How To Make A Still

Introduction: The Art and Science of Homemade Distillation

Building your own still is a project that combines practical craftsmanship with ancient science. Whether you are interested in producing essential oils, crafting small batches of spirits for personal use where permitted, or simply exploring the principles of distillation, learning **how to make a still** can be both rewarding and educational. A still is fundamentally a device that separates liquids based on differences in boiling points. While the concept is simple, constructing a safe, efficient, and reliable still requires careful planning, quality materials, and a solid understanding of the process. This guide will walk you through everything you need to know, from the basic theory to the detailed steps of assembly, ensuring that you build a still that functions properly and safely. Always remember that distillation of alcohol for consumption is regulated in many jurisdictions. **Understanding the legal landscape in your area is the first and most critical step** before you begin any construction.

Understanding the Basics of Distillation

At its core, distillation relies on the fact that different substances in a liquid mixture boil at different temperatures. When you heat a mixture, the component with the lowest boiling point vaporizes first. These vapors then travel through a cooled tube—the condenser—where they condense back into a liquid form, collected separately. This process is used to purify water, concentrate alcohol, extract essential oils, and even refine crude oil.

There are two primary types of stills used by home builders: the **pot still** and the **reflux still**. A pot still is the simplest design, consisting of a boiler, a column (or liebig), and a condenser. It is ideal for producing flavorful spirits or extracting essential oils. A reflux still adds a fractionating column above the boiler, often packed with copper mesh or glass beads, which allows for higher purity by repeatedly condensing and re-vaporizing the rising vapors. For beginners learning **how to make a still**, a simple pot still is often the best starting point because it is easier to construct and less prone to errors.

Legal Considerations and Safety First

Before purchasing any materials or cutting any pipes, you **must** research and comply with local, state, and federal laws regarding distillation. In many countries, including the United States, distilling alcohol without a license is illegal under the Alcohol and Tobacco Tax and Trade Bureau (TTB). Penalties can include fines and imprisonment. However, distillation for water purification, producing essential oils, or creating biodiesel may be legal in some places. Ensure you are building your still for a lawful purpose. Beyond legality, **safety is paramount**. Distillation involves high heat, flammable vapors, and pressure. Never use a closed system that cannot vent pressure. Use only materials rated for high temperature and safe for food contact—copper, stainless steel, and copper-free brass are preferred. Avoid using aluminum, lead-soldered joints, or plastics that can melt or leach toxins. Always operate your still in a well-ventilated area, away from open flames or sparks, and never leave a running still unattended.

Materials and Tools Needed

To build a reliable pot still, you will need the following materials:

- **Boiler vessel:** A stainless steel pressure cooker (8-12 quarts) or a small beer keg. Ensure it has a large opening for cleaning.
- **Copper or stainless steel tubing:** 1/2 inch diameter for the vapor path and condenser. Copper is preferred for its thermal conductivity and ability to remove sulfur compounds.
- **Condenser:** A 3/4 inch copper pipe (outer jacket) with a 1/2 inch inner pipe (vapor tube). This forms a Liebig condenser.
- **Fittings:** Compression fittings, copper couplings, a needle valve (if building a reflux column), and a triclamp or welded flange to attach the column to the boiler.
- **Thermometer:** A probe-style thermometer capable of reading up to 212°F (100°C) or higher. A digital thermometer is more accurate.
- **Heat source:** A propane burner, electric hot plate, or induction cooker (ensure it is compatible with your boiler).
- **Collection vessel:** A glass jar or stainless steel container to collect the distillate.
- **Tools:** Tube cutter, propane torch with solder (silver solder for copper, lead-free), sandpaper, and a drill.

Step-by-Step Guide: How to Make a Still

Step 1: Design and Planning

Sketch out your still on paper. Decide whether you want a pot still or reflux design. For a beginner, a pot still is simpler. Determine the size of your boiler—a 5-gallon (19-liter) keg is a popular choice for hobbyists. Plan the vapor path to rise vertically from the boiler, then turn 90 degrees into the condenser. Ensure all joints are accessible for cleaning. Measure the length of the condenser; a 12- to 18-inch Liebig condenser is usually sufficient for a small still. Make a list of all required fittings before purchasing.

Step 2: Preparing the Boiler

If using a pressure cooker, remove the safety valve and rubber gasket (replace with a high-temperature gasket if needed). Drill a hole in the lid to fit the column or a triclamp ferrule. If using a keg, cut off the top with an angle grinder and weld a 2-inch triclamp ferrule to the opening. **Ensure all metal burrs are smoothed**. The boiler must have a second hole for a thermometer probe at about half the height of the headspace. Use a food-safe sealant or PTFE tape on threads. Alternatively, you can use a pre-made still lid adapter kit.

Step 3: Constructing the Column and Condenser

For the column, cut a length of 1/2-inch copper pipe (12-18 inches for a pot still). If you are building a reflux still, use a longer column (18-24 inches) and fill it with copper mesh or ceramic rings. For the condenser, you will build a Liebig: Slide a 1/2-inch copper pipe inside a 3/4-inch copper pipe. Use reducing T-fittings at each end to create water inlet and outlet for the jacket. Solder the fittings carefully to create a watertight jacket. The inner vapor tube should protrude a few inches at each end. Sand the soldered joints to remove any flux residue.

Step 4: Assembling the Still

Attach the column to the boiler using a compression fitting or a triclamp with a silicone gasket (only for temperatures below 400°F, which is fine for ethanol distillation at ~173°F). Connect the other end of the column to the condenser using another compression or soldered coupling. Ensure the condenser is angled slightly downward to allow condensed liquid to flow into the collection vessel. Attach a hose to the water inlet (bottom of jacket) and outlet (top) for running cooling water. Use clear vinyl tubing for the water lines.

Step 5: Leak Testing

Before running any flammable liquids, perform a pressure test. Seal all openings except one. Using a bicycle pump or air compressor, pressurize the still to about 5 PSI (very low). Listen for hissing, and apply soapy water to every joint. Bubbles indicate a leak. Tighten connections or re-solder as needed. Also test the condenser by running water through the jacket and looking for drips. A vacuum test can also be done using a vacuum gauge, but for most home stills, the soap bubble test is sufficient. **Never use the still if it leaks under pressure.**

Advanced Options: Reflux Still and Column Packing

If you want higher proof spirits (above 180 proof / 90% ABV), you will need a reflux still. This is an extension of the basic pot still design. The column is taller (24-36 inches) and packed with a material that provides high surface area, such as copper mesh, stainless steel scrubbers, or glass beads. Additionally, you can add a reflux condenser at the top of the column—a small coil or a cold finger that condenses some vapors back down the column, improving separation. A needle valve at the top allows you to control the amount of reflux. Building a reflux still adds complexity but gives you far more control over the purity of your product.

Operating Your Still: Running a Batch

Once your still is assembled and leak-tested, you can run a batch. First, prepare your wash or mash (for alcohol) or simply water for cleaning runs. Fill the boiler no more than two-thirds full to avoid foaming. Connect cooling water (cold tap water works fine) and set up your collection container. Heat the boiler slowly. For alcohol, the target temperature is around 173°F (78°C) for ethanol. Watch the thermometer—when the temperature stabilizes near that point, you should see drops forming at the condenser. Collect the distillate in separate containers in order: **foreshots, heads, hearts, and tails**. Foreshots (first 5-10% of output) contain methanol and acetone—discard them. Heads (next ~15-20%) have sharp odors and flavors, often used for cleaning or re-distilling. The hearts contain the clean ethanol or neutral spirit—this is what you keep. Tails (the last fraction) have low alcohol and higher water content, often cloudy. Stop collecting when the temperature rises above ~200°F for alcohol. For water distillation or essential oils, the principles vary, but always monitor temperature and output.

Maintenance and Cleaning

After each use, disassemble the still and clean all parts thoroughly. Copper can develop a dark patina over time—this is normal and actually beneficial for removing sulfur compounds. However, you should scrub the inner vapor path with a non-abrasive brush and dish soap. Avoid using bleach or harsh chemicals that can leave residues. Rinse all parts with clean water and dry completely before storage. **Periodically check all seals and gaskets** for wear. Also clean the condenser jacket by flushing with a vinegar solution (1 part vinegar to 4 parts water) to remove mineral deposits. Proper maintenance will ensure your still lasts for many years and produces clean, safe distillate.

Conclusion: The Craft of Distillation Awaits

Learning **how to make a still** is an engaging project that bridges the gap between science and hands-on skill. Whether your goal is to produce high-purity water, craft herbal extracts, or explore the traditional art of distillation, the principles outlined here will set you on the right path. Always prioritize safety, legality, and quality materials. Building a still takes patience and attention to detail, but the sense of accomplishment when you see that first drop of clear distillate is unmatched. As you gain experience, you can refine your design—adding insulation, automating temperature control, or upgrading to a reflux column. The journey from a simple pot still to a sophisticated laboratory-grade system is a rewarding one. Remember, knowledge is the most important tool in your workshop. Study, build safely, and enjoy the timeless process of distillation.

