

The Hard Truth About Hard Water



Jack DeVetten

Owner of Ace Plumbing & Master Plumber

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Master Plumber Owner of Ace Plumbing

Jack DeVetten

Jack's dad, a plumber and pipefitter, was always in need of an extra pair of hands and his son was glad to help. He worked for years with his father while he completed his education. He took the time to hone his skills as a plumbing apprentice in the 1980s, completing his Master Plumbing Certification in 1991. Jack always had a natural curiosity about how things work. It helped him to develop techniques for residential installations that were time saving yet extremely efficient. In 1995, Jack purchased the assets of Double D Plumbing, where he had completed his apprenticeship. He used them to start Simcor Plumbing, a residential new construction company that flourished as Jack's reputation for honesty and fairness spread around Calgary. He served on the Alberta apprenticeship board developing exams for the next generation of gas-fitters. It was very satisfying but there was still something missing. He always had a passion for providing outstanding service to the home owner. He used to take personal time to meet with new home buyers to show them options for making their new homes more comfortable. The purchase of Ace Plumbing and Heating was the vehicle to provide that personal touch to service clients. Adopting the Happy Today or You Don't Pay Promise shocked his competitors but was a testament to how far Jack would go to make sure his customers were happy. Now only the best technicians committed to customer satisfaction, and installation excellence work for Ace Plumbing. They travel as far outside of Calgary as Langdon, Okotoks, and Chestermere to keep our customers safe, warm, dry, and satisfied! In 1995, Jack purchased the assets of Double D Plumbing, where he had completed his apprenticeship. He used them to start Simcor Plumbing, a company that flourished as Jack's reputation for honesty and fairness spread around Calgary.



The science of Calgary's hard water



Where does it come from

Hard water is defined as having 'high mineral content (in contrast with "soft water"). Hard water is formed when water percolated through deposits of limestone, chalk or gypsum which are largely made up of calcium and magnesium carbonates, bi carbonates and sulfates. Iron oxides or iron carbonates can give a reddish-brown colouration to hard water deposits. The City of Calgary measures water hardness by the amount of Calcium Carbonate in the water contains calcium carbonate (chalk). The amount of 'hardness' varies during different times of year. With the exception of June, all month's land between medium hard to hard. South Calgary has the highest hardness rating occurring in March at 210 mg/l on average.

Water hardness stats.

Hardness Rating **Concentration of Calcium Carbonate (mg/L)** **Concentration of Calcium Carbonate (grains per imperial gallon)**

Hardness Rating	Concentration of Calcium Carbonate (mg/L)	Concentration of Calcium Carbonate (grains per imperial gallon)
Soft	0 to <75	0 to < 5.2
Medium Hard	76 to <150	5.2 to <10.5
Hard	151 to < 300	10.6 to < 21
Very Hard	300 and greater	21 and greater



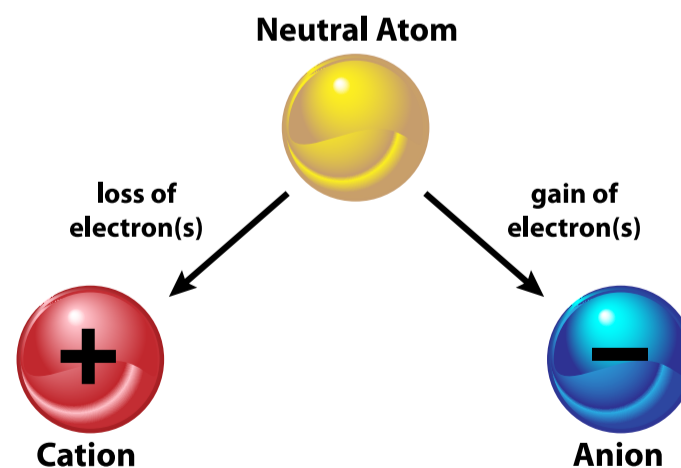
There are two types of hard water and act distinctly different when heated. The first is temporary hard water. It consists primarily of calcium and bicarbonate ions. . When heating the state of the ions decompose resulting in a solution that forms insoluble compounds, like CaCO_3 and MgCO_3 . The result is a shift that causes the white mineral deposits that we commonly see inside of kettles and water heaters

'permanent' but there are ways to 'soften" this type of water. Permanent hard water is referred to as 'permanent' but there are ways to 'soften" this type of water. It has high concentrations of the sulfate anion (SO_4^{2-}). It is referred to as 'permanent' because boiling will not precipitate out the ions. This type of hard water is most often responsible for the ring around the bathtub and around the shower drain. Permanent hard water carries cations that react with soap to create hard to clean soap scum. $2(\text{C}_{18}\text{H}_{35}\text{O}_2)^{-}(\text{aq}) + \text{Mg}(\text{aq})^{2+} \rightarrow \text{Mg}(\text{C}_{18}\text{H}_{35}\text{O}_2)_2(\text{s})$

Heat changes things

Permanent hard water is referred to as

Chemistry terms: Ions result from atoms or molecules that have gained or lost one or more valence electrons, giving them a positive or negative charge. Those with a negative charge are called anions and those with a positive charge are called cations. These opposing charges frequently result in ionic bonds with one another.





02

Tell tale signs of hard water.

Hard water shows itself around the home in a couple of ways. “Scale” is found wherever water is heated. Most often found in kettles, water heaters, boilers, hot water pipes and cooking pots. It exists where it can easily be seen and also where it cannot. The problem is, damage occurs when the hard water scale builds up on the surrounding containers or piping. It reacts with the metal or plastic surface. From the outside water heaters, boilers, instant hot water makers or piping can look completely new, yet on the inside the container or pipe is flaking away as it reacts with the damaging precipitate accumulating on the inside. The build-up of scale and reactive metal or

plastic can reduce the flow of water through the appliance or pipe. The chemical reaction between the scale weakens the structure until it becomes so thin it can no longer hold the water inside. Causing leaks, premature wear and malfunction.

Scale is often seen on leaking plumbing pipes, water heaters and boilers, it will have a white tell-tale ring where the water is dripping out, especially if it has been leaking for a long time. This type of scale is also often referred to as calcification.

Fighting soap scum

Soap Scum is the second way that hard water shows itself in residential homes. Wherever hard water mixes with soap, detergent, or cleaners there is a tell-tale soap scum film. The hard water reacts with the soap changing its chemical makeup and creating the dreaded soap scum. It sticks to everything. The more cleaner is added the thicker the soap scum builds up. Bathtubs are notorious for rings at the water line. The film sticks inside of sinks and in the drain pipe. The sticky soap scum collects hair inside the drain in bathrooms shrinking the inside volume of drain pipes. Even laundry isn't safe from soap scum. It's the reason white clothes turn gray. Even when using bleach, whites won't gleam. Dishes in the dishwasher will often begin to feel rough and glassware will get a coating that won't come off even if scrubbed by hand. Soap scum also leaves a film on skin, leaving it feeling tight and dry.



The battle is real.

Although it might seem like the right answer, scrubbing is not the answer to fighting soap scum. No matter how much elbow grease is applied there is no way to fight soap scum with scrub brushes, scouring pads and sponges. When scrubbing isn't working there is a temptation to use harsher chemicals. Some will just cause the soap scum to get worse, some cause damage to the surface and others are damaging to our health and the earth.

When fighting this noble battle there is only one real answer. A way to fight the soap scum where it starts. Because it has a chemical composition there are processes to prevent soap scum from even forming! The process is safe and has a very long and proven history. It eliminates the build up the scrubbing the need for harsh chemicals and it is safe for our health and the environment. Sounds like magic but it's actually science.



Around the house with hard water



03

Soap scum on fixture surfaces

When guests arrive

There are few things more embarrassing than when guests see a ring around the bathtub. Since the 1950's house keeping skills have been judged by the dreaded "bathtub ring". When it comes to house cleaning day, no one wants to scrub a bathtub ring harder than they have to. Yet, with hard water, cleaning soap scum is a real chore and can take up to three times longer. To remove the soap scum, many people rely on cleansers that are strong and harsh smelling. For those with sensitivities to harsh chemical cleaners, it is difficult to find a gentle one that works. While some harsh cleansers are effective, they decrease the shine on fiberglass bathtubs, damage chrome finishes, stain counter tops and shower doors. Even with harsh cleansers, there is a lot of work scrubbing, sometimes with abrasive sponges.

Will it stay clean?

All this to stay ahead of hard water soap scum. None of these solutions make battling soap scum any easier because once a bathtub is clean it only takes one use to create an instant disgusting ring again! No one needs that after a day of house cleaning!

Build-up on shower surfaces is another annoyance. Green or rust coloured scum begins to accumulate on the shower floor, sticking together with body wash, shampoos, conditioners and scrubs. There is no quick wiping that will remove that hideous build up. This will take good half hour of scrubbing and doesn't include the residue left on the surface of the shower door, another time-wasting chore that no one needs! Bath tubs get used several time a week. Bathing children, pets and adults trying to relax after a tough day. .



After each use, soap scum accumulates and that needs to be cleaned. There are more important things in life than scrubbing and then re-scrubbing a bath tub because of soap scum build up. A shame to waste all that effort when there's a simple solution to save hours of scrubbing and make taking a bath so much more enjoyable.





Soap scum in clean laundry



04

Dreaded grey looking whites

Inside machines using hard water, soap scum has found its way to nooks and crannies of the washer, most are hidden from view. Once accumulation of soap scum begins, it's like a magnet, attracting more detergent and fabric softener to it. When detergent is poured into the filler cups, it sticks to the soap scum inside the channel that leads to washer tub, slowing the flow of detergent and clogging the dispenser. Trying to remove that mess is next to impossible.

Done correctly, the scent of freshly washed clothes can calm anxiety, improve self-esteem, and transport soothing thoughts from happy times. It should be as easy as throwing clothes in the washing machine, adding detergent, softener, pressing a few buttons and presto! Clean clothes. Like most things, laundry is a skill that can be perfected in a short period of time once a few secrets are revealed. From previous sections in this e Book we know that hard water ions stick to surfaces and collect soap particles. Laundry detergent is a form of, that's right soap. The clothes have very porous surfaces. Is it possible hard water could prevent detergent particles from washing out of clothes?



Yes, in fact the trapped detergent will stick to the fabric and attract everyday dirt and grime. The hard water molecules prevent the detergent from creating suds and dissolving so it collects between the fibers to attract more dirt. This can be seen very easily in white and light clothes, it's the tell-tale grey colour of still new clothes and socks. Even adding bleach won't remove the soap scum from between the fibers.

05

Health, Beauty, Hair & Hard Water

It's hard to imagine that the human body would have a 'surface' for soap scum to stick to. Skin has a porous surface with oil producing glands to keep skin soft. Hard water ions mix with soap/body wash to produce a film that sticks to skin and covers these glands, making it impossible to keep skin moist and supple. Skin dries out and begins to flake on arms, legs and body. Slowly it begins to resemble the texture of alligator skin. Wrinkles and lines on the face become more pronounced, skin loses its brightness, looks dull and tight. Lotion applied to skin, only thickens the film blocking natural oils from moisten skin. Prolonged dryness and product accumulation



results in skin irritation, rash, eczema and psoriasis. Prolonged dryness not only causes skin to look tight and dry but as skin ages dryness accentuates wrinkles. Liquid makeup applied to dry skin begins to flake off almost instantly as the oils in it adhere to the film barrier. Even high end expensive creams, lotions serums, oils and cleansing creams lose their effectiveness. No matter how much money spent on lotions, serums, or oils none are able to penetrate the hard water film barrier.



Product build up

Hair has a different texture than most surfaces. Microscopic views show a scale like texture each strand with dozens of bands perfect for hard water ions to collect shampoo, conditioner and hair products. Hair weighed down with hair products often appears “greasy” and dark close to the scalp. Colour is dull, lacking luster. Certain types of shampoo can be used to temporarily strip hair of the build-up, unfortunately many also strip away natural oils leaving both scalp and hair weighted down and dry. Chemically treated hair quickly loses its healthy shine, leaving hair limp and hard to control. Film accumulates and hair feels heavy and unmanageable while ends continue to dry out and split leading to more haircuts in attempt to make hair look healthier.

Fighting static electricity in a dry climate like Calgary can be next to impossible when build up takes hold on hair. Hairspray seems like the likely solution but in the end only adds to the build up plaguing each hair strand and a very dry scalp.





06

Science of soft water

There are several ways to soften water but the most common is by ion exchange. Water from the water source well is piped to the softener tank. Inside, are millions of tiny resin beads that are positively charged to attract the calcium and magnesium ions in hard water. The most efficient type of water softeners keep track of how much water flows through the tank so it can be rinsed automatically. During the back-wash cycle, water mixed with salt (brine) is rinsed through the resin beads washing away the calcium, magnesium and any iron ions and replacing them with the positive cations of the salt. The resin is rejuvenated and ready to attract more mineral ions. This automatic process continues seamlessly for up to 10 years, as long as there is salt in the brine tank. Salt for the brine

tank is easily purchased from hardware, and grocery stores or provided by a local residential plumbing company.

There are some other ways of “softening” water. Distillation & calcium hydroxide are mainly for industrial applications. Chelating/catalytic water conditioners are growing in popularity as a residential alternative and use citric acid to prevent hard water from sticking to surfaces. Reverse osmosis is a process of forcing water through a membrane to remove the particles from water. RO water is most often used for drinking, since the process uses a lot of water to produce a small amount of filtered water.



Once the calcium, magnesium and iron ions have been successfully removed from hard water, it travels from the softener through the homes, piping system and into appliances like the dishwasher, instant hot water maker, washing machine, water heater, boilers and other appliances that use hot water. As the softened water moves through them no more 'scale' is accumulated and in some cases becomes lessened. The accumulation of 'soap scum' stops and with some cleaning disappears completely. Many surfaces lose the soap scum film unfortunately, more porous surfaces may remain stained. There is undoubtedly a noticeable change that occurs throughout the entire home. Everywhere soft water is used will begin to show the benefits. The inner workings of appliances may not be seen from the outside, but the longevity and performance will definitely show over the long term. Even filters in humidifiers will last longer. Many of these changes point directly to saving home maintenance dollars over time.

The magic of soft water

The magic of soft water is very apparent in the shower and bath. One of the most common observations is a slippery feeling when using soap for the first time with soft water. Many people experience an almost oily feeling on the skin when soap or shower gel is used. What is really happening is the accumulated hard water film on the skin is washing away. This slippery feeling rarely lasts longer than the first few times of washing and soon disappears with the soap scum film that has attached itself to the skin. More magic happens when washing dishes. Dish soap bubbles are more abundant with less soap needed. The bubble density is much greater making it easier to clean up pots and pans. Cooking oils are easier to wash away with less streaking on surfaces. Similar effects are noticed during clothes washing. Up to 2/3 less detergent is required to clean the same amount of clothes. Whites and light colours lose the grey tones and appear brighter. When bleach is used white clothes gleam an even brighter white. During house cleaning surfaces in the bath and shower are much cleaner and any residue from shampoos, and showering/bath products are easily wiped away with little or no scrubbing. There is very little if any water marking on the chrome and glass of the shower door and around drains. A sparkling clean home takes much less time and effort.





Health and soft water

The accumulation of minerals is highest during spring run-off, so that is when the biggest benefit to skin is realized. During this time of year, skin also suffers from dry air, and when hard water soap film prevents natural oils from hydrating the skin it can be extremely detrimental to skin health. With soft water the natural oils that keep the skin soft and supple are able to do their job, and when needed, lotions can penetrate and relieve dry skin. The amount of lotion required is much less than when trying to penetrate the barrier left by hard water. Wrinkle and dry skin remedies require a lesser amount to reach optimum effectiveness. Eczema, rash and dry flaky skin are lessened when pores are not blocked by hard water soap film. Prescription

medications penetrate the skin better, helping to resolve issues caused by overly dry skin more quickly. Skin is not the only part of our bodies that benefits from soft water. Hair health is also improved. The accumulation of hard water soap scum in hair causes it to remain dry and never benefits fully from hair products. Soft water enables shampoo and conditioner to wash dirt and oil away and conditioner to penetrate the hair to provide supple manageable hair. That's why hair washed with soft water has up to 70% more luster! The amount of product needed when washing hair is about 1/3 of what is required to coax suds out of hard water. With the price of hair washing products it's nice to know they will last 2/3 longer!



Soft water in appliances and fixtures.

Just as surfaces on the body reap the benefits of soft water, the same goes for the plumbing and heating system in homes.

Regardless of what configurations a home has whether heated by boiler or forced air, the benefits here are seen by less wear and tear on boiler pumps and piping since the amount of scale stops accumulating, and humidifiers and their filters will run better for longer. Water heaters will have less scale to heat through so heating water will be more efficient and less gas will be required. Any appliance that heats water will see benefits for longevity and efficiency. Dishwashers will clean better since food particles won't stick to accumulated soap scum stuck to the moving parts. Less dish washing detergent and rinse agent will be required to wash the same number of dishes. Instant hot water makers will last

longer and require fewer repairs from scaly buildup accumulation to the inner workings. Shower heads will require little to no descaling, enabling water pressure to be better and the flow won't spray off to the sides any longer. Cartridges inside faucets will last longer, scale won't interfere with the valve operation or flow, when turned on and off. Even tiny faucet aerators and O rings will last longer and keep water flowing in the right direction. Homes with boiler systems with more components like pumps, valves, air purging devices will also see the benefits of longer life due less degradation of the internal working parts due to hard water scale.

Water softener installation tips

Not every water softener installation is created equally. There are options that need to be considered before doing any installation. It is critical a certified plumbing technician install a water softener, for the client to gain the maximum health and practical benefit. A professional installation is necessary for the safe operation of the water softener and the piping in the home. Improper installation will cause major damage to fixtures, appliances, or piping. Connections need to be secure to avoid potentially damaging water leaks, even a small leak missed during installation could cause devastating damage to the home. Ace Plumbing technicians have many years of experience safely installing water softeners. Each installation is customized to meet client's individual expectations. All options are thoroughly explained so the client gains a complete understanding of how their needs will be met. Only water softeners safely installed by Ace Plumbing are covered by the "Happy Today or You Don't Pay" promise. Our promise is there to provide peace of mind and ensure that each client is happy with their purchase of a new water softener.



Water softener installation checklist

- Journey man plumber
- Upfront pricing
- List of options available
- Extended warranty available
- Softener salt program
- Company insurance
- Company bonded
- No payments for 6 months no interest
- Happy Today or You Don't Pay Promise



Punctual, professional, and great communication. I would hire them again.

-Matthew D



Only Ace Plumbing
Guarantees everything with:
"Happy Today or You Don't Pay"



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The professor of plumbing

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