

GLOSSARY OF TERMS

Basic Water Heater Parts Terminology

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A

AGA See "American Gas Association."

AHRI Air-Conditioning, Heating and Refrigeration Institute.

Ambient Temperature The average temperature of the atmosphere in the vicinity of an appliance.

American Gas Association (AGA) Independent testing laboratory that tests gas-related appliances and accessories to ANSI standards, or to AGA standards in the absence of a nationally recognized standard.

Ampere (amp, A) A unit that defines the rate of flow of electricity (current) in a circuit. Units are one coulomb (6.25 x 1,018 electrons) per second.

Anode Rod A sacrificial rod composed of one or more metals installed in the water heater that protects the tank from corrosion, helping extend the life of the tank.

ANSI American National Standards Institute. The United States government agency that defines and maintains technical standards.

Anti-Scald Valve Device used to prevent high water temperature.

ASHRAE American Society of Heating Refrigeration Air Conditioning Engineers.

ASME American Society of Mechanical Engineers.

ASTM America Society for Testing and Materials.

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B

Back-Flow When water travels from one system upstream or back into any part of the main distribution system.

Back-Flow Preventer Allows fluid to flow in only one direction in a pipe; also known as a check valve.

Boiling Point The equilibrium temperature between a liquid and a gaseous state. For example, the boiling point of water is 100°C (212°F) at standard atmospheric pressure.

BTU British Thermal Unit. A unit of energy defined as the amount of heat required to raise one pound of water from 32°F to 33°F at standard atmospheric pressure. One BTU is equal to 0.293 watt-hours. One kilowatt-hour is equal to 3,412 BTUs.

Burner A device in which a flame or heat is produced in a water heater.

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C

Calorie A unit of energy defined as the amount of heat energy required to raise the temperature of one gram of water 1°C at 15°C.

CE A manufacturer's mark that demonstrates compliance with European Union (EU) laws governing products sold in Europe.

CE-compliant Compliant with the essential requirements of European directives pertaining to safety and/or electromagnetic compatibility.

Celsius (C) Formerly known as Centigrade. A temperature scale in which water freezes at 0°C and boils at 100°C at standard atmospheric pressure. The formula for conversion to the Fahrenheit scale is: °F = (1.8 x °C) + 32.

Check Valve Allows fluid to flow in only one direction in a pipe; also known as a back-flow preventer.

Chemical Resistance The ability of a material to resist permeation, erosion or corrosion caused by base, acid or solvent chemicals.

Closed System A system where the incoming cold water supply has a device that will not allow water to expand when heated (i.e. check valve, back-flow preventer, some pressure reducing valves, water meters).

CNC Computerized Numerical Control. The programmed instructions used by a class of cutting tool machines (usually driven by design software) for creating machined parts and molds.

Control Accuracy The ability to maintain a process at the desired setting. This is a function of the entire system, including sensors, controllers, heaters, loads and inefficiencies.

CSA Canadian Standards Association. An independent testing laboratory that establishes commercial and industrial standards, tests and certifies products.

C-UL® Canadian recognition of Underwriters Laboratories, Inc. (UL®) approval of a particular product class, such as UL® 508. In some instances, C-UL® approval may stand in lieu of Canadian Standards Association (CSA) approval. All references to C-UL® stem from the original UL® file only, resident at the location of UL approval.

Current The rate of flow of electricity. The unit of measure is the ampere (A). 1 ampere = 1 coulomb per second.

Cycle Time The time required for a controller to complete one on-off-on cycle. It is usually expressed in seconds.

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D

DC Direct current. An electrical supply in which the polarity of the two wires does not change.

Degree The increments in a temperature scale, or the increments of rotation of a dial. The location of a reference point in electric or phase in a cycle, in mechanical or electrical cyclic scales. One cycle is equal to 360 degrees.

Degree Rise Difference (Delta "T") between the starting water temperature and the ending temperature after heating is complete.

Dielectric An insulating material with very low electrical conductivity.

Dielectric Breakdown The point at which a dielectric substance becomes conductive. Usually a catastrophic insulation failure caused by excessive voltage.

Dip Tube Tube inside the water heater that sends cold water to the bottom of the tank.

Direct Vent Pulls outside air for combustion and vents combustion gases directly outside.

Draft Diverter A device fitted in the flue way of a gas appliance to prevent updraft, downdraft or secondary flue blockage from obstructing the escape of products of combustion or otherwise affecting the normal operation of the appliance.

Drain Valve Device designed to allow drainage of stored contents from a water heater.

Dual Element Heater An electric water heater with an upper and lower element for heating water.

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E

ECO (Emergency Cut Off or Energy Cut Off) Safety device designed to cut off electricity to the water heater in the event the tank temperature rises to a specified temperature above the upper limit of the thermostat.

EF (Energy Factor) A measure of the overall efficiency rating of the water heater based on the model's recovery, efficiency, standby loss and energy input.

Efficiency A measure of a product's ability to utilize input energy; expressed as a percentage.

Electric Heating Elements The heat source inside an electric water heater, which extends directly into the tank where it radiates heat energy to the water around it. The water heating power of a heating element is expressed in watts per hour of operation. Most electric water heaters have two heating elements, one in the bottom of the tank and one in the top. The bottom element handles most of the load, heating cold water as it enters at the bottom of the tank. The top element only operates to give water in the top of the tank a quick water heating boost when needed.

Energy Guide Label The Federal Trade Commission (FTC) requires that gas, electric and oil residential automatic storage water heaters be labeled to show 1) an estimated annual cost of operation for that particular model, based on a national average cost of fuel specified by FTC, and 2) how the efficiency of that model compares to all other comparable models.

Expansion Tank Designed to absorb excess pressure due to thermal expansion, e.g. closed system.

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F

Fahrenheit The temperature scale that sets the freezing point of water at 32°F and its boiling point at 212°F at standard atmospheric pressure. The formula for conversion to Celsius is: °C = 5/9 (°F - 32°F).

First Hour Delivery (Rating) Combination of the usable stored volume of hot water in the tank plus the recovery capacity for the first hour of operation.

Flow Control Valve Device designed to reduce water flow (GPM) to a plumbing fixture (i.e. shower head at 5 GPM vs. 2.5 GPM); the use of flow control valves can be cost effective in load calculations, reducing the water usage and the amount of energy used to heat water.

Flow Rate Rating in gallons per minute (GPM) or gallons per hour (GPH).

Flue A passage way for products of combustion.

Flue Baffle A device to deflect, check or regulate flow of combustion gases through the flue.

Foam Insulation The insulation surrounding the surface of the water heater tank.

Foot Print The area of space taken up by the water heater.

FVIR Flammable Vapor Ignition Resistant. An advanced system designed to help prevent the accidental ignition of flammable vapors from gasoline and other sources outside the water heater. FVIR design water heaters meet standards for "Flammable Vapor Ignition Resistance" established by ANSI, the American National Standards Institute.

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G

Gas Control Device used to regulate gas pressure on a water heater.

Gas Burner The heat source inside a gas water heater, the gas burner is a round disk placed immediately beneath the tank containing water. At the beginning of a heating cycle, gas flows through the burner through multiple ports. This gas is then ignited by the pilot flame or electronic ignition, creating a round pattern of burner flame for even distribution and transfer of heat to the water.

Gas Flue Tube In a gas water heater, the flue tube is a cylindrical chimney that runs through the center of the tank. Products of combustion from the gas burner rise through the flue tube and leave the water heater, where they are safely discharged to the outdoors through the water heater's vent piping.

Glass Lining A coating applied to the inside of a water heater tank to shield the steel from water and help prevent corrosion. The glass lining is actually a porcelain compound, sprayed onto all inner tank surfaces and then fired on at very high temperatures, leaving a hard, protective surface.

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H

Hard Water Natural waters contain impurities in various proportions; traditionally hardness is a measure of calcium or dissolved solids in a solution. Below is a list of the types of hardness and their referenced parts per million range.

Type of Hardness

Grains

Soft 0-49ppm

0 - 2.91

Fairly Soft 50-99ppm

2.92 - 5.83

Fairly Hard 100-149ppm

5.84 - 8.75

Hard 150-249ppm

8.76 - 14.59

Very Hard 250ppm +

14.60+

Head Loss The pressure of water as measured at a stated point; it may be measured in feet or in pounds per square inch (PSI).

Heat Exchanger A heat transfer system.

Heat Pump Water Heaters Hybrid, or heat pump water heaters, use a heat pump to pull heat from the surrounding air and put it into the water heater, which also has resistance elements to heat water when conditions won't permit the heat pump to work properly or when more hot water is needed than the heat pump can produce. These conditions include very hot temperatures or fairly cold ones.

Heat Transfer When heat is passed from one medium to another.

Heat Traps Special fittings installed at the water heater's cold water inlet and hot water outlet connections. Heat traps help prevent heat from escaping through these connections during standby periods and help increase the overall energy factor.

Heating Elements See "Electric Heating Elements."

Hot Surface Ignition In some gas water heaters (for example, power-vent and power direct-vent models), the constantly burning pilot flame is replaced by a metallic (silicon nitride) igniter positioned next to the gas burner. When the thermostat calls for a new heating cycle, electricity heats up the igniter surface to a temperature sufficient to ignite the gas. Hot surface ignition is considered an energy-saver by eliminating the consumption of gas by the pilot flame.

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I

Immersion Referring to something submerged in water.

Incoming (Inlet) Temperature Temperature of water entering tank.

Input The amount of gas or electricity used per hour to heat water in the tank. Higher input means the water heater can heat more water faster when needed. Natural or propane gas input is expressed in BTUs (British Thermal Units) per hour, and electric input is expressed in Watts per hour.

Instantaneous Water Heater A type of water heater that heats water as it flows through a heat exchanger coil.

Insulation R Value A measurement of how well a water heater's insulation will help prevent radiant heat loss through the tank. The R Value of one inch (1") of foam insulation is 8.33. A higher R Value will help increase the overall Energy Factor.

ISO 9000 A series of five standards for developing a total quality management system. Developed by the International Organization for Standardization based in Geneva, Switzerland.

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J

Joule A basic unit of heat energy, equal to the work done when a current of one ampere is passed through a resistance of one ohm for one second.

Junction The point where two dissimilar metal conductors join to form a thermocouple.

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K

Kelvin (K) An absolute temperature scale. Zero Kelvin is absolute zero. No degree symbol (°) is used with the Kelvin scale. (0°C = 273.16K, 100°C = 373.15K).

Kilowatt (kW) Unit of electrical power equal to 1,000 watts or 3,412 BTUs per hour when the power factor equals 1.0.

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L

Life Cycle Labs A place where water heaters are tested at an accelerated rate to simulate life expectancies.

LP Liquid Propane. A fuel for gas water heaters.

Low-Watt Density and High-Watt Density Heating Elements A low-watt density electric heating element has a much larger surface area transferring heat to water in the tank. This spreads out the distribution of wattage. For example, each square inch of a 4500-watt low-watt density element is conducting less electrical energy than its high-watt density counterpart. As a result, a low-watt density element operates more efficiently and lasts longer because its surface simply doesn't have to work as hard.

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M

Manifolded Installation Parallel or reverse flow plumbing of water heaters for large hot water demand applications.

Metal Fatigue A breakdown in metal strength cause by mechanical action. For example, when sheath and conductor materials have different linear expansion coefficients, heating and cooling cause mechanical movement that induces strain. Metal fatigue shortens the life of the heater and the thermocouple.

Mixing Valve Mixes cold water with hot water from the water heater to achieve a specified delivery temperature.

MO Magnesium Oxide. The powdered chemical compound used in heater manufacturing to insulate the resistance wire from the metal sheath.

Mobile Home Water Heaters Gas or electric water heaters designed specifically to meet HUD requirements for manufactured housing installation. A gas mobile home water heater features a gas control that is convertible for natural or propane gas operation. Only water heaters that meet HUD manufactured housing standards can be installed in mobile homes. A standard residential water heater should never be installed in a mobile home.

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N

National Bureau of Standards (NBS) Now called the National Institute of Standards and Technology (NIST).

National Institute of Standards and Technology (NIST) A United States government agency responsible for establishing scientific and technical standards. Formerly the National Bureau of Standards.

National Pipe Thread (NPT) The taper pipe thread standard used in North America as defined by ANSI B1.20.1.

Natural Gas A fuel delivered by a utility distribution system used on gas-fired water heaters.

Net Usable BTU The portion of a fuel's heat energy actually transferred into the water by the heater.

Non-CFC Foam insulation that minimizes the use of Chlorofluorocarbons.

NSF National Sanitation Foundation.

Nylon 6/6 A thermoplastic polymer that is characterized by its mechanical strength and heat resistance.

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O

Ohm (Ω) The unit of electric resistance. The resistance value through which one volt will maintain a current of one ampere. See "Ohm's Law."

Ohm's Law Current in a circuit is directly proportional to the voltage and inversely proportional to resistance; stated as: $E = IR$, $I = E/R$, $R = E/I$, $P = EI$ where I = current in amperes, E = EMF in volts, R = resistance in ohms and P = power in watts.

Oil Powered A water heater that uses oil as its fuel source.

Operating Cost The cost of running a water heater for a given time period.

P

PEX Cross-linked high density polyethylene polymer that is widely used in the plumbing industry.

Piezo Igniter A special feature on FVIR gas water heaters. During installation, or if the pilot flame is extinguished for any reason, the Piezo igniter allows the pilot flame to be re-lit without matches with just the push of a button located outside the water heater.

Pilot A small burner used to ignite the main burner.

Pilot Flame A small, constantly burning flame positioned next to the gas burner. When the thermostat calls for water heating and gas begins to flow through the burner, the pilot flame ignites the gas causing full burner operation.

Pipe Nipples Pipe nipples are connectors. Threaded on both ends, they allow plumbing to be connected to a water heater. They can be made of brass, galvanized steel, or plastic-lined.

Point-of-Use Electric Water Heaters Water heaters designed to serve low-demand applications such as powder rooms, utility sinks and other applications where a limited amount of hot water is required. Small storage tanks (2 through 30 gallons) and compact design permit installation in a cabinet, under a sink, or in other limited-space areas.

Polycarbonate (PC) A thermoplastic that offers high strength and toughness.

Polyethylene (PE) A thermoplastic that exhibits excellent dielectric characteristics.

Polymer Any substance made of many repeating chemical molecules. Often used in place of plastic, rubber or elastomer.

Polypropylene A thermoplastic that is similar to polyethylene, but has a higher softening point (temperature).

Polysulfone (PSU) A thermoplastic that is known for its stability in hot water.

Power Direct-Vent Gas Water Heaters Combine benefits of direct-vent and power-vent water heaters. Utilize two-pipe system, with one pipe for incoming combustion air and a second pipe for venting. Permit combined horizontal and vertical vent runs up to 45 feet, using inexpensive PVC, CPVC or ABS plastic pipe. Quiet modular blower requires electrical power.

Power-Vent Gas Water Heaters Draw combustion air from indoors like a standard-vent water heater, but permit combined horizontal or vertical vent runs up to 115 feet using inexpensive PVC, CPVC or ABS plastic pipe. Quiet modular blower requires electrical power.

Power Venting Mechanical draft exhaust to outside, usually utilizing room air to support combustion.

Powered Anodes (Impressed Current Anodes) Typically used in commercial water heaters, powered anodes do not sacrifice themselves and are not consumed over time. Powered anodes are typically supplied voltage by an electronic control that can sense the degree of the water conductivity and adjust the supplied voltage accordingly. While sacrificial anodes are consumed more rapidly in softened water, powered anodes actually work less hard because higher conductivity makes it easier for electricity to flow between the anode and cathode (tank steel). Powered anode rods are typically Titanium, but they also have a Mixed Metal-Oxide Coating.

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R

Rated Storage Volume Quantity of water (expressed in gallons) stored in a tank.

Recovery (at 90° Temperature Rise) Converts BTU or Watt input into gallons heated per one hour (GPH). 90° Rise indicates that incoming cold water is increased in temperature by 90°F.

Reference Junction The known temperature point at which a thermocouple or its extension wire connects to a temperature measurement instrument or controller.

Resistance Opposition to the flow of electric current, measured in ohms.

Resistance Temperature Detector (RTD) A sensor that uses the resistance temperature characteristic to measure temperature. There are two basic types of RTDs: the wire RTD, which is usually made of platinum, and the thermistor, which is made of a semiconductor material. The wire RTD is a positive temperature coefficient sensor only, while the thermistor can have either a negative or positive temperature coefficient.

Return Circulation System Tempered water from or near the point of usage which eliminates waste of hot water used for long runs and adds storage to the system.

Reverse Flow Another method of manifolding water heaters together in order to limit the unbalanced pressures in a multiple heater installation.

RF (Recovery Factor) Rating based on the efficiency of the product which is input required to raise 1 gallon of water 1°F.

Gas

75% to 99% RF = 11 to 7.9 BTU/H

Electric

100% RF = .0024 KW/H

Oil

70% to 85% RF = 11.79 to 9.7 BTU/H

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S

Safety Shut Off Valve A device on a gas appliance which shuts off the gas supply to prevent a hazardous situation. A flame failure safety shut off operates when the actuating flame becomes extinguished. A 100% shut off cuts off all gas including main and pilot burners.

Scale A coating or layer (usually lime, biocarbonate or calcium) on the bottom of a tank or interior parts, that may prevent heat transfer.

Sediment The substance that settles on the bottom of a tank.

Seebeck Coefficient The rate of change (derivative) of thermal EMF (voltage) with respect to temperature. Expressed as millivolts per degree.

Seebeck Effect When a circuit is formed with a junction of two dissimilar metals and the junctions at each end are held at different temperatures, a current will flow in the circuit.

Seebeck EMF The net thermal electromotive force (EMF) in a thermocouple under conditions of zero current.

Semiconductor Any material that exhibits a degree of electrical conductivity that falls between that of conductors and dielectrics.

Series System Generally where the primary heater preheats water to a given desired general purpose temperature and feeds into another heater.

Sliding Inner Door A door slides along combustion chamber radius for easy access to the burner and pilot.

Spark Ignition A coil of wire in the form of a cylinder that carries a current; resembles a bar magnet.

Spark Test A test procedure to evaluate the integrity of the glass lining.

Spud A threaded opening on the water heater tank.

Stacking Also known as thermal stratification, or build-up, it is the ability of hot water to form layers of different temperatures in the tank.

Standard-Vent Gas Water Heaters Also known as atmospheric vent. Draw all air needed for proper burner operation from the indoor air around the water heater and vents products of combustion vertically through the roof of the home.

Standing Pilot A small burner used to ignite the main burner.

Storage Tank A tank used to hold a specific volume of water.

Surface Mount Usually referring to thermostats mounted on the outside of the tank surface which sense temperature through the steel tank.

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T

T&P Valve (Temperature and Pressure Relief Valve) An important safety feature, which must be installed on every water heater. In the event of excessive temperature and/or pressure in the tank, the T&P valve automatically opens to discharge hot water and help prevent a potentially hazardous condition.

Table Top Electric Water Heaters Feature a rectangular cabinet with a flat surface at 36" height, providing extra usable counter space wherever installed.

Tankless Water Heater Commonly known as instantaneous or point-of-use water heaters.

Temperature Rise (Delta "T") The number of degrees Fahrenheit (F) the incoming cold water must be raised to reach the desired hot water temperature.

Therm A measurement of 100,000 BTUs.

Thermal Efficiency Ability to transfer and absorb heat from fuel source into the water.

Thermal Expansion Water, a non-compressible liquid, expands when heated.

Thermal Stratification Also known as stacking, or build-up, it is the ability of hot water to form layers of different temperatures in the tank.

Thermocouple (T/C) A temperature sensing device made by joining two dissimilar metals. This junction produces an electrical voltage in proportion to the difference in temperature between the hot junction (sensing junction) and the lead wire connection to the instrument (cold junction).

Thermopile An arrangement of thermocouples in a series with alternate junctions at the measuring temperature and the reference temperature. This arrangement amplifies the thermoelectric voltage. Thermopiles are usually used in infrared detectors in radiation pyrometry.

Thermostat In a gas or electric water heater, the thermostat constantly monitors water temperature in the bottom of the tank. When water temperature drops beneath the desired setting, the thermostat signals gas flow or electric heating element operation to begin, starting a new water heating cycle. When water temperature in the bottom of the tank is increased to the desired setting, the thermostat shuts off gas flow or electric heating element operation.

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U

UL® The registered trademark and abbreviation for the Underwriter's Laboratories, Inc. An independent testing laboratory that establishes commercial and industrial standards, and tests and certifies products in the United States.

Usable Storage The percentage of hot water that can be drawn from a tank before the temperature drops to a point that is no longer considered hot.

Utility Water Heaters Gas or electric water heaters with high energy factors, which may qualify for special energy-efficiency rebates offered by gas and electric utilities.

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V

Vacuum Relief Valve (Anti-Siphon) Recommended for installation on all side (bottom) cold inlet heaters; prevents internal vacuum conditions that could drain a system by back siphonage, eliminates burned out electric elements and collapsed tanks.

Venting Materials Materials used for evacuating vent gases from a dwelling, i.e. PVC, CPVC, ABS, metal.

Volt Unit of measurement of electromotive force. AC or DC.

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W

Waterway Fitting A channel through which water can flow; connects water heater to inlet and outlet lines.

Watt (W) A unit of electrical energy or power; one ampere x one volt = one watt.

Watt Density Amount of watts concentrated per square inch of element rod surface area.

Working Pressure Maximum pressure of the operating system permissible.

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Lint Screen

Removes lint and dirt from primary air before it enters the primary air opening. Also traps particles on the inlet side of a gas control valve.

Low Nox

Term that refers to natural gas water heaters required in select areas of California which are built with a special burner to help reduce or limit the amount of nitrous oxides (Nox) released during the combustion process.

Low Watt Density Element

The watt density of an element is the amount of heat transferred from any point on the surface of the element to the water. A low watt density element has more surface area of heating element than a high watt density element, but is transferring the same amount of energy into the water. A low watt density element will generally last longer than a high watt density element.

Maintenance Rate (Stand-by losses)

The maintenance rate is the rate which heat or energy has to be supplied to an appliance to maintain its temperature at the required level when the unit is not being used. In the case of a storage heater, it is the heat input required to hold the unit at the required temperature (generally 80°F above ambient on gas heaters and 100°F above ambient on electric heaters). The maintenance rate may be measured in BTU per hour for gas or kilowatts per 24 hours for electricity. The temperature above ambient must always be quoted.

Multiple Heater Installation

This is an installation where a number of heaters are used to supply the total building hot water requirements. The heaters are manifolded together in one location and the installation can be defined as a 'central water heating system'. This is one of the easiest systems to service and maintain. When one heater is being serviced, the remaining heater(s) will continue to supply hot water.

Multi-Watt Element

An element that has the capability to function at two different wattages. The Multi-Watt element offered by Rheem is convertible from 3800 to 5500 watts.

NAECA

National Appliance Energy Conservation Act of 1987... The Federal Law enacted by Congress which sets minimum energy efficiency standards for residential water heaters and other products. Effective with water heaters produced on or after January 1, 1990. NAECA supersedes all previous state and local energy efficiency requirements.

NPT (National Pipe Thread)

Nipples

Can be made of various materials. Used to connect the water heater to the piping system.