



hot vs. cold water

why the difference?

by Marlo Dean

All pressure washers fall into one of two categories: hot water or cold water. Because both types of pressure washers offer models with the same gpm and psi and can clean indoors or outdoors, it begs the question: why do I need a hot water pressure washer when everything else is the same?

The answer is as close as the kitchen sink.

You've just had a delicious spaghetti supper, and it's time to wash the dishes. Fill one sink with cold water and the other with hot water. See which cleans faster and better. Even with a heavy dose of soap in the cold water sink, hot water cleans significantly more effectively.

Why? It's a story as tiny as the molecules that make up water.

We learned in our early school years how everything is made up of atoms that bond together to form molecules. These tiny molecules are in constant motion. With water, the hotter it gets the faster the molecules move, until at 212 F they become airborne and form steam. As we cool water, the molecules slow until they eventually become ice hard.

Svante A. Arrhenius (1859–1927), a Swedish chemist, researched the heat-energy relationship. In short, he concluded that higher temperatures cause molecules to collide with each other creating energy that can cause the molecules of grease and grime to break free from the surface to which they're attached. Dirt particles are quite often attracted and adhere to a particular material, as in the example of dust on a painted surface. Water on its own is not able to loosen the dirt and remove it from the surface of the material.

In other words, cleaning is accomplished by lowering the surface tension.

Actually, there are three key elements—heat, agitation and soap—that work best to reduce the surface tension of dirt and grime. Here's how each works:

- Heat, as described above, creates a high-speed molecular action that physically breaks the bond between grime and the surface to which it's attached.
- Agitation is the impact that comes from the water volume and water pressure hitting the surface—the same action that you get when you scrub the dinner

plate in your kitchen sink or blast it with a spray of water. You can influence this with your impact pressure, flow rate, spray angle, and spraying distance.

- Finally, soap (often called "detergent" by pressure washer users) chemically breaks the bond between dirt and the surface by reducing the surface tension. In order to achieve the desired cleaning effect, active substances that affect the whole surface surfactants in detergents are employed. These dipolar molecules reduce the surface tension of the water and create bonds between aqueous and non-aqueous substances. Water containing surfactants is able to penetrate under the dirt and to reduce the forces of attraction to such an extent that the dirt becomes loose and can be sprayed away from the surface and transported away. The actual reaction time in a high pressure application may amount to less than a second, even several minutes elapse before rinsing. When the strength of the detergent solution is .2–4 percent, there is little to be gained from a long period of soaking.

The simultaneous application of mechanical energy, chemical energy from detergent, and heat energy means a hot water pressure washer can deliver cleaning's most effective knockout punch. With almost all cleaning tasks, it is possible to achieve a 40 to 60 percent reduction in the time required for cleaning by using hot rather than cold water.

So How Do You Know When to Use Hot Water?

If you're cleaning engines, automotive parts, or anything with oil or grease, you'll need hot water. Like the dishes in your sink, hot water cuts grease and grime; cold water only pushes it around. Removal of corrosion-preventative substances or high pressure phosphatizing will most likely also necessitate heat.

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On the other hand, if you're simply blasting away soil, caked-on mud, or even stripping paint, a cold water pressure washer will work just fine. Combined with detergent, a cold-water pressure washer can be very effective in many applications.

The rule of thumb is simple: if cold water can clean it good, hot water can clean it better.

Does Heat Affect Use of Chemicals?

The provision of heat will usually accelerate chemical reactions, with the general rule of thumb being that activity doubles for every 10 C (50 F) increase. In reality, this just applies up to the optimum temperature for a particular reaction. Detergents are formulated to perform best at varying temperatures so this should be taken into account; some may actually perform relatively independent of temperature. Additionally, certain surfactants used in some of the formulations have a maximum temperature at which they can stay in solution. This maximum solubility temperature is called the "cloud point," and when that temperature is exceeded, the solution will turn cloudy as the surfactant separates itself from the water. When this occurs, the detergent also loses its ability to do the job that it is supposed to do.

Does Heat Affect the Wastewater?

Higher temperatures will cause greater emulsification of oils and chemical reactions that will impede the treatment process. If the water is being recycled, this should not necessitate any change in treatment. The effect of temperature on the wastewater treatment is complex depending on the method and design of the equipment used. The removal efficiency declines as temperature increases for suspended solid (SS), phosphate ion, nitrate ion, ammonium ion, and chemical oxygen demand (COD). Ozone treatment and filtration is adversely affected as water temperature increases.

Does a Hot Water Pressure Washer Cost More?

Yes, sometimes two to three times more, due to the complexity of heating hot water while under pressure. Hot water pressure washers also require more maintenance, as the burner assembly, coil, and redundant excess-pressure protection all may need repair over time. Still, hot water pressure washers easily pay for themselves in labor cost savings from faster, more effective cleaning.

How Is Water Heated in a Pressure Washer?

Water enters a pressure washer from a spigot or tank via a garden hose.

It first passes through a high-pressure pump, which speeds the water on its way through a heating coil, consisting of up to 200 ft. of ½-in. steel pipe or tubing. The serpentine configuration allows the water to get maximum exposure to the flame (fueled by oil, diesel, or natural/propane gas) as it roars through the center or core of the coil. By the time the water rushes out of the coil and through the wand and nozzle, it will have reached temperatures of up to 200 F.

Don't I Need Steam, Too?

It's not unusual to hear hot water pressure washers referred to as steam cleaners. While there are a few applications, such as detailing an automobile engine, that require steam, it has been proven over the years that hot water under pressure is a much more effective method of cleaning than steam. That's because hot water washing has the additional benefit of the water volume impacting the surface. Steam has heat but very little impact force or agitation, which is one of the three key cleaning elements.

Still, some pressure washers offer a "steam combination" option where the hot-water flow is restricted in order to create a "wet steam" effect for those rare applications where there's a delicate surface and the impact of water under pressure could cause damage. *cr*



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