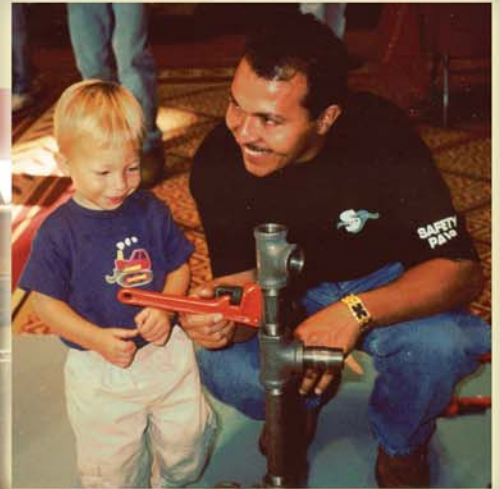


# CONSTRUCTING YOUR FUTURE

Consider a Career in Plumbing, Heating, Ventilation, Air Conditioning (HVAC)



PLUMBING-HEATING-COOLING  
CONTRACTORS AUXILIARY

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# CONSTRUCTING YOUR FUTURE

## Consider a Career in Plumbing, Heating, Ventilation, Air Conditioning (HVAC)

### *What do you want to do after high school?*

Take a moment and consider all the options. You might consider college but wonder what to study or whether you can meet the commitment. It takes at least four years to obtain a bachelor's degree, and some fields require a master's degree or a doctorate in order to obtain work. College is expensive, so you may decide to work while attending school to gain experience in your chosen field. You might find that you can only work at entry level until you have completed at least two years of college, and you usually won't work at career level until after graduation. Some graduates can't find work to match their degree field.

The military is another option. If you want to become an officer, a college degree is necessary. You may be unsure about committing for a specific length of time or worried about combat or separation from family. Though there are many career options in the military, you want to guarantee that whatever you choose will have some application in civilian life, as well.

What about going to work directly after graduation? You can make money quickly, however, with limited skills come limited



*Sundra Ryce discusses plans with her staff. She started working in her father's plumbing business and formed her own construction company in 1996. Her clients include the military, state agencies, and numerous businesses around Buffalo, NY.*

income. It can be difficult to get interesting or challenging work unless you are able to work at a company where friends and family are already employed and can help you. Retail, fast food, or factory work may be your only options. Minimum wage jobs offer few or no benefits and limited advancement without additional schooling. It is typical to work at less-than-desirable shifts or schedules.

Perhaps you are considering attending a community college or technical/specialty school. The time commitment is shorter. You can earn a certificate or degree, and you have many choices in instruction. Programs vary from a few months to two years, and are easier to enroll in and less costly than a four-year college. Some programs offer quick financial results for the education you undertake because you get to work at career level sooner. The big question to consider is what you want to do.



*High School teachers visiting fabrication shop during Career Day.*

## *Have you considered construction?*

There is always a need for skilled construction workers, especially those with post-secondary (after high school) training. The construction industry is the largest employer outside of the government (and also employs people in government). Over four million people are working in construction right now, and women and minorities make up to one third of all construction workers.

The pay is good, and some construction careers pay better than those requiring a baccalaureate program. Advancement is based

on experience as well as education. Some areas are in desperate need for qualified workers, but construction work is performed all across the country. One thing is certain: the future will change the way we work. Air and water quality, environmental protection, smart homes, energy efficiency and energy alternatives are all impacting how we perform our work and how we train for future employment. You can have a direct impact on the lives, safety, health, and comfort of people.

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## *What would a career in construction involve?*

Variety - every day is different, no two jobs are quite the same, and the work can be challenging. New opportunities come every day - problems that need to be solved, new products to consider, new techniques that make working easier and offer greater building quality. Many folks like the ability to work outdoors rather than sit at a desk all day. Others love using computer technology to design homes, buildings, factories, and even whole communities.

It helps in construction to have mechanical aptitude. However, don't let that limit you. Do you have good organizational skills? You might enjoy planning construction jobs or ensuring that materials and services are provided when working crews need them most.

Are you a visual person; do you see pictures in your mind? If you like to solve problems or are creative, you might be good at improvising solutions when unforeseen problems arise. Do you have good "people skills?" Do you get along well with others and enjoy talking to new people and working in new situations? You might enjoy working as a foreman or a supervisor because of the opportunity to work with different people and construction disciplines at different job sites. This might be the career for you.

Work in construction offers good money, and the work is essential. What you are doing affects how people live and work, ensures that necessary services like clean water and sanitation are available, that the living and working climate is comfortable and safe, and that buildings, structures, and roadways withstand the forces of nature and the passage of time. Many people love construction work because there is great satisfaction in seeing something created and built right before their very eyes - you get to see the completion of your own work.

You have the opportunity to indulge in your interests, whether you like designing a system or building from scratch, servicing and repairing equipment and systems that are already built, or even performing restoration work for historical interest. You can operate



*Apprentices assemble PVC piping in a training exercise.*

a variety of machinery and vehicles and you will use the computer and computerized equipment more than you might realize. Changes in technology continue to improve working conditions, safety, and efficiency, and you will be trained to keep up with the changes. The construction industry evolves as new environmental concerns require new methods of performing work, and new materials are created to safeguard the environment. Stronger, lighter, and more innovative materials and products are constantly created that bring increased versatility and lower costs. As populations shift and needs change, methods

change to continue to offer the best in comfort, safety and affordability.

You could even be your own boss. You could become an independent contractor or own your own business and employ others. You might find the financial aspects intriguing. You could prepare and bid on work contracts and oversee work budgets, or you could become involved in the sale of construction products or services. You could become a master at your craft, commanding a high salary because of your talent and experience. You might go into design and engineering work. The opportunities are endless.

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## *Where are the jobs and what do they pay?*

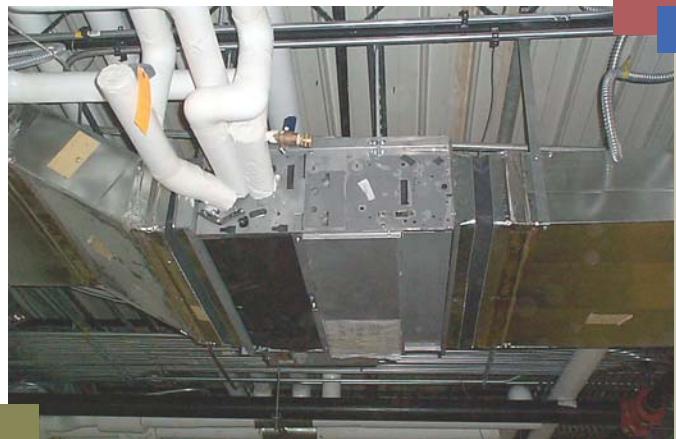
The United States Department of Labor recently reported that most construction and mechanical contracting jobs could expect to grow by 20-25 % over the course of the next decade. It is estimated that we will need a quarter million HVAC technicians and nearly half a million plumbers and pipe fitters in the next several years to meet demand. In some areas, demand for new housing far outstrips supply, and interest rates have been favorable for several years for construction loans.

What kind of money could you make? Plumbers and HVAC workers consistently make some of the best salaries in construction. Apprentices can earn up to \$35,000 a year, and skilled journeymen can earn \$100,000 a year, depending on their skills, training, and career path. Specialty workers can make even more money. Construction engineers start at \$30,000-\$55,000, and experienced engineers can earn over \$100,000 a year.

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## *What does the construction industry include?*

Many disciplines and services are included. Disciplines include industrial, residential, commercial, and government, and military construction. Services include piping for hot and cold water, waste and sanitation, chemicals or food products, steam and power, fire suppression, fuel and natural gas, medical gases, or even nuclear systems. Concrete is used for foundations, walls, floors, roadways, and in innovative products such as kitchen counters. You might work with asphalt to lay roadways, or use stone, brick and other masonry products to construct a building. You could join and weld steel for a building's skeleton or construct an entire ship or submarine. You may use wood, drywall or plaster,



*Supply and return lines serve a supply duct assembly containing cooling coils and air filters.*

*continued next page*

windows, doors, and a variety of finishing and roofing materials to create sought-after homes or to restore treasured historical sites. You might install cable and equipment to supply power or the latest telecommunications service. You may devise whole systems for climate control, from heaters and coolers, to the ductwork, fans, insulation and components



*An air conditioning chiller is a heat exchanger that cools down water. The water is circulated through the building to various cooling coils located in ductwork.*

necessary for air control and circulation. Or you may create industrial clean rooms or medical operating theatres, or provide fire protection, security capability, move people and materials with elevators or other transport systems, or even create entertainment venues as part of a construction job.

You might plan and lay out job sites to provide for storm water control to safeguard bodies of water, or to construct buildings on manmade land or over water where the capability did not exist a few decades ago. All of this work involves machinery operation, from trucks and excavators, to cranes and tunnel-cutters. You might consider designing for niche markets like kitchen/bath design, medical systems, or industrial systems. You may consider working as an estimator; you would estimate cost and labor, schedule work and temporary support services, and create work packages and material kits for larger jobs. You may consider a career in human resources, where you would hire and train other qualified workers. Or you may work as a building inspector to interpret building codes, regulations and standards and ensure that construction adheres to these codes.

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## *Is there more about HVAC and refrigeration?*

HVAC stands for “heating, ventilation, and air conditioning.” Often, you will see the letter R as well, meaning “refrigeration.” HVAC and refrigeration systems are used in homes, office buildings, factories and industrial plants, stores and malls, hospitals, in airplanes, ships, cars, trucks and trains, and in schools and colleges. These systems help keep food and medical supplies safe, air clean and comfortable, protect computers from overheating, and safeguard working conditions.

HVAC technicians or mechanics install, maintain, repair, and modernize ventilation, heating, cooling, refrigeration/cryogenic, environmental and industrial systems, equipment, and controls. They typically work with air conditioners, fans and motors, filters, steam, hot water, or fossil fuel heating systems, electric and geothermal heat pumps, radiant heat, waste heat, furnaces, boilers, refrigeration

units, heat exchangers, evaporators, and compressors, specialty and industrial sheet metal and flexible ducting, refrigerant and coolant piping, sensors, gauges, electricity and electronic controls. As a specialist you could work on large scale chillers and cooling plants, devise industrial ventilation to cut down on airborne particles or noxious gases, design and install refrigeration or cryogenics chambers and systems, or even design solar energy systems that provide heat, hot water and electricity. You might be asked occasionally to recharge refrigerant (such as R-22) or repair leaks in refrigerant piping, or install an air conditioner and ducting in a home that currently has none. You might perform heating or cooling load calculations to size a heating and cooling system for a new building or resize one that has been expanded and modified. You may design building air ducting for



installation where each piece is individually fabricated and routed around existing obstacles in the building.

Growing concerns over indoor air quality have encouraged new specialties, including providing clean rooms for the manufacture of medicinal products or high quality computer components, air filtration and vacuum systems to entrap pollutants and allergens, and industrial ducting and ventilation systems to exhaust poisonous or noxious chemical fumes, dusts, and particles to keep workers safe and reduce fire and explosion hazards. A hundred years ago, creative builders devised systems to cool entire buildings, such as Carnegie Hall, with blocks of ice in order to help people be more comfortable. Now we have the ability to condition and reclaim air in such a manner that we can live and work comfortably almost anywhere on our planet, as well as under-

ground in mines a mile below the planet's surface, and in our oceans in submarines, and also now in space on the International Space Station.



*Insulated circulation piping for a heating loop are labeled for easy identification.*

## *Is there more about plumbing and pipefitting?*

Plumbers traditionally install, maintain and repair hot and cold running water and sanitation (wastewater, sewage, grease trapping) piping, equipment and systems. Every home and business benefits from plumbing services. Did you know that the Greeks, Babylonians, Romans and their contemporaries invented and perfected heating, plumbing, and sanitation systems more than 2,000 years ago? Knowledge of these systems was forgotten for over 1,500 years! Most homes in America didn't even have indoor plumbing until well into the 20th century.

Plumbers select and install fixtures and appliances such as toilets, sinks, dishwashers, washing machines, showers, baths, and other components for bathrooms, kitchens, and laundries in homes. They also provide systems and commercial equipment for restaurants and bars, hospitals, hotels, schools, offices and public buildings, and shops and malls. Often specialty systems are needed such as compressed air or cutting fluid collection for industrial plants, or sterilizers and medical gases for hospitals. Plumbers also install fire suppression systems.

Plumbers install piping and tubing, fittings, pumps, valves, gauges and control

devices. You could be a pipe fitter or steam fitter and install a variety of piping systems for power plants (such as steam, cooling or seawater, and fuel) or industrial process plants (such as chemicals, food stuffs and slurries, or petroleum products). You might install compressed air and industrial gases like nitrogen, or hydraulic and pneumatic (air) power and control systems. Occasionally you'll perform repair or modification work to install a new pump, repair leaking piping, or service valves or pumps. You might prefabricate some of your piping assemblies in the shop and then bring them to the job site and complete the assembly there, rather than assemble everything in the field. You might work in buildings, at factories, on aircraft or spacecraft, or on ships and submarines. You may learn to braze or weld, cut, bend and thread metal pipe, or you may work with PVC or flexible tubing. You may hydrostatically test piping to make sure it doesn't leak, or clean out drain piping or service test and inspect pumps or other equipment to determine how they should be repaired.

## How is the industry changing?

Newer heat pumps are available which better utilize the Earth's own heating and cooling in order to provide efficient heating and cooling for your home. Air quality is better, thanks to better filtration and air cleaning or vacuuming systems that remove dust parti-



*A building's water supply contains a combination of valves and components to regulate pressure, prevent backflow, and trap large particles, to keep our water safer.*

cles, pollen and allergens, and molds. Computer-controlled systems continue to improve, too. Some are so sophisticated they can brew your morning coffee as well as regulate your house's temperature.

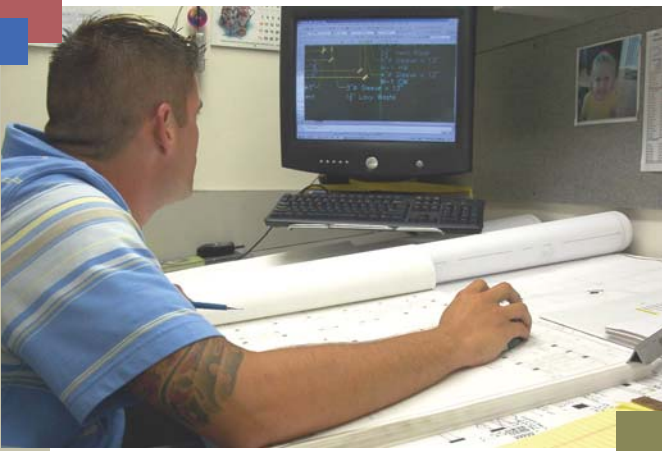
New water reclamation and purification methods include reverse osmosis, ultraviolet light, and desalination. Environmental concerns continue to affect how plumbing fixtures such as toilets and shower nozzles are designed in order to save water, and better mixing and control valves make regulating water temperature safer to prevent scalding.

Asbestos insulation and ozone-depleting refrigerants have long been replaced with more environmentally friendly materials, and technological advancements in manufacturing mean that more reliable and more efficient products continue to be created. The Chunnel and the International Space Station are two of many technological achievements that continue to provide new challenges for HVAC and plumbing and pipe fitting applications.

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## How is the computer used for construction?

You have probably heard of computer-aided drafting/design. Drafters use computers for creating designs, layouts, assembly draw-



*Drafters use the computer to generate drawings, to create parts lists, and to compare multiple views of construction layouts.*

ings, and parts and materials schedules. Three-dimensional visualization helps designers and engineers lay out and compare individual and multiple structural, piping, ventilation and electrical details to ensure that nothing interferes with anything else. Computer aided manufacturing is used in the fabrication of duct assemblies, welding and joining, machining and manufacture of specific components such as valve or pump housings. There is increasing use of automatic controls for climate control, fire and smoke detection and suppression, and process controls.

Software packages for job estimation and project management ease the task of preparing material and labor cost estimates, and just-in-time parts and inventory control help with the ordering and tracking of construction materials and material packages. Managers and supervisors also use the computer to

develop and track construction schedules so they can predict when products and services are needed. Supervisors and crews rely on the latest telecommunications equipment, and

technicians use all kinds of electronic testing and diagnostic equipment, such as sensors for temperature and pressure, laser precision positioning, and welding quality.

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## *Is the work dangerous?*

Any construction work can be dangerous, just like working in a steel mill, factory, the military, or even a hospital. Most construction work is performed outdoors, so the weather has to be considered. Construction sites can be loud, dirty, and hazardous, so most workers and supervisors wear hard hats, safety glasses, safety shoes, welding gloves, and other personal protection equipment as needed. Some industries are inherently dangerous, such as nuclear power or petrochemical plants, but workers are well trained to understand the dangers and work appropriately. There are regulations from the Occupational Safety and Health Act and other federal and state sources that govern worker safety. Sometimes you might have to work in cramped, uncomfortable surroundings in order to install piping or a piece of equipment or ducting. You might be inclined

to think that all the personal protection is a bother, and you just want to “get in there and get the work done.” Don’t be fooled, however, just because a situation looks safe; the protective clothing, tools and precautions are for your safety. Mostly, just use good judgment and common sense. You certainly won’t be bored!

*A pipefitter cuts steel pipe with a cutting torch.*



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## *What education do I need?*

Some amount of post-secondary education is essential. You will find, however, that in construction, on-the-job training is as important as education. How much education you need is dependent on the career path you choose and what you are interested in learning and being qualified to do. Typically you could attend a community college or technical or trade school and obtain a specialty certificate or an associate’s degree in your field. Many engineering and industrial societies and trade associations also offer training in traditional classes, by video, or online in order for you to refresh your skills.

Look for a registered apprenticeship or union trade program that combines education with real world job experience and hands on training (work-based learning). Some programs last 4-5 years, and you would work in the summer or on a seasonal or regular basis. The more formalized the program, the better. The more training and experience you receive, the more money you earn. You might think you’d be better off going to college if you’re putting in that much time, but how many colleges will pay you to work AND study?

## *How would I start out in the workplace?*

You would be known as an apprentice. Apprentices learn on the job while in school and are paid while they learn. They learn by doing in addition to learning from instructors and from textbooks. They work side by side with journeymen and supervisors, learning how to install fixtures or fittings, how to maintain equipment and tools, read blueprints and material lists, follow codes and regulations. Your employer usually pays for your schooling, though you may be asked to work for him

for a certain period of time afterward. Scholarships and student loan programs are also available to help defray the cost. Many high schools offer apprentice and summer worker programs; take advantage of them and gain experience and knowledge even more quickly!

Journeymen are skilled workers who have completed their apprenticeship. Pay is better, and you gain responsibility. Journeymen can handle more complex work, can work independently, and often continue supplemental training to learn more specialty work or to keep abreast of changes in equipment and techniques. They may work with work packages or kits at larger construction sites, which contain all the materials, tools, and information necessary to complete the installation. They may also prefabricate and test certain pipe or duct assemblies in their shop, then take them to the job site to complete installation there.

Masters are experts in their craft who can handle specialty work or very involved projects. Licensing or examination is usually necessary to become a certified master, but they are often their own contractors!



*Apprentices discuss flow problems in a pipefitting class.*

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## *What about planning and management?*

Foremen and forewomen have moved up through the ranks to become supervisors and coordinators of work crews and specific jobs. They have great knowledge of their craft or trade. They inspect drawings, ensure job safety and make sure that the work progresses smoothly. They work with foremen from other disciplines to ensure that all needed services are provided, that the systems and equipment are installed in a manner and a schedule that works best for everyone, that nothing interferes with the installation of anything else, and that all work is completed in a timely manner. They will oversee the routing and staging of materials and equipment and even entire work package pallets, and will oversee the testing and turnover of the final product to the owner. Foremen need to be

clear thinkers and have a good eye for detail; they often have to make quick decisions based on the daily changes at the job site, their knowledge of their craft, and what they have experienced in the past.

General foreman work on large job sites that oversee multiple jobs and crews. There is greater management responsibility, including making personnel decisions, and they work directly with owners, designers and engineers to get the job done.

Estimators (sometimes called planners) review the job site, design drawings, and material specifications to determine the materials and equipment that need to be ordered. They work with the foremen, designers, and project managers. They review building codes and work methods/standards to determine what

equipment and services might be necessary, and review the work schedule to ensure that services and materials are provided at the right time. They select and price materials, estimate the quantity of materials needed, find vendors who will sell them the products, get bids, and purchase the products. They will help determine budgets, or work within existing budgets. They will also solicit bids for support or specialty services such as welders or riggers, or arrange for temporary services such as power or compressed air. Estimators will also estimate the cost of the work required and what amount and type of labor will be involved, and will create and track job orders for the materials, the work performed, and the services provided. Estimators often work under pressure, so accurate work is essential and good organization skills really come in handy. Larger job sites often require materials and tools, drawing plans, installation methods and standards, and equipment and system tests to be gathered or bundled into work kits or work packages, so estimators will often determine what is necessary for each work package.

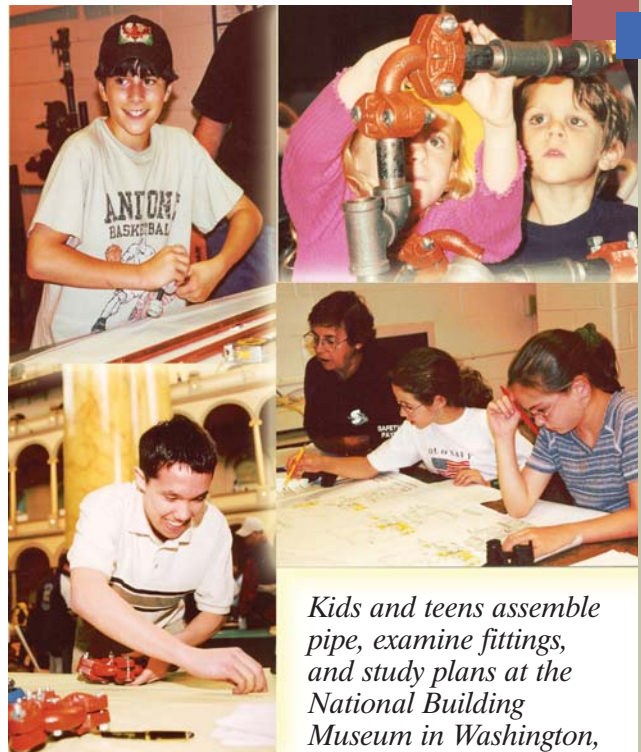
Supervisors (who may also be called superintendents or project managers) administrate specific projects and oversee the entire project design and construction process from conception to turnover. They work with the owner to determine what the job requirements are and to ensure the final product that is delivered meets the owner's satisfaction. Supervisors are instrumental in developing the production or key events schedule, which is necessary to properly sequence work and services. They may review design drawings for completeness and accuracy; may select, approve, and receive materials and services; and may order tests or inspections for equipment. Supervisors oversee construction work, inspect it for quality, and work with foremen to coordinate jobs and crews in order to meet the production schedule. They have to be good problem solvers, organized and methodical, but also be flexible in decision-making when problems arise.

You may even want to consider construction management. Construction managers receive some engineering training, but also study and use training in financial and person-



*Experienced foremen continue their education to keep up with new technology.*

nel management, including estimating and accounting, law, risk management, human resources, and personal and environmental safety. Construction management degree programs are increasingly available at colleges and universities, who recognize that traditional management degrees don't take into account the differences required for effective management in large, industrial settings.



*Kids and teens assemble pipe, examine fittings, and study plans at the National Building Museum in Washington, DC to introduce them to construction.*

## What about design and engineering?

Designers or drafters prepare drawings and plans for use by the construction crews, often at the direction of a design engineer. They may make sketches out in the field to plan what work is to be conveyed in the drawings, or they will work from an engineer's sketches. Drafters then develop the drawings by hand (or increasingly by computer with drafting software such as AutoCAD®). Drawings could describe new installations, or modifications of existing installations. They show dimensions and details, specify where equipment is to be laid out and where services are to be routed, provide instructions for fabrication and assembly, and list all of the materials and components necessary to do the work. They will also describe how the completed work is to be tested or proven for satisfactory performance. Sometimes they will prepare assembly drawings for prefabrication work, as well as layout drawings to show where the prefabricated assemblies will be located.

Engineering or architectural technicians, construction technicians, and construction scientists typically receive associate's degrees or bachelor's degrees in engineering technology. Degree programs are also available in construction technology and construction management. They usually include some business and managerial training along with design and engineering training. Graduates from these programs may conduct various aspects of construction such as equipment testing, welding quality control, or work time studies, or may be involved in creating and tracking construction budgets, schedules, material procurement, or personnel management.

You might see industrial, mechanical, civil, electrical, construction, environmental, fire protection, petrochemical, energy or nuclear engineers on a construction job site. Often, the engineers that work most with

plumbing and HVAC are mechanical and civil engineers. Construction engineering programs that incorporate many disciplines are also increasingly available, and unlike a more general mechanical engineering program, are specifically tailored to train engineers for a future in construction. Architects may also prepare civil, electrical, or piping drawings as well as structural drawings and building layouts. Engineers and architects need to obtain a bachelor's degree in their discipline, and some engineers and architects are required to be licensed by their state, depending on their job functions.

Design or consulting engineers will determine layouts for the new installations or modifications, will select and evaluate equipment and materials, and perform calculations to determine equipment or system sizes, capacities, design loads and service connections. They often work with building codes or engineering standards and specifications to make sure that their designs are compliant. They will review drawings from multiple disciplines to ensure that all equipment and systems are properly laid out for installation, and that proper support, electrical connections, piping connections, and other services are all accounted for. They will also make sure that there are no interferences or misconnections with the installation, and may even provide instructions for temporary modifications of existing systems or structure in order to bring in (route) the new equipment. They work with designer drafters, planners and estimators, foremen and supervisors, as well as other

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### 20 LARGEST CONSTRUCTION UNIVERSITY PROGRAMS

*Source: McGraw-Hill Engineering News Record*

Colorado State University	Kansas State University
Texas A & M University	Arizona State University
Purdue University	Indiana U/Purdue U. of Indianapolis
Auburn University	University of Wisconsin - Stout
Brigham Young University	University of Florida
Louisiana State University	University of Nebraska - Lincoln
East Carolina University	Montana State University
University of Cincinnati	California SPU - San Luis Obispo
California State U - Chico	Florida International University
Iowa State University	Georgia Southern University

engineers and the owner, to ensure that everything is accounted for and to incorporate any changes in design that may be necessary. They also visit the job site to ensure that installation goes smoothly according to schedule and design, and help resolve problems as they occur.

Project engineers oversee entire projects from initial design to final turnover, and plan construction and material budgets, work

schedules, and major milestones. Site engineers oversee the construction site daily and ensure that the necessary services are provided in order to complete the work. Either of these could also be the project managers or construction managers.

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## *What do I need to learn?*

As an apprentice, your classes will include the physics and mathematics applicable to piping or HVAC design and installation. You will learn about pressure, flow, heat transfer, heating and cooling/refrigeration cycles, statics and dynamics, hydraulics, fluid mechanics and dynamics, thermodynamics, and mechanics of materials. You will learn about sanitation, water quality, bacteriology, and climate control. You will learn basic theory and installation techniques in electrical, plumbing, HVAC, structural, welding, and sheetmetal work. You will learn mechanical drawing and how to read drawings and material lists. Everything you learn in the classroom will be reinforced by practice and experience in the lab, shop or field.

To prepare for these fields, you will want to take certain subjects in high school. You should take math courses in algebra, plane geometry and trigonometry. Exposure to some statistics, business math, and engineering economics is also desirable. Students interested in pursuing engineering careers will also need to take more advanced courses.

You should take general high school science courses in physics and chemistry, and it helps also to take biology. To be an effective communicator, you should take four years of courses in reading comprehension, writing and composition, grammar skills, research, and technical or business writing. You should learn computer keyboarding as well as some basic word processing, spreadsheet and Internet research skills.

You want to look for technical schools and apprenticeship programs that will teach you the basic concepts and theory, vocabulary, and

typical problems and industry trends. If your high school offers an introductory course in construction and design, as well as introductory or advanced courses in drafting and CAD, carpentry, electricity, plumbing, HVAC, refrigeration, masonry/bricklaying, hydraulics/pneumatics, welding and metalwork, take as many as you can. Some schools offer these courses as career or curriculum clusters, specially selected to help you learn how to work in a specific field.

Whether you learn in high school or through an apprentice program, you should develop the ability to read and understand design specifications and drawings or blueprints, materials lists, installation instructions, methods and standards, and testing procedures. Learn about work packaging and prefabrication as well as assembly, installation,



*Using drafting and CAD design, piping assemblies are efficiently prefabricated before they are installed at their final location.*

*continued next page*

and modification. Work with hands-on tools and equipment including pipe cutters, welding and brazing equipment, voltmeters, gauges and sensors. Learn how to test equipment and systems, troubleshoot problems, and verify system or component performance.

You may be able to take project courses during your senior year to gain design and hands on experience. They will help you learn problem-solving skills for real work scenarios and often involve working at actual shops and construction sites. Look for summer intern-

ship possibilities with local contractors. Remember that a high school diploma is essential, and post secondary education can be acquired from a variety of sources. You don't have to get a four-year degree right off the top. Aim for a combination of work and study. Remember, also, that a good record of school attendance shows dependability, and involvement in extracurricular or community activities shows that you are well rounded. Both of these will help you get a job!

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### *Do I have to take tests or get licensed?*

For some disciplines, you will. National tests or examinations for some trades are available from the National Center for Construction Education and Research. Many communities and trade associations or organizations have their own requirements. Associations and state agencies have estab-

lished accreditation and licensing criteria. Some engineers, architects, and surveyors are required to be licensed by their state; national exams are held periodically. Ask local contractors, your school, or your state licensing board about what might be required in your community or state.

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### *What other skills should I have?*

The ability to work with others and work as part of a team is essential. Average strength and coordination is fine, but it pays to be in general good health. You should be able to think on your feet to solve problems that

result from unforeseen circumstances. You should be willing to work hard, be punctual, and be determined to get ahead. Know your trade, and learn about changes as they occur. You should be creative, use good judgment, and be organized. Mechanical aptitude is a plus, but neatness and methodical work are good as well. Continue to advance and broaden your education and training to learn new disciplines, new techniques or about new equipment.



*Caption*



## Where might I get work?

You could work for a small business contractor who typically employs a few or a dozen people and serves a small geographical area. Small contractors usually order and sell equipment directly, and design, fabricate, and install equipment and systems, as well as maintain and service them after the fact.

Larger companies employ up to several hundred people, and may encompass part or all of a job site (with a central design or corporate office located on or offsite). They may work on multiple job sites throughout a large

metropolitan area. Or you could work for a local, state, or federal government agency, which typically performs its own design work and, depending on the agency, may perform fabrication, installation and modification work as well. Large companies may subcontract work to small or specialized contractors.

Consulting firms perform design work and cost estimates, and may oversee installation. They employ design engineers, architects and project managers who work with construction contractors to get the work completed.

## Where else could I go with my career?

Having a good technical background in your field, and at least a few years of hands-on experience, gives you various possibilities should you ever want to switch career paths. The more experience and diverse knowledge you gain, the better for you. As you gain more experience and a broader client base, you may even decide to own your own contracting business. You may provide related or specialty services within your current company, such as accounting, marketing or sales. Consider these options.

Specialty contractors provide construction services such as earthmoving or scaffolding, rigging, and crane service for large construction projects. Specialty companies provide design, prefabrication and installation of special systems such as large-scale air conditioning or refrigeration plants, industrial ventilation, water reclamation and treatment, computer and automatic controls, and fire suppression. Contractors could specialize chiefly in maintenance and service work, or offer restoration service for historical preservation. Manufacturing companies make specific equipment, materials and components that designers and installers will use in the field. Merchandising supply and sales vendors sell products and materials, stock inventory, and work with contractors to supply them with the materials and equipment they need at the time they need it.

Government agencies and inspectors develop and enforce design and building codes, develop procedural methods and stan-

dards, inspect job sites for safety and for proper installation and construction, test equipment or systems, approve building permits and final construction. Utility companies provide temporary or permanent power, sanitation, water, fuel and natural gas, compressed air, and other services.

Facility engineers operate, maintain, and modernize equipment and systems once they are complete and will develop and utilize maintenance standards to keep things operating smoothly. Applications engineers select specific equipment necessary to meet design goals, and will often develop and work from design and engineering specifications and industry standards. Research and development engineers engage in new product design, development, manufacturing and testing.



*Ferguson Enterprises is verifying a job order before delivery.*

## What might I do during a typical workday?

First thing in the morning, you might review design drawings or plans for whatever installations that you would be expected to begin or to complete that day. You would take note of whether any changes had been made in the design because of unforeseen problems. Maybe there are problems because some other equipment or structure is located “in the way” or because you may have to make substitutions for materials that haven’t arrived at the job site yet. You would select the equipment and materials necessary to complete your installation work, and check out the appropriate tools from your tool crib or supply locker. You would then take everything to the job site. Once there, you’ll check with the foreman or supervisor to catch up with what’s

going on and to ensure that the services you need, such as power or rigging, are provided. You would verify the path in which your piping or ductwork is supposed to be installed, double check dimensions and measurements, and look for interferences. After lunch you may be ready to begin your installation work. You may have to discuss matters with other trade workers like electricians in order to get your equipment’s electrical connections hooked up. Once the installation work for that day is complete, you would clean up your tools and debris, plan the next day’s work and services, perform any cleaning, flow, or hydrostatic testing required, then spend some time talking with your foreman or supervisor about the jobs that would be performed the next week.

One day you may install new equipment, such as an air conditioning unit and its accompanying systems and components. The next day you may perform a maintenance check on a unit that is already installed on a previous job site, or repair it if the inspection warrants it. The day after that, you may meet with a customer who wants to install a unit. You will plan how and where it will be installed, along with the additional services and equipment necessary for it to operate. No two jobs are ever quite the same, and the experience you gain can be used on future job sites.



*A journeyman prepares to solder fittings in a piping assembly.*

## Conclusion

You will have a lot of choices ahead of you in the next few years, and trying to decide upon a career path can be overwhelming. Talk to your teachers, guidance counselors, family friends and local contractors to try to determine what your best course of action might be. We hope you consider construction work, especially plumbing and HVAC. You will find the work exciting and fulfilling, and financially rewarding as well! You will find that your skills are in demand, and that as the industry grows and changes, you can adapt your skills to meet the new technologies and new concerns. Opportunities exist to branch off into new areas, too, and gain further education. You have a unique opportunity to provide

vital services that ensure comfort, health and well-being. Only a few careers can make that claim!



*Bienvenu Brothers Enterprises of Louisiana was founded in 1930. It is now in its third generation and has employed fourteen family members.*

## Sources include the following documents:

- “Can I Turn HVACR and Plumbing Into a Career?”* Brochure. Association for Career and Technical Education, Alexandria, VA.
- “Job Descriptions for the Construction Industry.”* Report. Oregon Building Congress.
- “Your Future in Plumbing, Heating and Cooling: Answering 14 questions about opportunity, money, security, employment, nature of work, etc.”* Report. Shapiro & Duncan, Inc., Mechanical Contractor, 14620 Rothgeb Drive, Rockville, MD 20850. (301) 315-6260.
- “Take Your Career...to the Max! Management and Engineering Careers in Mechanical Contracting”* Brochure, 1995. *“Your Future in the Plumbing-Heating-Cooling Industry.”* Brochure No. 00-0388A. *“Your PIPELINE to Hot Careers and Cold Cash: Careers in the Plumbing and HVAC Industry.”* Video and brochure, 1994. Mechanical Contractors Foundation, Mechanical Contractors Association of America (MCAA), 1385 Piccard Drive, Rockville, MD 20850. (800) 556-3653 and NAPHCC Education Foundation, National Association of Plumbing-Heating-Cooling Contractors, 180 S. Washington Street, Falls Church, VA 22046. (800) 533-7694.
- “Target a Successful Career in Heating, Ventilation, Air Conditioning, Refrigeration and Plumbing: Can I turn HVACR and plumbing into a career?”* Brochure. Refrigeration, Plumbing, HVAC Career Education Coalition, PO Box 4361, Washington, DC 20044.
- “The Nation’s C-Schools: Undergraduate construction programs raise skills and expectations, but face own challenges.”* Magazine and online article. 29 October 2001. McGraw-Hill Construction Engineering News - Record. McGraw-Hill.  
Online at <http://enr.construction.com/features/education/archives/011029a.asp>.



## Websites

### Career ideas and teacher resources

[www.futureforcenow.com](http://www.futureforcenow.com)

[www.coolcareers.org](http://www.coolcareers.org)

[www.abc.org](http://www.abc.org)

[www.acteonline.org/career/skills/index.cfm](http://www.acteonline.org/career/skills/index.cfm)

Coalition of Industry Associates

Heating, Ventilation, Air Conditioning, Refrigeration and Plumbing Career Education Coalition

Associated Builders and Contractors, Inc.

Association for Career and Technical Education

### Education, certification, and apprenticeship programs

[www.nccer.org](http://www.nccer.org)

[www.acce-hq.org](http://www.acce-hq.org)

[www.abet.org](http://www.abet.org)

[www.nait.org](http://www.nait.org)

[www.mcaa.org](http://www.mcaa.org)

[www.obcweb.org](http://www.obcweb.org)

[www.ari.org/edu/schools.html](http://www.ari.org/edu/schools.html)

[www.natex.org](http://www.natex.org)

[www.pahra.hvacr.org](http://www.pahra.hvacr.org)

[www.rses.org](http://www.rses.org)

[www.acca.org](http://www.acca.org)

[www.theplumber.com](http://www.theplumber.com)

[www.skillsusa.com](http://www.skillsusa.com)

National Center for Construction Education and Research

American Council for Construction Education

Accreditation Board for Engineering and Technology

National Association for Industrial Technology

Mechanical Contractors Association of America

Oregon Building Congress

Air Conditioning and Refrigeration Institute

The North American Technician Excellence Program

The Partnership of Air Conditioning, Heating and Refrigeration Accreditation Program

Refrigeration Service Engineers Society

The Air Conditioning Contractors of America

Hill Daughtry

SkillsUSA

### Technical societies and trade associations

[www.smacna.org](http://www.smacna.org)

[www.hardinet.org](http://www.hardinet.org)

[www.ashrae.org](http://www.ashrae.org)

[www.icarma.org](http://www.icarma.org)

[www.agc.org](http://www.agc.org)

[www.phccweb.org](http://www.phccweb.org)

[www.phccweb.org/auxiliary](http://www.phccweb.org/auxiliary)

Sheetmetal and Air Conditioning Contractors' National Association

Heating, Air Conditioning, and Refrigeration Distributors International

American Society of Heating, Refrigeration, and Air Conditioning Engineers, Inc.

International Council of Air Conditioning and Refrigeration Manufacturers' Association

Associated General Contractors

Plumbing, Heating, Cooling Contractors-National Association (PHCC-NA)

Plumbing, Heating, Cooling Contractors-National Auxiliary

### Services, products, online magazines and information

[www.AHAM.org](http://www.AHAM.org)

[www.gamanet.org](http://www.gamanet.org)

[www.heatinghelp.com](http://www.heatinghelp.com)

[www.plumbinghvac.com](http://www.plumbinghvac.com)

[www.enr.com](http://www.enr.com)

[www.contractormag.com](http://www.contractormag.com)

Association of Home Appliance Manufacturers

Gas Appliance Manufacturers Association

Don Holohan Associates, Inc.

The Building and Home Improvement Network

McGraw-Hill Construction Engineering News-Record

Penton Media, Inc.