

Residential Plumbing Standards

Volume I

Home Builders Institute

An Overview of HBI Framework for Skill Standards

We are pleased to present the fourth in a series of National Skill Standards for the residential construction industry. The goal of this project is to establish national standards for the residential construction industry that reflect industry skill requirements. The standards will provide a basis for the certification and training of workers as well as objective benchmarks for employee selection and training needs. In addition, educators will find the standards useful for designing curricula and evaluating individual training outcomes.

These standards by themselves do not represent a model training program. Rather, these standards are designed to be a source in developing training programs and curricula and evaluating outcomes of residential plumbing training program outcomes.

Residential plumbing standards are designed for trainees entering the second year of training and journey level plumbers. Standards are developed and validated for the following nine plumbing specialties: *Public Water and Sewer Connections, Private Water and Sewer Connections, Lift Stations and Sewage Systems, Water Quality and Filtration Systems, Solar Systems, Hydronic Heating Systems and Boilers, Gas Piping, Backflow Protection, and Irrigation Protection*. Thirteen (13) critical work functions or duty areas are identified.

Critical work functions describe the major tasks and content areas of work within a specialty.

Key activities or major tasks and knowledge involved in completing critical work functions are also provided.

Performance Indicators, or skill standards, which help determine when key activities are being performed, are referenced to critical work functions.

In addition, applied academic skills required to perform key activities are provided. These include mathematics, communications, and applied science academic skills.

Safety requirements are also linked to key activities.

How the Standards Were Developed

Committees of subject matter experts (SMEs) representing residential plumbers, small and medium size plumbing contractors, instructors, trainers and other experts in the field from different parts of the nation were used to establish and validate the standards. The final list of (13) thirteen critical work functions cutting across nine plumbing specialties reflects and accommodates regional differences.

The project included the formation of a committee of National Association of Home Builders (NAHB) leaders in the field of plumbing. In addition, the author and editor of Delmar's plumbing text (Thompson Learning Company) were included in this committee.

These leaders represented the following regions: Northeast, Northwest, Southwest, Southeast, Mid-Atlantic and Gulf Coast.

- A preliminary list of critical work functions and activities performed by residential plumbers was developed and organized into duty areas. Sources included industry texts and curricula, as well as association reference.
- An initial committee of nine SMEs edited, reviewed and rated critical work functions, key activities and applied academic skills. The committee also reviewed and referenced applied academic skills, safety requirements and tools

required for each of these functions and activities.

- A second group of eight SMEs cross-validated the original list and developed and approved performance standards for critical work functions and key activities.

Residential Plumbing Specialties

Subject Matter Experts (SMEs) divided the broad plumbing occupational category into nine specialties. This reflects the trends towards specialization in the residential home building industry.

The table below shows the percent of all plumbing activities performed by each specialty. A total 92 activities were identified and rated by the committees.

Table 1. What percent of plumbing activities are performed by each specialty?

Public Water/Sewer Connections	84%
Private Water/Sewer Connections	83%
Solar Systems	80%
Backflow Protection Systems	74%
Lift Stations & Sewage Systems	65%
Hydronic Heating Systems	65%
Gas Piping	65%
Irrigation Systems	54%
Water Quality & Filtration Systems	45%

Table 1 illustrates core of occupational activities common to many plumbing specialties.

For example, through training in Heat Pumps, trainees should gain a broad based to work in other specialties.

How Standards are Organized

Plumbing standards are organized into the follow broad categories: Applied Academic Skills; Basic Occupational Skills; and Specific Occupational Skills. Performance indicators or skill standards have been developed for each key activity or major tasks and knowledge required for completing critical work functions.

Applied Academic Skills include Basic Plumbing Theory, Mathematics, Communications and Science Skills that are fundamental to plumbing trainers and journey level workers.

Basic Occupational Skills include Safety, Tools and Equipment, as well as plumbing materials, joining and connecting pipe and using drawings and plans.

Plumbing Occupational Skills are organized into the following critical work functions *skill* categories: (1)

Install Drainage, Waste & Vent Systems (DWV), (2) Install Water Supply & Distribution Systems, (3) Install Fixtures, Appliances and Equipment, (4) Install Domestic Water Heaters, (5) Install Boilers, (6) Hydronic Heat, and (7) Troubleshoot, Maintain & Repair

The percent of all trainee and journey level plumbers who perform tasks and key activities, and importance of these tasks are displayed in Appendix A.

Applied Academic Skills

Residential plumbers must master a broad array of applied academic skills in order to work and communicate effectively on the job site.

Basic Plumbing Theory

- Understand and apply basic public health issues of water supply and sewage disposal to residential plumbing.
- Understand and apply basic principles of alternating and direct current.
- Understand and apply basic principles of the British Thermal Unit (BTU).
- Understand and apply basic principles of expansion of water and effect on plumbing systems and components.
- Understand and apply basic principles of drainage, waste and vent systems.
- Understand and apply basic principles of domestic water distribution systems.

- Understand and apply basic principles of natural gas and propane systems.

Mathematics

- Perform simple arithmetic functions including addition, subtraction, multiplication, and division of whole, decimals, fractions and mixed numbers with and without calculators.
- Measure and calculate linear distances, circles, angles, and radii.
- Identify common geometric shapes and compute volumes using basic geometry.
- Measure water weight, volume and pressure.
- Calculate pressure from height of water.
- Understand and interpret job and manufacturers' tables, graphs and charts.
- Understand and explain the relationship between water pressure, head and force.
- Calculate end-to-end and center-to-center measurements.

- Solve multi-step problems using basic applied formulas.
- Calculate grade, percent grade, drop and run of piping.

Communication Skills

- Follow verbal directions.
- Follow written directions including reading and understanding technical manuals, schematics, tables, graphs, and charts.
- Give one- or two-step directions to associates and clients.
- Give multiple-step directions to associates and clients involving using diagnostic and technical data and information.

Science

- Understand and apply basic principles of temperature, pressure and temperature conversion.
- Understand and apply basic principles of heat transfer and combustion.
- Understand and apply basic principles of matter, mass and weight.

Basic Occupational Skills

Plumbers are also required to be proficient in a variety of basic occupational skills, many of which cut across all of the plumbing specialties.

General Safety Procedures

- Understand and apply proper safety procedures when working with pressurized systems, electrical energy, heat, cold, chemicals, rotating machinery, and heavy objects.

Safety Rules

- Understand and apply Occupational Safety and Health Administration (OSHA) regulations that cover plumbing practices.
- Understand and apply Environmental Protection Agency (EPA) regulations that cover water quality and venting.
- Apply basic fall protection safety procedures.
- Apply all OSHA, EPA and DOT hazardous materials safety procedures.
- Apply local plumbing codes and regulations.
- Apply safety and maintenance procedures for power tools and electrical cords.
- Apply OSHA trenching safety procedures.
- Apply vehicle loading, operation and maintenance safety procedures.
- Apply OSHA ladder and scaffold safety and maintenance procedures.
- Apply personal protective equipment (PPE) including safety glasses, electrical protection, shoes, hardhat, and other practices.
- Use safe methods and tools for lifting and moving materials and equipment to prevent personal injury and property damage.
- Use proper procedures to prevent, report and respond to fire and other safety hazardous risks.
- Apply brazing and soldering safety procedures to prevent fires and personal injury.
- Use proper protection and procedures to avoid contamination and infection from blood-borne pathogens.
- Use proper procedures to prevent explosions when working on natural gas and propane systems.
- Apply safety requirements for working in confined spaces.

Tools and Equipment

Basic Safety of Plumbing Tools and Equipment

- Describe and apply proper safe practices when using tools and equipment in residential plumbing.
- Describe and apply proper safe practices used for soldering and brazing.

Join Pipe and Connections

- Identify, select, measure and install the proper type of pipe and tubing used in heating and plumbing applications.
- Identify, select, measure and install the proper type of valves and other components used in heating and plumbing applications.
- Describe and apply proper procedures for measuring and fabricating copper pipe, including brazing, soldering, cutting, cleaning reaming, bending and flaring.
- Describe and apply proper procedures for measuring, fabricating and testing plastic water and drainage, waste and vent pipe including

cutting, cleaning, solvent welding, connecting and hanging.

- Describe and apply proper procedures for measuring, cutting, cleaning, reaming, threading and testing steel pipe joined with thread sealant that is properly applied.
- Describe and apply proper procedures for measuring, fabricating and testing cast iron pipe.
- Describe and apply proper procedures for measuring, fabricating and testing flexible gas pipe.
- Explain factors that affect the selection of proper fittings or valves for a specific installation including backwater valves, gate valves, globe valves, check valves, elbows, tees unions, etc.
- Explain the various factors that affect the selection of flanges, hangers, supports and insulation.

- Describe and explain the use of fitting allowances when fabricating piping.
- Provide for proper allowances for threaded steel, copper tubing and plastic pipe fittings.
- Provide equal spacing of fittings using center-to-center measurements.
- Properly install piping with 45-degree diagonals and offsets with Wye fittings.

Plumbing Materials

- Properly identify and select piping, valves and fittings using standard plumbing specifications.
- Describe, select and install hanging devices and supports.
- Describe, select and install plumbing components using proper fasteners, adhesives, primers, compounds, caulking, putty and seals.
- Properly identify and select plumbing fixtures taking into account fixture clearances.

- Properly identify and select lead-free flux, solder and brazing materials for the appropriate applications.

Plumbing Drawings, Plans and Charts

- Properly identify fixture symbols and placement of fixtures in construction site using drawings.
- Correctly interpret symbols, dimensions and placement of plumbing fixtures and piping on isometric drawing.
- Read plan view and isometric drawings using standard plumbing fixture and piping symbols.
- Sketch plan view and isometric drawings using standard plumbing fixture and piping symbols.
- Correctly interpret and understand plumbing symbols and location of fixtures and piping on residential construction plans.

Skill Levels and Training

Plumber trainee skill standards can typically be met in a one-year training program depending upon the student's prior educational background (especially in the area of mathematics and science), work experience, interests and mechanical aptitude, as well as breadth, scope and sequence of the training program. Trainees usually perform work under the direction of a journey level plumber.

Trainee skills are typically learned in a high school vocational program, apprenticeship program, informal or formal plumbing-based training program, on-the-job-training or some combination of these.

Journey plumbers work independently and typically have completed an apprentice program. Incumbent workers with extensive experience in plumbing may be able to demonstrate competence on standards with little or no additional structured training.

Plumbing Occupational Skills

Plumbing specialties require different skill sets, standards and performance indicators. The following pages detail critical work functions, activities and standards for the following plumbing specialties: public water and sewer connections, private systems, lift stations and sewage systems, solar systems, hydronic heating and boilers, gas piping, backflow protection and irrigation systems.

Install Drainage, Waste & Vent Systems

Sizing the Drainage System

- Understand and apply the principles of drainage systems.
- Determine drainage system sizing using drainage fixture units.
- Determine proper pipe sizing according to local codes.

Excavation and Grade

- Excavate and backfill a trench to proper grade.
- Comply with applicable local codes and OSHA standards including proper shoring and barricading.

Building Drains

- Understand and apply principles of building drains.
- Install main building drains according to plan specifications.
- Fabricate watertight joints and support all joints.
- Comply with applicable local codes.
- Follow all applicable safety procedures.

Change of Direction/Fitting Uses

- Understand and apply principles of proper use of change of direction fittings.
- Install fittings in building drains according to plan specifications.
- Fabricate watertight joints and support all joints.
- Comply with applicable local codes.
- Follow all applicable safety procedures.

Soil and Waste Stacks, Vent Stacks and Stack Vents

- Understand and apply principles of stacks.
- Explain the purposes of stacks.
- Identify piping materials used to fabricate stacks.
- Install stacks according to plans.
- Fabricate watertight joints and support all joints.
- Comply with applicable local codes.
- Follow all applicable safety procedures.

Fixture Venting

- Understand and apply principles of venting.
- Explain the purposes of trap distance regulations.
- Install vents according to plans.
- Comply with applicable local codes.
- Follow all applicable safety procedures.

Traps & Cleanouts

- Describe the purposes of traps and cleanouts.
- Install traps and cleanouts according to plans.

- Fabricate watertight joints and support all joints.
- Comply with applicable local codes.
- Follow all applicable safety procedures.

Floor Drains

- Describe the various types of floor drains.
- Estimate proper size of floor drains.
- Install floor drains according to plans and specifications.
- Fabricate watertight joints and support all piping and joints.
- Comply with applicable local codes.
- Follow all applicable safety procedures.

Air Admittance Valves

- Describe the function of air admittance valves.
- Install air admittance valves according to plans.
- Comply with applicable local codes.

- Follow all applicable safety procedures.

Fixture Supports

- Install fixture supports according to plans and manufacturer's specifications.
- Comply with applicable local codes.
- Follow all applicable safety procedures.

Testing Drainage Systems

- Test drainage systems for leaks.
- Comply with applicable local codes.
- Follow all applicable safety procedures.

Building Sewer & Public Tie-Ins (at curb)

- Describe different types of pipe materials used for house sewers.
- Install sewer and public ties-ins at proper grade with proper supports.

- Align pipes and ensure that joints are leak-free.
- Install backwater valves as required.
- Comply with applicable local codes.
- Follow all applicable safety procedures.

Install Water Supply & Distribution Systems

Sizing the Water Supply Systems

- Understand the basic principles of friction loss and water velocity in pipes.
- Size the water supply system based on water supply fixture units and local code requirements.

Roughing-In

- Describe piping materials used in rough-in.
- Describe the function of rough-in components including hose bibbs, water meters, curb boxes, strainers, pressure-reducing valves and bypass.

- Rough-in a residential water supply and distribution system according to plans.
- Cap and test all water lines before wall covering is applied.
- Comply with applicable local codes.
- Follow all applicable safety procedures.

Cross Connections

- Explain the danger of cross connections and function of backflow preventers.
- Explain procedures for preventing back siphonage through water pipes.
- Describe how and where cross connections can occur.

Backflow Protection

Explain the causes and prevention of backflow.

Thermal Expansion Caused by Closed System

- Explain the affect of thermal expansion caused by a closed system.

Water Hammer Arrestors

- Explain causes of water hammer.
- Install water-hammer arrestors according to manufacturer and plan specifications.
- Comply with applicable local codes.
- Follow all applicable safety procedures.

Water and Hydrostatic Pressure Testing

- Understand and perform tests of water pressure and hydrostatic water pressure.
- Comply with all applicable safety procedures.

Water Service

- Describe the different piping materials for water service.

Water Supply

- Identify the principal sources of potable water.
- Identify principles of water quality and filtration.

- Describe the differences between public and private water systems.

Private Water Systems

- Describe the major components of private water systems including pumps, switches, control valves and pressure tanks.
 - Explain how the parts of private water systems work together.
 - Comply with applicable local codes.
 - Follow all applicable safety procedures.
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- Install a water service according to plans and specifications.
 - Test and inspect leaks and flow according to plan specification.
 - Comply with applicable local codes.
 - Follow all applicable safety procedures.

Water Meters

- Explain the function of a water meter.
- Comply with applicable local codes

Fixtures, Appliances and Equipment

Fixture Rough-In

- Describe the major components used in rough-in.
- Properly rough-in piping and components according to manufacturer's specifications and construction plans.
- Comply with applicable local codes and regulations.
- Follow all applicable safety procedures.

Faucets

- Describe the different types of faucets commonly used in residential construction.
- Properly identify the faucets, place in correct position, and fabricate watertight joints.

- Place faucet spouts above the flood level rim of fixture.
- Test all joints for leaks.

Tubs and Showers

- Describe the different types of shower heads and body sprays commonly used in residential construction.
- Install tubs, shower receptors (units) and valves (faucets) according to manufacturer specifications and applicable codes.
- Properly place shower heads and fabricate watertight joints.
- Test all joints for leaks.
- Follow all applicable temperature control and safety procedures.

Connect Waste and Overflow Outlets

- Describe the purpose of waste and overflow outlets.

- Properly install waste and overflow drains using putty, caulking, other appropriate sealants and washers.
- Test all joints for leaks.

Strainers & Port Openings or Pop-Ups

- List the parts and purpose of overflows.
- Properly install strainers, port openings and pop-ups using pipe dope and putty.
- Test all overflows for leaks.

Water Heaters

- Understand and apply principles of electric and gas water heaters.
- Describe proper components of electric and gas water heaters.
- Install water heaters according to manufacturer specifications and local codes.
- Test all joints for leaks.
- Follow all applicable safety procedures.

Water Closers and Bidets

- Describe the different types of water closets and bidets used in residential construction.
- Install water closets and bidets according to manufacturer specifications.
- Test all joints for leaks.
- Follow all applicable safety procedures.

Dishwashers

- Properly install dishwashers according to manufacturer specifications and local codes.
- Test all joints for leaks.
- Follow all applicable safety procedures.

Laundry Tubs

- Properly install laundry tubs.
- Test all joints for leaks.
- Follow all applicable safety procedures.

Trap and Faucet Connections

- Describe the proper trap and faucet connections commonly use in residential construction.
- Properly install trap and faucet connections per manufacturer specifications.
- Use smooth-jawed wrenches or strap wrenches to avoid marring fixture finishes.

Sump Pumps, Ejector Systems and Cellar Drains

- Understand and apply principles of submersible sump pumps, sewage ejector systems and cellar (subsurface) drains.
- Explain the purpose of check valves, gate valves and unions used in connection with sump pumps and ejector systems.
- Install pumps according to manufacturer specifications.
- Comply with applicable local codes.
- Follow all applicable safety procedures.

Handicapped-Accessible Facilities

- Install handicapped accessible fixtures according to manufacturer specifications and applicable codes.
- Comply with applicable national and local codes.
- Follow all applicable safety procedures.

Install Domestic Water Heaters

Heating Water

- Understand the principles of water circulation.
- Describe factors that affect circulation.
- Describe how circulating water pipes are installed to permit proper circulation.
- Size a water heater according to residence requirements.
- Describe the operation of hot water circulating systems.

Gas Water Heaters

- Describe the operation of gas water heaters.
- Describe the major parts of gas water heaters.
- Install a gas water heater according to plans and manufacturer specifications.
- Comply with applicable local codes and NFPA standards.
- Follow all applicable safety procedures.

Electric Water Heaters

- Describe the operation of electric water heaters.
- Describe the major parts of electric water heaters.
- Install an electric water heater according to plans and manufacturer specifications.
- Comply with applicable local codes and NFPA standards.
- Follow all applicable safety procedures.

Thermostats

- Understand principles and operation of thermostats.

- Describe the operation of thermocouples and thermopiles in gas- fired water heaters.
- Explain safety procedures and controls for gas fired water heaters.

Relief Valves

- Describe the operation of temperature/pressure (T&P) relief valves.
- Describe the purposes and uses of T&P relief valves.
- Describe the operation of lever and weight, spring and diaphragm relief valves.
- Select and install proper relief valve.

Expansion Tanks

- Describe the purpose of expansion tanks.
- Apply Boyle's Law to the operation of expansion tanks.
- Select and install proper expansion tank.

Tankless Water Systems

- Understand and apply principles of types of tankless water systems.
- Describe the operation of tankless water systems.
- Install a tankless water system according to plans and manufacturer specifications.
- Comply with applicable local codes and NFPA standards.
- Follow all applicable safety procedures.

Solar Water Heaters

- Understand the operation of solar water heating systems.
- Describe the major components of solar water heating systems including collectors, heat exchangers, pump, storage tank and temperature control.
- Install a solar water system according to plans and manufacturer specifications.

- Comply with applicable local codes.
- Follow all applicable safety procedures.

Dielectric Connections

- Understand and apply principles of dielectric connections.

Earthquake & Regional Conditions

- Understand the effect of earthquakes and other regional conditions on plumbing.

Mixing Valves

- Describe the function and uses of mixing valves.
- Describe differences between mixing and tempering valves.
- Select and install mixing valves according to manufacturer specifications and local codes.
- Comply with all applicable safety procedures.

Boilers

- Understand and apply principles of electric, gas and oil boilers.
- Select and install appropriate boilers according to manufacturer specifications and local codes.
- Test boiler system components and safety controls.
- Follow all applicable safety procedures.

Hydronic Heat

Principles of Hydronic Heat

- Understand and apply principles of gas-fired, electric or oil-fired hot water and radiant panel hydronic heating systems.
- Describe the major components of a hydronic heating systems including pressure relief valve, zone control valve, balancing valve, limit controls, expansion tank, boiler, backflow prevention device and air elimination device.

- Understand and apply principles of centrifugal pumps.

Install Hydronic Heating Systems

- Install gas-fired, electric or oil-fired hot water and radiant panel hydronic heating systems according to manufacturer specifications.
- Comply with applicable codes and regulations.
- Install boiler, pumps, piping, makeup water supply and other components properly for the correct water flow to meet a building's heating and domestic hot-water requirements.
- Fill and bleed the system according to manufacturer specifications.
- Install all safety devices properly as required by local codes.
- Follow all applicable safety procedures.

Test Integrity of Hydronic Heating Water Circuits

- Test hydronic heating piping system, including heating and hot-water circuits for leaks and air entrapment.
- Make adjustments as required.
- Follow all applicable safety procedures.

Hydronic Heating Systems Start-Up

- Perform all applicable safety tests that meet manufacturer specifications and applicable codes at start-up.
- Follow all applicable safety procedures.

Troubleshoot, Maintenance and Repairs

Diagnosing & Repairing Fixtures & Appliances

- Follow systematic and comprehensive diagnostic practices consistent with manufacturer specifications.
- Record anything not meeting specifications.

- Recommend and complete repairs that meet applicable manufacturer and job specifications and local codes.

Diagnosing & Repairing Water Distribution Systems

- Follow systematic and comprehensive diagnostic practices consistent with manufacturer specifications and generally acceptable plumbing practices.
- Record measurements not meeting specifications and other problems.
- Recommend and complete repairs that meet applicable manufacturer and job specifications and local codes.

Diagnosing & Repairing Gas Systems

- Follow systematic and comprehensive diagnostic practices consistent with manufacturer specifications and generally accepted plumbing practices.
- Record measurements not meeting specifications and other problems.
- Recommend and complete repairs that meet applicable manufacturer and job specifications, local codes and NFPA standards.

Diagnosing & Repairing Drainage and Vent Systems

- Follow systematic and comprehensive diagnostic practices consistent with generally accepted plumbing practices.
- Record anything not meeting specifications.
- Recommend and complete repairs that meet job specifications and local codes.

Diagnosing & Repairing Heating Systems

- Follow systematic and comprehensive diagnostic practices consistent with manufacturer specifications and generally accepted plumbing practices.
- Record measurements not meeting specifications and other problems.
- Recommend and complete repairs that meet applicable manufacturer and job specifications and local codes.

Diagnosing & Repairing Water Heating Systems

- Follow systematic and comprehensive diagnostic practices consistent with manufacturer specifications and generally accepted plumbing practices.
- Record measurements not meeting specifications and other problems.
- Recommend and complete repairs that meet applicable manufacturer and job specifications and local codes.

Clearing Stoppages

- Describe how to locate stoppages.
- Describe safety hazards and personal health considerations when clearing stoppages.
- Clean fixture traps and trap arms, vents and sewage pipes.
- Follow all applicable safety procedures.

Critical Work Functions and Key Activity Ratings

Appendix A shows importance ratings and percent of trainees and journey level plumbers who perform critical work functions and key activities for the nine plumbing specialties.

Importance

The importance of key activities, tasks and topical content areas reported in Appendix A reflects the proficiency or skill required to perform each task and the impact or risk to the employer, job incumbent,

and/or homeowner if the task is preformed improperly. Impact or risk includes possible injury to the job incumbent, financial/litigation exposure to the employer, health risk to the homeowner, to name but a few.

Proficiency was rated by the SMEs using a four-point scale with 1 indicating Minimally Skilled and 4 indicating Highly Skilled.

Risk was rated using a four-point scale with 1 indicating Minimal Risk and 4 indicating Catastrophic Risk.

The *percent of trainees and journey level plumbers performing activities* was determined by SMEs.

Appendix B lists tools and equipment required for trainees and journey level residential plumbers.

Appendix A HBI/NAHB Plumbing Standards Importance Matrix

Rating Scale

Extremely Important Content/Tasks 13-16
Moderately Important Content/Tasks 9-12
Somewhat Important Content/Tasks 5-8
Low Importance Content/Tasks 0-4

Specialties

PWC Public Water/Sewer Connections **Hyd** Hydronic Heating & Boilers
PrSys Private Systems **Gas** Gas Piping
Lift Lift Stations & Sewage Systems **BFP** Backflow Protection
WQ Water Quality/Filtration Systems **Irrig** Irrigation Systems
Solar Solar Systems

Critical Work Functions/Duty Areas	Importance		Percent Who Perform Task		Which specialties perform this task?								
	Trainee	Journey	Trainee	Journey	PrSys	PWC	Solar	BFP	Lift	Hyd	GAS	Irrig	WQ
Safety & OSHA Regulations													
OSHA, MSDS and Local Regulations	16	16	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Personal Protection Equipment	16	16	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
First Aid & Medical Emergencies	16	16	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Burn Protection	16	16	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Blood-Borne Pathogens	16	16	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Electrical Safety	16	16	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Trenches	16	16	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		
Ladders & Fall Protection	16	16	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Vehicle Loading, Operation & Maintenance	16	16	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Material Handling	16	16	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Average	16	16											
Basic Plumbing Theory													
Public Health Issues (Water Supplies, Sewage Disposal)	8	16	40%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drainage, Waste & Vent Theory	4	16	40%	100%	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>				
Domestic Water Distribution Systems	2	16	40%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>
Natural Gas & Propane Systems	1	16	10%	100%						<input type="checkbox"/>	<input type="checkbox"/>		
British Thermal Units	1	4	10%	30%			<input type="checkbox"/>			<input type="checkbox"/>			
Expansion of Water	1	12	10%	50%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>			
Basic Electricity	4	12	10%	80%	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>			
Average	3	13											

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Specialties

PWC Public Water/Sewer Connections **Hyd** Hydronic Heating & Boilers
PrSys Private Systems **Gas** Gas Piping
Lift Lift Stations & Sewage Systems **BFP** Backflow Protection
WQ Water Quality/Filtration Systems **Irrig** Irrigation Systems
Solar Solar Systems

Critical Work Functions/Duty Areas	Importance		Percent Who Perform Task		Which specialties perform this task?								
	Trainee	Journey	Trainee	Journey	PrSys	PWC	Solar	BFP	Lift	Hyd	GAS	Irrig	WQ
Using Plumbing Tools & Equipment													
Measuring & Leveling Tools	9	12	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hand & Power Tools	12	16	90%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Soldering	16	16	90%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Brazing	1	16	5%	50%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Average	10	15											
Plumbing Materials Supplies													
Pipe, Valves & Fittings Specifications & Identification	6	12	95%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fasteners, Hangers & Supports	3	8	95%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fixture Identification & Allowances	6	8	90%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Compounds, Caulking, Putty & Seals	6	8	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adhesives & Primers	9	12	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flux & Solder	9	12	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Average	7	10											

Appendix A HBI/NAHB Plumbing Standards Importance Matrix

Rating Scale

Extremely Important Content/Tasks 13-16
Moderately Important Content/Tasks 9-12
Somewhat Important Content/Tasks 5-8

Low Importance Content/Tasks 0-4

Specialties

PWC Public Water/Sewer Connections **Hyd** Hydronic Heating & Boilers
PrSys Private Systems **Gas** Gas Piping
Lift Lift Stations & Sewage Systems **BFP** Backflow Protection

WQ Water Quality/Filtration Systems **Irrig** Irrigation Systems
Solar Solar Systems

Critical Work Functions/Duty Areas	Importance		Percent Who Perform Task		Which specialties perform this task?								
	Trainee	Journey	Trainee	Journey	PrSys	PWC	Solar	BFP	Lift	Hyd	GAS	Irrig	WQ
Join Pipe & Connections													
Types of Piping Materials (PVC, steel, copper)	8	16	80%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Valves and Other Components	4	12	50%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Design Specifications	1	12	10%	75%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Plastic Pipe													
Types of Plastic Pipe	12	16	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fitting, Connecting, Insulating & Supporting	9	16	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Copper Pipe													
Types of Copper Pipe	8	16	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fitting, Connecting, Insulating & Supporting	9	16	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Steel Pipe													
Types of Steel Pipe	4	16	75%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fitting, Connecting & Supporting	6	16	50%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flexible Gas					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Types of Flexible Gas Pipe	12	16	75%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fitting, Connecting & Supporting	6	16	75%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cast Iron													
Types of Cast Iron Pipe	4	16	50%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fitting, Connecting & Supporting	6	16	10%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Average	7	15											

Appendix A HBI/NAHB Plumbing Standards Importance Matrix

Rating Scale

Extremely Important Content/Tasks 13-16
Moderately Important Content/Tasks 9-12
Somewhat Important Content/Tasks 5-8
Low Importance Content/Tasks 0-4

Specialties

PWC Public Water/Sewer Connections **Hyd** Hydronic Heating & Boilers
PrSys Private Systems **Gas** Gas Piping
Lift Lift Stations & Sewage Systems **BFP** Backflow Protection
WQ Water Quality/Filtration Systems **Irrig** Irrigation Systems
Solar Solar Systems

Critical Work Functions/Duty Areas	Importance		Percent Who Perform Task		Which specialties perform this task?								
	Trainee	Journey	Trainee	Journey	PrSys	PWC	Solar	BFP	Lift	Hyd	GAS	Irrig	WQ
	Use Blueprints, Plans, Drawings & Specifications												
Reading Residential Plans & Blueprints	6	12	30%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Specifications & Placement Drawings	6	12	50%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reading Plan View Drawings	6	12	50%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sketching Plan View Drawings	1	12	20%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reading Isometric Drawings	2	12	20%	95%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sketching Isometric Drawings	1	12	10%	50%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Average	4	12											
Install Drainage, Waste & Vent Systems													
Sizing the Drainage System	1	12	15%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Excavation & Grade	12	16	75%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Building Drains	1	8	75%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Change of Direction/Fitting Uses	4	8	75%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stacks and Branches	1	8	75%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Venting Types & Codes	1	12	50%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Traps & Cleanouts	3	8	75%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Floor and Area Drains	2	8	75%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Air Admittance Valves	3	8	75%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fixture Supports	2	8	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Testing Drain Systems for Leaks	3	8	90%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Building Sewer & Public Tie-Ins (at curb)	4	12	75%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Average	3	10											

Appendix A HBI/NAHB Plumbing Standards Importance Matrix

Rating Scale

Extremely Important Content/Tasks 13-16
 Moderately Important Content/Tasks 9-12
 Somewhat Important Content/Tasks 5-8
 Low Importance Content/Tasks 0-4

Specialties

PWC Public Water/Sewer Connections **Hyd** Hydronic Heating & Boilers
PrSys Private Systems **Gas** Gas Piping
Lift Lift Stations & Sewage Systems **BFP** Backflow Protection
WQ Water Quality/Filtration Systems **Irrig** Irrigation Systems
Solar Solar Systems

Critical Work Functions/Duty Areas	Importance		Percent Who Perform Task		Which specialties perform this task?								
	Trainee	Journey	Trainee	Journey	PrSys	PWC	Solar	BFP	Lift	Hyd	GAS	Irrig	WQ
	Install Water Supply & Distribution Systems												
Sizing the Water Supply Systems (Volume, Friction Loss)	1	12	15%	100%	<input type="checkbox"/>	<input type="checkbox"/>							<input type="checkbox"/>
Roughing-In	4	12	75%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>
Cross Connections	8	16	50%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>			<input type="checkbox"/>
Backflow Protection	2	16	50%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>			<input type="checkbox"/>
Pressure Reducing Valve	1	8	50%	100%	<input type="checkbox"/>	<input type="checkbox"/>							<input type="checkbox"/>
Thermal Expansion Caused by Closed System	2	16	50%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>			
Water Hammer Arrestors	2	4	75%	100%	<input type="checkbox"/>	<input type="checkbox"/>							
Testing Water Supply Systems	4	12	100%	100%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>			<input type="checkbox"/>
Water Service	4	8	75%	100%	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>					
Private Water Systems (wells)	1	2	15%	75%	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>					<input type="checkbox"/>
Average	3	11											

Appendix A HBI/NAHB Plumbing Standards Importance Matrix

Rating Scale

Extremely Important Content/Tasks 13-16
Moderately Important Content/Tasks 9-12
Somewhat Important Content/Tasks 5-8
Low Importance Content/Tasks 0-4

Specialties

PWC Public Water/Sewer Connections **Hyd** Hydronic Heating & Boilers
PrSys Private Systems **Gas** Gas Piping
Lift Lift Stations & Sewage Systems **BFP** Backflow Protection
WQ Water Quality/Filtration Systems **Irrig** Irrigation Systems
Solar Solar Systems

Critical Work Functions/Duty Areas	Importance		Percent Who Perform Task		Which specialties perform this task?								
	Trainee	Journey	Trainee	Journey	PrSys	PWC	Solar	BFP	Lift	Hyd	GAS	Irrig	WQ
	Install Fixtures, Appliances & Equipment												
Tubs & Showers	4	8	75%	100%									
Waste and Overflow Outlets	4	8	75%	100%									
Faucets	4	8	75%	100%									
Water Heaters	4	16	75%	100%			☐			☐		☐	
Water Closets/Bidets	4	8	75%	100%									
Washers & Dishwashers	4	8	75%	100%				☐					
Sinks, Trap and Disposals	4	8	75%	100%									
Sump Pumps and Cellar Drains	4	12	75%	100%									
Handicapped-Accessible Facilities	4	8	75%	100%									
Average	4	9											

Appendix A HBI/NAHB Plumbing Standards Importance Matrix

Rating Scale

Extremely Important Content/Tasks 13-16
Moderately Important Content/Tasks 9-12
Somewhat Important Content/Tasks 5-8
Low Importance Content/Tasks 0-4

Specialties

PWC Public Water/Sewer Connections **Hyd** Hydronic Heating & Boilers
PrSys Private Systems **Gas** Gas Piping
Lift Lift Stations & Sewage Systems **BFP** Backflow Protection
WQ Water Quality/Filtration Systems **Irrig** Irrigation Systems
Solar Solar Systems

Critical Work Functions/Duty Areas	Importance		Percent Who Perform Task		Which specialties perform this task?								
	Trainee	Journey	Trainee	Journey	PrSys	PWC	Solar	BFP	Lift	Hyd	GAS	Irrig	WQ
	Install Domestic Water Heaters												
Sizing Water Heaters	1	8	5%	90%			<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>		
Installation Criteria & Location Specifications	2	8	5%	90%			<input type="checkbox"/>						
Earthquake & Regional Conditions	2	16	5%	50%			<input type="checkbox"/>						
Gas Water Heaters	2	16	100%	100%			<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>		
Electric Water Heaters	2	12	100%	100%			<input type="checkbox"/>	<input type="checkbox"/>					
Tankless Water Systems	1	16	5%	90%			<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>		
Solar Water Heating	1	12	5%	50%			<input type="checkbox"/>	<input type="checkbox"/>					
Thermostats	2	16	5%	100%			<input type="checkbox"/>				<input type="checkbox"/>		
Relief Valves	8	16	100%	100%			<input type="checkbox"/>	<input type="checkbox"/>					
Expansion Tanks	2	16	100%	100%			<input type="checkbox"/>	<input type="checkbox"/>					
Hot Water Circulating Systems	2	4	5%	90%			<input type="checkbox"/>						
Dielectric Connections	2	4	100%	100%			<input type="checkbox"/>						
Mixing Valves	2	8	5%	90%			<input type="checkbox"/>						
Average	2	12											
Boilers													
Types of Boilers	1	12	5%	40%			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		
Boiler Installation	1	16	5%	40%			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		
Component Testing at Startup	1	16	5%	40%			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		
Average	1	15											

Appendix A
HBI/NAHB Plumbing Standards Importance Matrix

Rating Scale

Extremely Important Content/Tasks 13-16
 Moderately Important Content/Tasks 9-12
 Somewhat Important Content/Tasks 5-8
 Low Importance Content/Tasks 0-4

Specialties

PWC Public Water/Sewer Connections **Hyd** Hydronic Heating & Boilers
PrSys Private Systems **Gas** Gas Piping
Lift Lift Stations & Sewage Systems **BFP** Backflow Protection
WQ Water Quality/Filtration Systems **Irrig** Irrigation Systems
Solar Solar Systems

Critical Work Functions/Duty Areas	Importance		Percent Who Perform Task		Which specialties perform this task?								
	Trainee	Journey	Trainee	Journey	PrSys	PWC	Solar	BFP	Lift	Hyd	GAS	Irrig	WQ
	Hydronic Heat												
Types of Hydronic Heating Systems	2	8	5%	40%			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		
Hydronic Heating System Installation	2	16	5%	40%			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		
Integrity Testing of Water System	2	8	5%	40%			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		
Perform Required Performance Tests at Startup	1	16	5%	40%			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		
Average	2	12											
Troubleshoot, Maintenance & Repairs													
Diagnosis & Repair Fixtures & Appliances	1	8	5%	50%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Diagnosis & Repair Water Distribution Systems	1	16	5%	50%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Diagnosis & Repair Gas Systems	1	16	5%	50%			<input type="checkbox"/>				<input type="checkbox"/>		
Diagnosis & Repair Drainage & Vent Systems	1	16	5%	50%	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>				
Diagnosis & Repair Heating Systems	1	16	5%	35%			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		
Diagnosis & Repair Water Heaters	1	16	5%	50%			<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>		
Clear Stoppages	6	9	5%	50%	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>				
Average	2	14											

Appendix B HBI/NAHB Plumbing Standard Tools

Percent of Trainees and Journey Level Plumbers Using Specific Plumbing Tools

	Trainees	Journey		Trainees	Journey
Standard Hand Tools			Copper Tubing Tools		
Hammer, Tape Measure	100%	100%	Tubing Cutters	100%	100%
Channel Locks	100%	100%	Torch Assembly	100%	100%
Crescent and Pipe Wrenches	100%	100%	Striker	100%	100%
Saws	100%	100%	Reamers	100%	100%
Screw Drivers	100%	100%	Fire Extinguishers	100%	100%
Utility Knives	100%	100%	Steel Pipe Tools		
Nail Puller	100%	100%	Pipe Wrenches	100%	100%
Shovel	100%	100%	Cutters and Threaders	100%	100%
Chisels	100%	100%	Leak Detectors	25%	100%
Basin Wrench	100%	100%	Meters		
Power Tools			Electrical	40%	100%
Power Saws	100%	100%	Temperature	40%	100%
Drill	100%	100%	Ladder	100%	100%
Water Piping Tools	100%	100%	Pocket Thermometer	20%	100%
Pipe Threader	100%	100%	Personal Protection	100%	100%
Tool. Belt, Bag or Box	100%	100%	Equipment		