

Cable connector savers - 25 position

Shielded with cover	L1@.200	Ea	52.50	8.04	60.54
Plastic without cover	L1@.200	Ea	38.80	8.04	46.84
Plastic with cover	L1@.200	Ea	66.50	8.04	74.54

Cable connector gender changer - 25 position assemblies

Shielded-cover, plug	L1@.250	Ea	79.20	10.00	89.20
Plastic-cover, plug	L1@.250	Ea	47.00	10.00	57.00
Shielded-no cover, recept.	L1@.300	Ea	48.30	12.10	60.40
Shielded-cover, receptacle	L1@.300	Ea	77.30	12.10	89.40
Plastic-no cover, recept.	L1@.300	Ea	47.30	12.10	59.40
Plastic-cover, receptacle	L1@.300	Ea	73.10	12.10	85.20

Use these figures to estimate the cost of cable fittings installed under the conditions described on pages 5 and 6. The crew size is one technician. The labor cost per manhour is \$40.19. These costs include cable stripping, layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Cable Fittings

Material	Craft@ Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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Strain relief cable cover, 180 degree

.500 O.D. & smaller cable	L1@.100	Ea	3.28	4.02	7.30
.500 O.D. & larger cable	L1@.150	Ea	3.03	6.03	9.06
.290 - .360 cable O.D.	L1@.100	Ea	1.64	4.02	5.66
.360 - .430 cable O.D.	L1@.150	Ea	1.50	6.03	7.53

Baluns, RJ11 to BNC plug, twisted pair cable

14' twisted pair, plugs	L1@.150	Ea	25.50	6.03	31.53
30' twisted pair, plugs	L1@.200	Ea	31.50	8.04	39.54
8" coaxial pigtail, plugs	L1@.100	Ea	21.80	4.02	25.82
RJ11 jack to BNC plug	L1@.100	Ea	21.80	4.02	25.82
RJ11 to DPC plug filtered	L1@.100	Ea	33.60	4.02	37.62

RJ45 plug to BNC plug

14' twisted pair, plugs	L1@.150	Ea	25.50	6.03	31.53
30' twisted pair, plugs	L1@.200	Ea	31.50	8.04	39.54



Keyed RJ45 plug to BNC plug with coaxial pigtail plugs

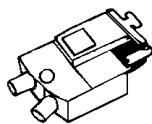
8"	L1@.100	Ea	21.80	4.02	25.82
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Cable fittings, twisted pair to BNC plugs

Screw terminal to BNC plug	L1@.250	Ea	21.80	10.00	31.80
Screw terminal to panel	L1@.250	Ea	21.80	10.00	31.80
RJ11 jack to BNC jack	L1@.100	Ea	21.40	4.02	25.42
RJ11 jack to BNC jack	L1@.100	Ea	21.30	4.02	25.32
RJ11 jack to pan. BNC jack	L1@.100	Ea	27.40	4.02	31.42
RJ45 jack to BNC jack	L1@.100	Ea	22.70	4.02	26.72
RJ45 jack to pan. BNC jack	L1@.100	Ea	21.40	4.02	25.42
RJ11 to twinaxial plug	L1@.150	Ea	36.10	6.03	42.13
RJ11 with 14' twist-pr. cable	L1@.150	Ea	39.20	6.03	45.23

Use these figures to estimate the cost of cable fittings installed under the conditions described on pages 5 and 6. The crew size is one technician. The labor cost per manhour is \$40.19. These costs include cable stripping, layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Cable Fittings



Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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Baluns, 4-position data connectors, 93 ohm to 150 ohm coaxial shielded twisted pair

Conn. to dual BNC jack	L1@.250	Ea	53.20	10.00	63.20
Conn. to single BNC jack	L1@.250	Ea	30.80	10.00	40.80

Connector to modular jack IMP, matching, 105 ohm to 150 ohm twisted pair cable

6 pos. unshielded to shield	L1@.200	Ea	35.70	8.04	43.74
8 pos. unshielded to shield	L1@.200	Ea	35.70	8.04	43.74

Modular couplers, in-line

6 position	L1@.050	Ea	3.87	2.01	5.88
8 position	L1@.050	Ea	4.16	2.01	6.17
8 position, keyed	L1@.050	Ea	4.46	2.01	6.47

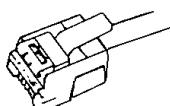
Modular couplers, right angle

6 position	L1@.050	Ea	4.01	2.01	6.02
8 position	L1@.050	Ea	4.16	2.01	6.17
8 position, keyed	L1@.050	Ea	3.74	2.01	5.75

Modular keystone jacks, telephone cable

22 - 24 AWG, 3 pair	L1@.050	Ea	4.70	2.01	6.71
24 - 28 AWG, 3 pair	L1@.050	Ea	4.70	2.01	6.71
19 - 22 AWG, 3 pair	L1@.050	Ea	4.97	2.01	6.98
22 - 24 AWG, 4 pair	L1@.050	Ea	4.85	2.01	6.86
24 - 28 AWG, 4 pair	L1@.050	Ea	5.14	2.01	7.15
22 - 24 AWG, 4 pr, keyed	L1@.050	Ea	4.97	2.01	6.98
24 - 28 AWG, 4 pr, keyed	L1@.050	Ea	5.30	2.01	7.31

Telephone splice connectors



2-wire, translucent	L1@.250	Ea	88.00	10.00	98.00
2-wire, yellow	L1@.250	Ea	63.80	10.00	73.80
2-wire, clear	L1@.250	Ea	75.50	10.00	85.50
3-wire, translucent	L1@.300	Ea	105.00	12.10	117.10
3-wire, yellow	L1@.300	Ea	74.30	12.10	86.40
3-wire, clear	L1@.300	Ea	92.70	12.10	104.80

Use these figures to estimate the cost of cable fittings installed under the conditions described on pages 5 and 6. The crew size is one technician. The labor cost per manhour is \$40.19. These costs include cable stripping, layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Cable Fittings

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
BNC crimp-on plug connector for RG/U cable					
Commercial silver, 58	L1@.100	Ea	1.57	4.02	5.59
Commercial gold, 58	L1@.100	Ea	2.39	4.02	6.41
Standard silver, 58	L1@.100	Ea	3.11	4.02	7.13
Standard gold, 58	L1@.100	Ea	8.81	4.02	12.83
Comm. silver, hex, 58	L1@.100	Ea	1.72	4.02	5.74
Comm. gold, hex, 58	L1@.100	Ea	2.98	4.02	7.00
Comm. silver, plenum, 58	L1@.100	Ea	1.77	4.02	5.79
Comm. gold, plenum, 58	L1@.100	Ea	2.05	4.02	6.07
Std. silver, plenum, 58	L1@.100	Ea	3.12	4.02	7.14
Std. gold, plenum, 58	L1@.100	Ea	4.56	4.02	8.58
Std. gold, 90 degree, 58	L1@.100	Ea	18.70	4.02	22.72
Comm. silver, 59/62	L1@.100	Ea	1.60	4.02	5.62
Comm. gold, 59/62	L1@.100	Ea	2.48	4.02	6.50
Std. silver, 59/62	L1@.100	Ea	3.45	4.02	7.47
Std. gold, 59/62	L1@.100	Ea	3.87	4.02	7.89
Comm. silver, hex, 59/62	L1@.100	Ea	3.16	4.02	7.18
Comm. gold, hex, 59/62	L1@.100	Ea	3.74	4.02	7.76
Comm. silv., plenum, 59/62	L1@.100	Ea	1.75	4.02	5.77
Comm. gold, plenum, 59/62	L1@.100	Ea	2.05	4.02	6.07
Std. silver, plenum, 59/62	L1@.100	Ea	3.16	4.02	7.18
Std. gold, plenum, 59/62	L1@.100	Ea	3.74	4.02	7.76
Std. gold, 90 degree, 59/62	L1@.100	Ea	18.70	4.02	22.72
Comm. silver, hi temp, 59	L1@.100	Ea	2.74	4.02	6.76
Comm. gold, hi temp, 59	L1@.100	Ea	18.00	4.02	22.02

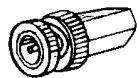
BNC crimp-on connector, jack type for RG/U cable

Comm. silver, 58	L1@.150	Ea	3.16	6.03	9.19
Comm. gold, 58	L1@.150	Ea	3.45	6.03	9.48
Comm. silver, plenum, 58	L1@.150	Ea	4.16	6.03	10.19
Comm. gold, plenum, 58	L1@.150	Ea	4.85	6.03	10.88
Std. gold plenum, 58	L1@.150	Ea	4.85	6.03	10.88
Comm. gold, bulkhead, 58	L1@.150	Ea	5.14	6.03	11.17
Std. gold, bulkhead, 58	L1@.150	Ea	6.00	6.03	12.03

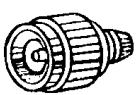
Use these figures to estimate the cost of cable fittings installed under the conditions described on pages 5 and 6. The crew size is one technician. The labor cost per manhour is \$40.19. These costs include cable stripping, layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.



Cable Fittings



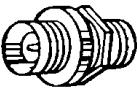
Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
BNC twist-on plug connector for RG/U cable					
Straight plug, 58	L1@.200	Ea	2.61	8.04	10.65
Straight plug, 59/62	L1@.200	Ea	2.05	8.04	10.09
Straight plug, plenum, 59/62	L1@.200	Ea	2.61	8.04	10.65
Straight jack, 58	L1@.200	Ea	3.13	8.04	11.17
Straight jack, 59/62	L1@.200	Ea	3.45	8.04	11.49
Straight jack, 59	L1@.200	Ea	10.10	8.04	18.14
90 degree plug, 58	L1@.250	Ea	22.80	10.00	32.80
90 degree plug, 59/62	L1@.250	Ea	22.80	10.00	32.80



Straight plug, 58	L1@.200	Ea	3.16	8.04	11.20
Straight plug, 59/62	L1@.200	Ea	3.16	8.04	11.20
Straight jack, 58	L1@.200	Ea	25.10	8.04	33.14
Straight jack, 59/62	L1@.200	Ea	21.80	8.04	29.84



Twist-on plug, 59/62	L1@.250	Ea	.63	10.00	10.63
Crimp-on, 59	L1@.250	Ea	.58	10.00	10.58
Crimp-on, 6	L1@.250	Ea	.58	10.00	10.58
2 pc, crimp-on, 6	L1@.250	Ea	1.05	10.00	11.05



Comm. plug, 8	L1@.200	Ea	6.27	8.04	14.31
Std. plug, plenum	L1@.200	Ea	10.10	8.04	18.14
Jack to jack, plenum	L1@.250	Ea	15.20	10.00	25.20
Plug terminator	L1@.200	Ea	11.60	8.04	19.64
Jack terminator	L1@.200	Ea	11.60	8.04	19.64
Crimp plug, RGS/11	L1@.200	Ea	7.67	8.04	15.71

Use these figures to estimate the cost of cable fittings installed under the conditions described on pages 5 and 6. The crew size is one technician. The labor cost per manhour is \$40.19. These costs include cable stripping, layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Cable Fittings

Material	Craft@ Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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Twinaxial cable connectors

Solder plug	L1@.300	Ea	4.85	12.10	16.95
Crimp-on plug	L1@.200	Ea	6.13	8.04	14.17
Solder jack	L1@.300	Ea	9.80	12.10	21.90
In-line splice, jack to jack	L1@.250	Ea	7.67	10.00	17.67
Bulkhead jack, solder	L1@.300	Ea	22.40	12.10	34.50

Coaxial cable adapters

In-line splice, jack to jack	L1@.300	Ea	5.85	12.10	17.95
Bulk. splice, jack to jack	L1@.250	Ea	6.69	10.00	16.69
Right angle plug, 58	L1@.300	Ea	18.70	12.10	30.80
Right angle plug, 59/62	L1@.300	Ea	18.70	12.10	30.80
Bulkhead jack, 58	L1@.250	Ea	6.27	10.00	16.27
Bulkhead jack, 59/62	L1@.250	Ea	6.27	10.00	16.27
T-connector	L1@.300	Ea	13.00	12.10	25.10



Use these figures to estimate the cost of cable fittings installed under the conditions described on pages 5 and 6. The crew size is one technician. The labor cost per manhour is \$40.19. These costs include cable stripping, layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Wire Conversion Table

For insulated conductors rated 0-2000 volts 60 degrees C (140 degrees F), not more than three conductors in a raceway or cable or earth (direct burial) on ambient temperatures of 30 degrees C (86 degrees F)

60 degrees C		90 degrees C	
Copper	Aluminum	Copper	Aluminum
# 10	# 8	# 10	# 8
# 8	# 6	# 8	# 6
# 6	# 4	# 6	# 4
# 4	# 2	# 4	# 2
# 2	# 1/0	# 2	# 1/0
# 1	# 2/0	# 1	# 2/0
# 1/0	# 3/0	# 1/0	# 3/0
# 2/0	# 4/0	# 2/0	# 4/0
# 3/0	# 250 kcmil	# 3/0	# 250 kcmil
# 4/0	# 350 kcmil	# 4/0	# 350 kcmil
# 250 kcmil	# 400 kcmil	# 250 kcmil	# 400 kcmil
# 300 kcmil	# 500 kcmil	# 300 kcmil	# 500 kcmil
# 350 kcmil	# 500 kcmil	# 350 kcmil	# 500 kcmil
# 400 kcmil	# 600 kcmil	# 400 kcmil	# 600 kcmil
# 500 kcmil	# 750 kcmil	# 500 kcmil	# 750 kcmil
# 600 kcmil	# 900 kcmil	# 600 kcmil	# 900 kcmil
# 750 kcmil	# 1250 kcmil	# 750 kcmil	# 1250 kcmil

See the tables in NEC Section 310 for conductor ampacities for general wiring

Section 19: Undercarpet Wiring Systems

In a large office open space area being prepared for either tenant improvements or rehab to accommodate desk and furniture layout, **undercarpet wiring systems** can be the easiest solution. In this case the structure is existing and the planned locations for the work station desks and other office furniture will require wiring systems.

Installing these systems in an existing structure can be very expensive and probably disruptive to existing tenants sharing space in the building. If the tenant improvements are on the ground floor, the systems will probably require cutting and patching the floor for the conduit systems.

When the improvements are on floors above the ground floor, conduit systems might be installed in the ceiling cavity of the floor below. In order to gain access to the floor above, the floor is core drilled for conduit stubups at the location of the service outlets.

The local building code may require that penetrations between floors be fireproofed in an approved manner. An oversized core penetration should be made to allow for adequate fireproofing material to stop the spread of fire.

Designers and manufacturers have engineered the undercarpet wiring system concept for a low cost, quick and clean alternative in maintaining an open office landscape. The wiring system can be designed to fulfill the user's needs and installed just before the carpeting is laid.

When the need arises to relocate a desk or office furniture, the carpet can be cut to extend the wiring systems to additional outlets and can be easily patched by a carpet layer. Then when more

work stations are needed, the carpet can be cut, the wiring systems extended and the carpet patched. This wiring system is very flexible and economical for a large open space office environment.

Care should be exercised in making the office furniture planned layout. The service outlets should be accurately located to fit the required need.

As the need for office work stations increases or adjustments are needed, the wiring services can be modified. A well-planned layout should take this into consideration during the planning of the services.

The installation of the actual material is simple. The location of the service outlets are marked on the bare clean floor. The straight path for the cable from the wall junction boxes to the service outlet can be marked with a chalk line, the floor swept clean and the cable attached to the floor with the adhesive on the cable. The same procedure is used for runs between outlet locations.

Care must be used to protect the wiring systems from damage by other trades, construction equipment and furniture handling. The wiring system cables are tough and for added protection, a 7"- wide top shield is installed over the cable.

If your company is not familiar with undercarpet wiring systems, ask your supplier for help in planning the layout. The supplier will probably contact a manufacturer's representative for assistance on product information.

Undercarpet Wiring Systems

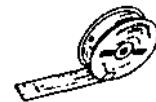
Material	Craft@ Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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20 amp, 300 volt, 3-conductor #12 AWG

2" x 50'	L2@0.30	Ea	37.40	12.10	49.50
2" x 100'	L2@0.60	Ea	72.80	24.10	96.90
2" x 250'	L2@1.50	Ea	160.00	60.30	220.30

20 amp, 300 volt, 4-conductor #12 AWG

2-1/2" x 50'	L2@0.40	Ea	49.80	16.10	65.90
2-1/2" x 100'	L2@0.80	Ea	99.80	32.20	132.00
2-1/2" x 250'	L2@2.00	Ea	250.00	80.40	330.40



20 amp, 300 volt, 4-conductor #12 AWG with isolated ground

2-1/2" x 100'	L2@0.80	Ea	101.00	32.20	133.20
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30 amp, 300 volt, 3-conductor #12 AWG, 100' reel

White, green, black	L2@0.35	Ea	14.90	14.10	29.00
White, green, red	L2@0.35	Ea	16.00	14.10	30.10
White, green, blue	L2@0.35	Ea	16.00	14.10	30.10

30 amp, 300 volt, 3-conductor #10 AWG, 100' reel

White, green, black	L2@0.40	Ea	19.40	16.10	35.50
White, green, red	L2@0.40	Ea	17.20	16.10	33.30
White, green, blue	L2@0.40	Ea	17.20	16.10	33.30



20 amp, 300 volt, 5-conductor #12 AWG, 100' reel

White, green, black, blue & red	L2@0.40	Ea	25.00	16.10	41.10
White, green, green/yellow, red & blue, with isolated ground	L2@0.40	Ea	28.20	16.10	44.30

30 amp, 300 volt, 5-conductor #10 AWG, 100' reel

White, green, black, red & blue	L2@0.45	Ea	28.20	18.10	46.30
White, green, green/yellow, red & blue with isolated ground	L2@0.45	Ea	28.80	18.10	46.90

Use these figures to estimate the cost of undercarpet wiring systems installed in a building under the conditions described on pages 5 and 6. Costs listed are for each item installed. The crew is one or two electricians, as indicated, working at a labor cost of \$40.19 per manhour. These costs include layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

Undercarpet Wiring Systems

Material	Craft@Hrs	Unit	Material Cost	Labor Cost	Installed Cost
Integrated voice & data cable, 100' reel					
2 pair shielded	L2@0.40	Ea	20.90	16.10	37.00
3 pair shielded	L2@0.40	Ea	17.90	16.10	34.00
4 pair shielded	L2@0.50	Ea	21.50	20.10	41.60
Color coded cable, 100' reel					
2 pair twisted	L2@0.40	Ea	99.80	16.10	115.90
4 pair twisted	L2@0.40	Ea	82.00	16.10	98.10
Top shield tape					
7" x 50'	L1@0.25	Ea	14.30	10.00	24.30
7" x 100'	L1@0.50	Ea	28.80	20.10	48.90
7" x 250'	L1@1.25	Ea	71.80	50.20	122.00
Station wire connectors					
2 pair jack	L1@0.15	Ea	4.30	6.03	10.33
3 pair jack	L1@0.15	Ea	5.72	6.03	11.75
3 pair jack	L1@0.20	Ea	6.44	8.04	14.48
3 pair plug	L1@0.15	Ea	5.02	6.03	11.05
4 pair plug	L1@0.20	Ea	5.72	8.04	13.76
Tap & splice adapter					
3-conductor adapter	L1@0.10	Ea	31.50	4.02	35.52
Insulation kit					
Tap & splice	L1@0.15	Ea	35.10	6.03	41.13
Transition boxes					
Tel/data access	L1@0.30	Ea	27.30	12.10	39.40
Transition partitions					
Hi/Lo separator	L1@0.35	Ea	22.80	14.10	36.90

Use these figures to estimate the cost of undercarpet wiring systems installed in a building under the conditions described on pages 5 and 6. Costs listed are for each item installed. The crew is one or two electricians, as indicated, working at a labor cost of \$40.19 per manhour. These costs include layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.



Undercarpet Wiring Systems

Material	Craft@ Hrs	Unit	Material Cost	Labor Cost	Installed Cost
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Transition junction boxes

Surface mounted	L1@0.30	Ea	210.00	12.10	222.10
Flush floor mounted	L1@0.50	Ea	205.00	20.10	225.10
Stud mounted	L1@0.35	Ea	66.00	14.10	80.10
Thin stud mounted	L1@0.35	Ea	59.00	14.10	73.10
Stud mounted, DLB	L1@0.35	Ea	88.20	14.10	102.30
Single terminal box	L1@0.30	Ea	52.10	12.10	64.20

Terminal blocks

Round to flat cable	L1@0.35	Ea	23.50	14.10	37.60
3-wire underflow duct	L1@0.35	Ea	27.30	14.10	41.40
3-wire insul. displace.	L1@0.25	Ea	50.20	10.00	60.20
5-wire insul. displace.	L1@0.30	Ea	71.80	12.10	83.90

Four way power intrafacer

Transition assembly	L1@0.25	Ea	80.00	10.00	90.00
Insulated ground transition assembly	L1@0.35	Ea	83.10	14.10	97.20

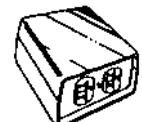


Five way power intrafacer

Transition assembly	L1@0.35	Ea	66.00	14.10	80.10
Insulated ground transition assembly	L1@0.40	Ea	72.30	16.10	88.40

Pedestals for power, less duplex receptacles

For one duplex outlet	L1@0.30	Ea	110.00	12.10	122.10
For two duplex outlets	L1@0.40	Ea	124.00	16.10	140.10



Pedestals

Communications	L1@0.30	Ea	53.10	12.10	65.20
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Use these figures to estimate the cost of undercarpet wiring systems installed in a building under the conditions described on pages 5 and 6. Costs listed are for each item installed. The crew is one electrician working at a labor cost of \$40.19 per manhour. These costs include layout, material handling, and normal waste. Add for sales tax, delivery, supervision, mobilization, demobilization, cleanup, overhead and profit.

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