

WANT TO \$AVE REAL DOLLAR\$ IN THE FUTURE?

Sacrifice you Sacrificial A

Do you have a mains-pressure storage hot water system? Is it five years old or older? Then you probably should make arrangements to have its sacrificial anode replaced, to ensure at least another five or six years life before it fails. Replacing the anode is straightforward, cheap and will save you lots of money.

In these days of “carbon pollution panic” and dire predictions of climate change havoc, electric off-peak hot-water systems are supposedly regarded as wasteful and to be avoided.

So much so that they are prohibited in new homes and there is a possibility that they will be banned from sale in the future for replacement of existing systems.

Either way, it is in your interest to keep your existing off-peak storage hot-water system going as long as possible. Replacing it will be costly and if replaced with a gas instantaneous or storage system, it is likely to be more expensive to run.

There are two ways to ensure long life in any mains-pressure storage hot-water system. First, keep the thermostat to as low a setting as is practical.

Normally, it should be set to no more than 60°C. Any higher setting causes increased thermal cycling stress in the tank itself, not to mention the increased risk of scalding to infants and elderly people.

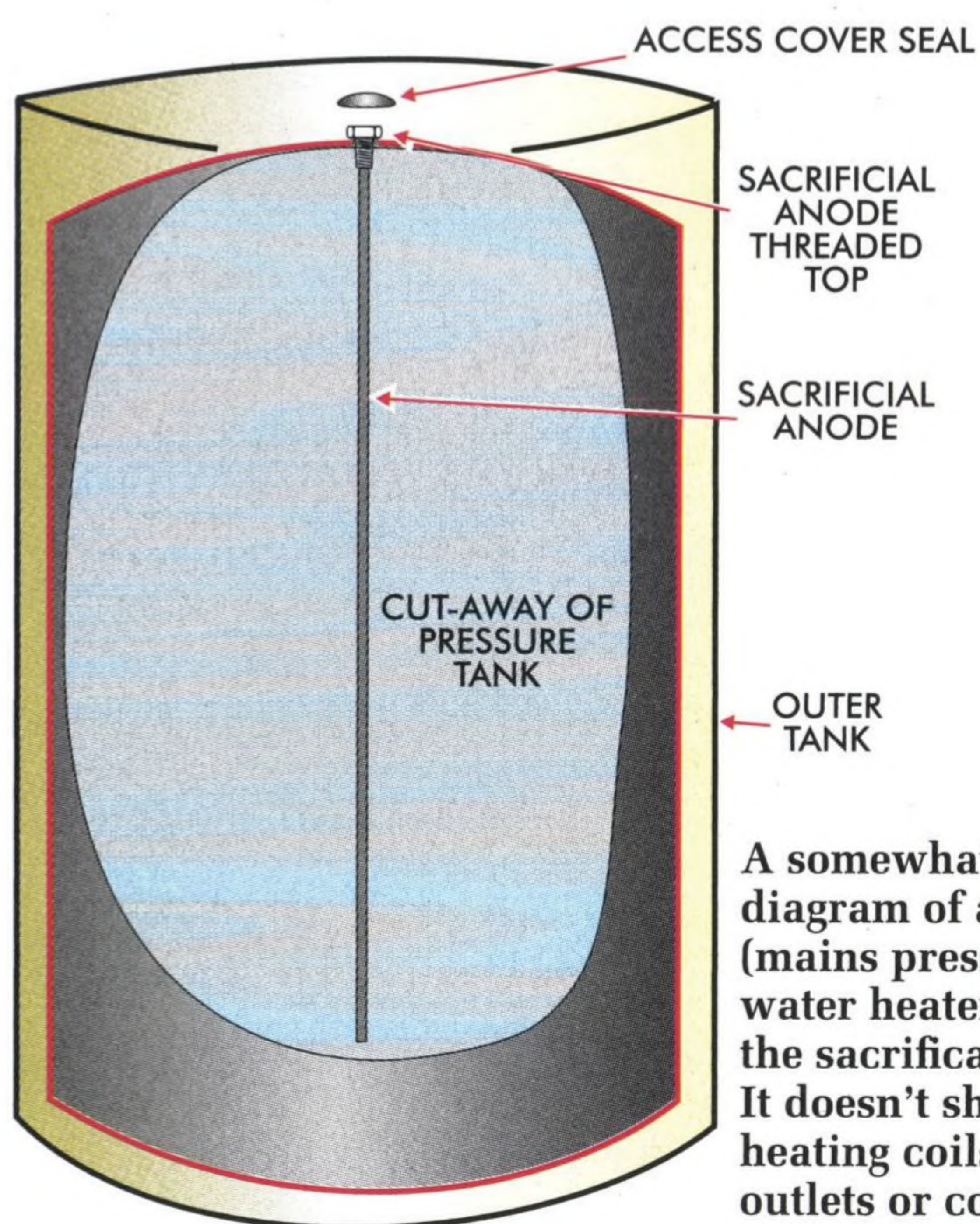
Second, make sure that the sacrificial anode is working, ie, being sacrificed to protect the tank. That’s if it is indeed still there – there’s a distinct possibility that it will have been worn away, either mostly or even completely.

What’s a sacrificial anode?

By way of explanation, all storage hot-water systems, be they electric, gas-fired, solar or heat pump, use a steel tank which is lined with a vitreous coating. As time goes on, that vitreous coating is subjected to a lot of stresses and inevitably, very fine cracks develop and allow the hot

water under pressure to come into contact with the tank and then corrosion starts.

Or at least it would, if the tank was not fitted with a sacrificial anode. As its name suggest, it is “sacrificed” and it corrodes before the tank does. The anode is usually made of magnesium, a metal which is more “active”



By LEO SIMPSON

ir node!

This sacrificial anode is about five years old. Even though it's not too far gone, for the purpose of this article we decided to have it replaced. Note that there is insufficient headroom above the tank to enable it to be fully removed. You would need a segmented anode for this job (the inset photo shows a non-segmented type – see overleaf).



(with a more negative electrochemical potential) than the steel of the tank.

All of which is good but if you leave the sacrificial anode for too long, it will be sacrificed too much and then the tank's life is quite limited. Unfortunately, by the time you notice that the tank is leaking, it is too late to do anything about it and it must be replaced. That's expensive.

If you live in Sydney or other Australian city or town with a "soft" water supply you can normally expect to get about ten years or less from a hot-water tank. Or at least, that's what most people get because they don't know about the sacrificial anode and its function.

Incidentally, sacrificial anodes are also found on ships, larger boats and even outboard motors, for exactly the same reason – they prevent the hull or motor being eaten away by electrolysis. But we digress.

In most hot water systems the sacrificial anode is in the form of a long (magnesium) rod which hangs down inside the tank and is suspended from the top plate. It is quite easy to inspect and replace and we will go through the steps in a moment. You can do it yourself with the only tool required being a socket spanner or if you are not confident about meddling with your tank, a plumber can do it.

At this stage we should state that most plumbers seem quite ignorant of the facts that first, hot-water tanks do have sacrificial anodes and second, that they should be inspected or replaced at specified intervals. And some plumbers take the attitude that if the tank is more than

a few years old, it should not be disturbed in any way.

That's silly. First, it's an easy service for a plumber and second, they only have to read the manufacturers' info to find out the details.

To illustrate, some 13 years ago a company specialising in servicing hot water systems contacted me and suggested that the sacrificial anode in our hot-water tank should be inspected and replaced. By that time, the tank was about seven years old. Inspection revealed that the anode was very heavily corroded but still intact and it was strongly recommended that it should be immediately replaced. I agreed and it was only about ten minutes work.

Fast forward some seven or eight years to late 2007 and one day I noticed that the outside of the tank seemed quite warm. In fact the top of



An example of a sacrificial anode that really has worn right away. The central iron core is now clearly visible which means that the anode is now playing no part in protecting the iron tank. It would be very surprising if this hot water system was not badly leaking.



Here's a "segmented" sacrificial anode, designed to be inserted into the tank where there is insufficient headroom to fit the "straight" variety. Each of these segments can bend with respect to one another and re-straightened as it is inserted into the tank. It's important to note that the anode must not touch the walls of the tank inside or it may actually contribute to rapid corrosion, not protect from it.

the tank was more than warm; it was hot. I duly removed the plastic inspection disc at the top of the tank, only to discover that the insulation was quite wet.

Hmm. I had left it too long to replace the anode.

About a month or so later, the tank was clearly leaking and subsequently I had it replaced with a virtually identical 315-litre model.

As a matter of interest, the sacrificial anode had completely gone and its mating thread in the tank had heavily corroded, leading to the leak. Still, the good thing was that I had achieved about 15 years from the tank; quite a bit longer than the average of 10 years which is typical of a mains pressure off-peak hot-water system in Sydney.

But how much more life would I have obtained if the anode had been replaced in reasonable time?

Fast forward again, to July 2012, and we were about to have some major home renovations done and as part of the deal, the hot water tank was to be moved from inside the laundry to a store-room nearby. By this time the tank was only five years old but I decided to obtain a new sacrificial anode and have it replaced at the same time.

Now here is the tricky bit. Many storage hot-water systems are in rooms where there is limited headroom above the tank. A 315-litre tank is about 1.6 metres high (depending on whether it has been mounted on a plastic or concrete pad) while the anode itself is 1.4 metres or thereabouts.

You need more than one metre of head-room above the tank if you are to remove it without bending it. And even if you do manage to bend the old anode sufficiently to remove it, how can you manage to get the new one in?

Fortunately there is a solution: flexible segmented anodes. The segments are about 300mm long and so the anode can be bent (carefully!) to insert it into tanks with limited headroom.

In my case the limited headroom did not matter because the anode replacement could be done when the tank was being moved by the plumber. But for the purpose of this article, I purchased a segmented anode.

Where to buy a sacrificial anode

You need to contact a plumbing supplier with the make and model of your hot-water tank, and if possible, the recommended anode type, which should be in owner's handbook. If not, contact the tank manufacturer.

You're most unlikely to find a sacrificial anode at your local hardware store, even if it does have a good range of plumbing fittings – it is most unlikely to stock sacrificial anodes.

In fact, you may well find that the plumbing specialist store will have to order one in for you. However, this is

not foolproof: they need to know what you want!

After talking about sacrificial anodes, another of our staff members was prompted to change his. So he went into a local plumber's "wholesaler" (a major store with large amounts of stock) and asked for a sacrificial anode to suit a Siebel Eltron WA300 Heat Pump hot water system.

The instruction manual for this heater says to check the sacrificial anode after 12 months – he's had it for nearly three years. And heat pumps cost far more to replace than conventional hot water systems!

The (usually quite knowledgeable) girl behind the counter looked at him as if he was talking Swahili and turned to the other salesman to see if he knew what was being asked for. Blank looks abound! So they asked a plumber who was also being served at the time and he got this quizzical look on his face while shaking his head.

The girl then said "I'll have to ask Bob when he comes back from lunch and ring you back". Bob, as it turned out, was the manager of the place who had been a plumber most of his working life.

Apparently he asked "why would anyone want one of those?" but at least knew what a sacrificial anode was! The end result was that they couldn't locate one from any of their normal suppliers.

Our guy then rang the importers and was told that it was a bog-standard 1.2m "black top" anode and "anyone could sell you one of those". He told the bloke on the phone his tale of woe at the wholesalers, who responded with comments along the lines of what we said earlier in this article. "Plumbers don't replace them," he said, "but that could be because it's much more lucrative to replace a whole hot water system when it starts to leak."

If that's not an indictment of an industry, then what is?

But he was able to steer our guy in the right direction – "call Reece Plumbing Supplies," he said. They should be able to help you.

He was right – they could and did (although they had to order one in, as even then it was not a normal stock line).

And if you don't want to DIY?

If you do not want to do the job yourself, contact a local company who specialise in hot-water service, or even the manufacturer of your unit. Most have service departments.

But be prepared for a long silence when you tell them what you want!

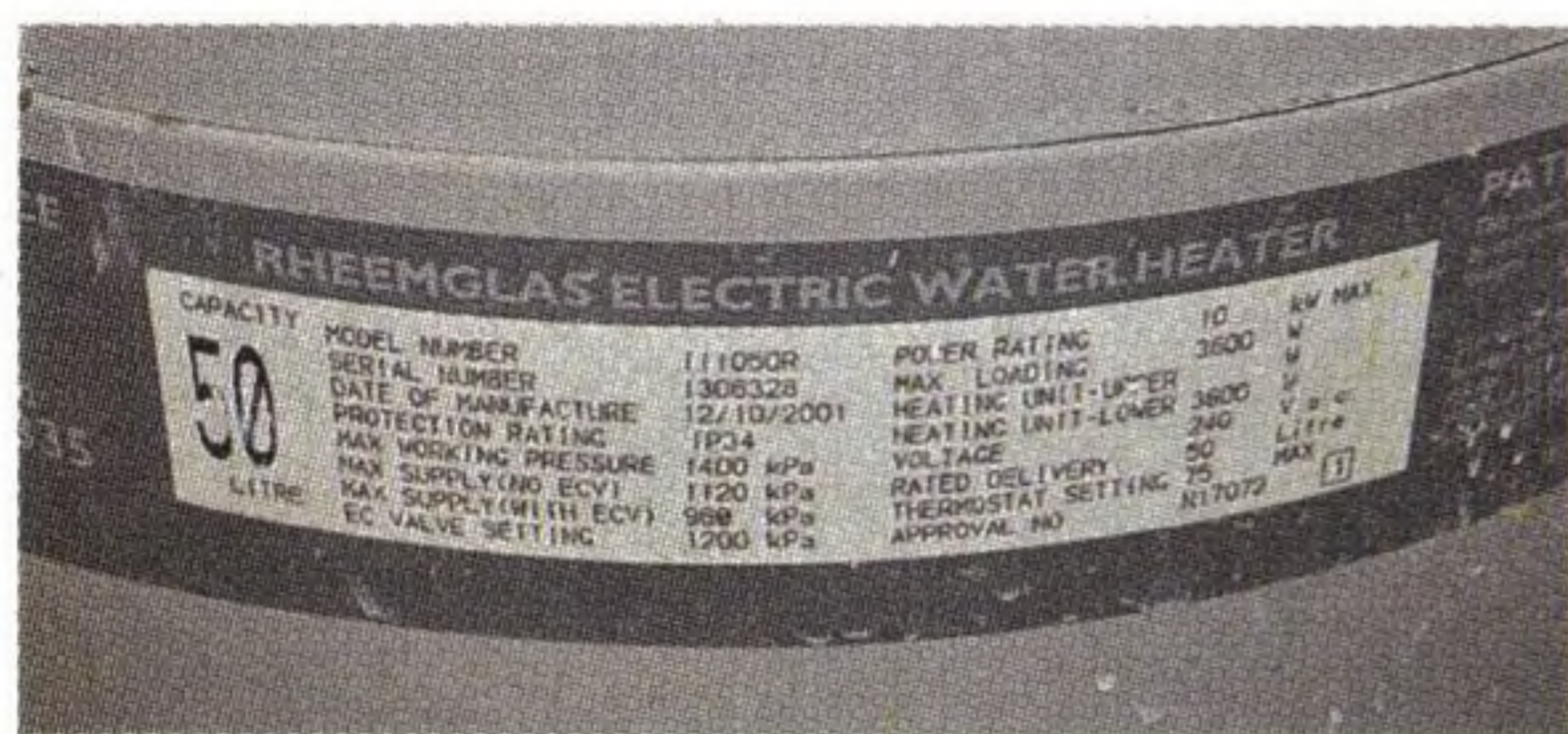
DANGER: Hydrogen build-up in hot water tanks

When changing a sacrificial anode, or even when using a pressurised hot water system after a period of non-use (eg, returning from holidays) be careful of hydrogen build-up in the tank.

Hydrogen, a colourless and odourless (but highly explosive) gas, is released from the anode as part of the chemical reaction which allows it to protect the tank. In normal use it is eliminated from the tank by the flow of water (you may experience a sputter at times when you turn the hot water tap on).

Therefore this is not normally a problem when changing sacrificial anodes because you remove the pressure (and hydrogen gas) by turning on a hot tap and activating the pressure release valve but you should avoid smoking and also remove any other ignition sources before starting work.

The steps you need to replace your anode



[a] Check the specifications label on your tank. You need to know the anode type required (eg, black or blue; dependent on water quality) and the brand, model and size of tank. If the anode type is not listed, your supplier will need the other information to get the right one.

[b] Having obtained the required sacrificial anode, check that its length is about right for the tank; it must not be too long. If it touches the sides or bottom inside the tank, it can cause rapid corrosion – exactly what you *don't* want!



[c] Turn off the electricity supply at the switchboard by removing the hot-water fuse or switching off the relevant circuit breaker or main switch (or both).

[d] Turn off the water supply with the stop-cock on the cold water inlet.

[e] Release the pressure inside the tank by lifting the lever on the pressure relief valve near the top of the tank. Lift it gently and release it gently; do not let it snap back into place because that might damage the valve seat.



[f] Open one or more of the hot water taps in your home to bleed off a little water. Not much should come out.

[g] Remove the plastic inspection cover in centre of the top plate of the tank. You should see the black nut (typically 11/16 inch).

[h] Use the correct socket to loosen the nut. Do it slowly; just in case you did not do the preceding steps! No water should leak out.

[i] Before removing the old anode, check that its threaded section at the top is identical to the replacement anode. If it is not identical, you will need to re-install the old anode and get the correct replacement.

[j] OK. So is the old anode heavily corroded? If not, you may want to leave it for another year. Before screwing it back into place, remove the old Teflon tape from the threads and run a few turns of new tape around it to ensure a good seal. Do it up tight but not overly so. Remember that you will want to remove it in the future.

If the anode is heavily corroded, it should be replaced and if there is limited head-room, you will need to carefully bend it as you lift it out. Do not apply any leverage to the threaded section in the tank as you do this. Mind you, if the anode is heavily corroded there may not be much of it left so removing it should be easy.

[k] Now you need to insert the new anode. If you have a straight anode and no head-room limitation, you can just lower it into the tank. Note that some anodes will be supplied with Teflon tape already wound on to the threaded section. If this is not present, you must wind several turns of Teflon tape around thread, in the same directions as the thread. Almost invariably, that is clockwise.

If you have restricted head-room above the tank, you will need a flexible (ie, segmented) anode. It must be inserted into the tank so that when it is fully in, it is not touching the inside (of the tank). You do this by

straightening each pair of segments as they are lowered into the tank. When you are sure that nothing is touching inside, tighten (but do not over-tighten) the nut.

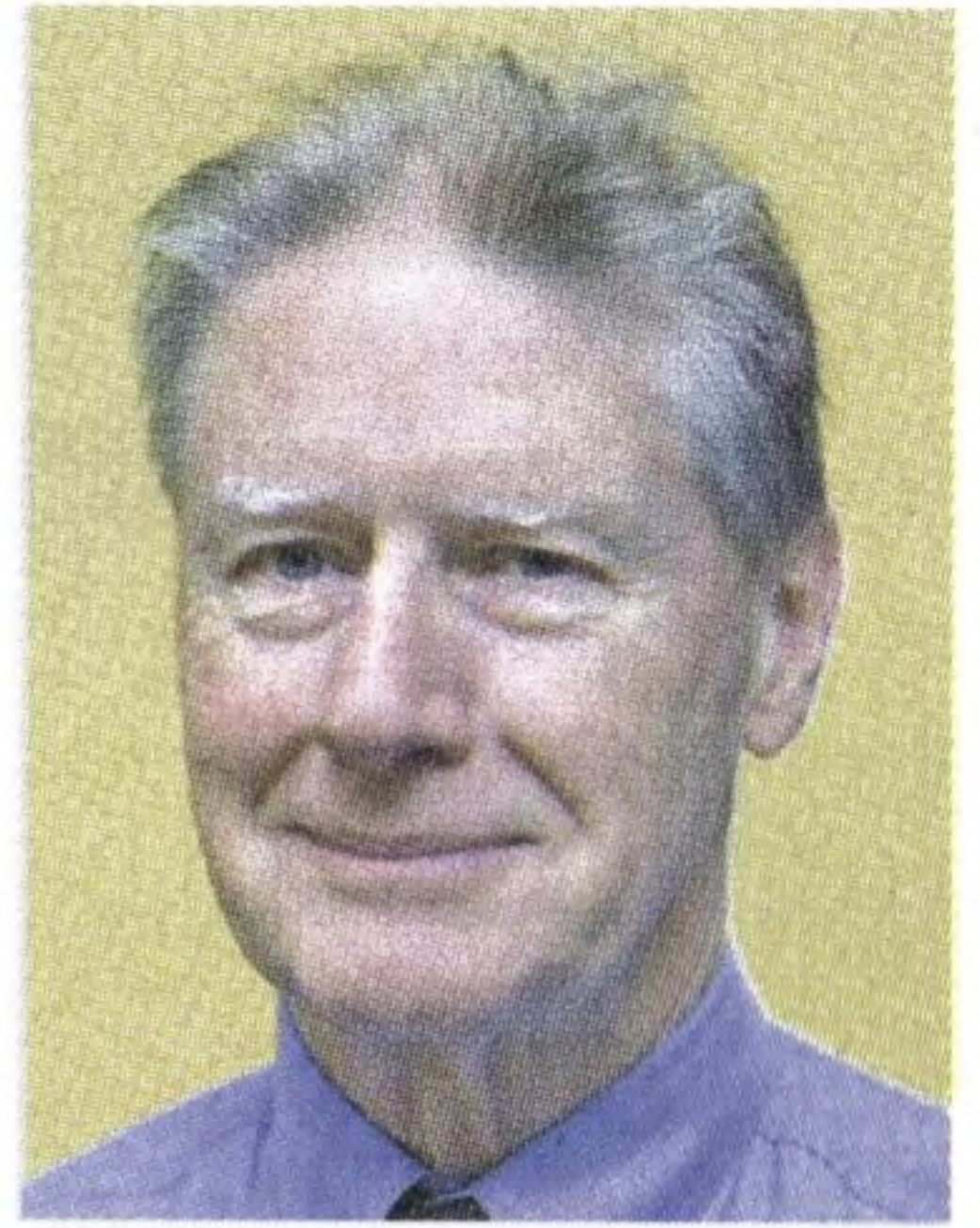
Then reverse the other steps of the removal process. That is, turn on the water supply to the tank, let the water run briefly from one or more the taps inside you house and then check that no water is seeping from around the top of the new anode. When everything is hunky-dory, snap the plastic inspection cover back into place and restore the electricity supply. **SC**



Publisher's Letter

Replacing sacrificial anodes in hot-water systems is good for the environment

This month, we have a seemingly low-tech story about replacing the sacrificial anode in a mains-pressure off-peak hot-water storage tank. Why would we have such a story in SILICON CHIP? Well, why not? SILICON CHIP readers are concerned about energy efficiency and as a corollary of that, in getting the best performance from anything electrical or electronic. And hot-water systems certainly fit into those criteria.



There are millions of these tanks in homes and businesses throughout Australia and yet most owners and users of these tanks are blithely unaware that there is such a "thing" as a sacrificial anode in their tank and that it should be inspected and replaced on a regular basis. Of course, this does not only apply to mains powered hot-water systems. It also applies to gas fired systems, solar hot-water systems and even those that use a heat pump as the power source; anything with a steel storage tank and with mains water pressure is at risk of corrosion and eventual failure.

And yet I know that if you ask all your acquaintances about the state of the sacrificial anode in their hot-water systems you will get a blank stare from virtually all of them. Boat owners know about sacrificial anodes but virtually no-one else does, including the people who install them: plumbers.

Boat owners do have their sacrificial anodes replaced regularly, usually every year, but those same owners probably don't know about the one in their hot-water system.

What this means is that virtually all the millions of hot-water systems in use throughout Australia give far less than their potential life span. And since most mains-pressure hot-water systems typically last less than 10 years, precisely because their sacrificial anodes were not replaced when they should have been, that probably means that the annual cost in Australia runs into 100s of millions of dollars a year.

It get worse though, if you consider the cost of replacing solar or heat-pump systems. These generally cost far more to install than the lowly and these days much-despised off-peak electric hot-water systems yet as far as I know, owners of these systems are seldom specifically told about the need to inspect and replace sacrificial anodes.

Solar hot-water systems are even more at risk because they typically have a roof-mounted horizontal tank, unless you are fortunate enough to have purchased a stainless steel tank which does not need a sacrificial anode! Roof-mounted tanks may not be out of sight but their corrosion risk is certainly out of mind.

So while many people may worry about the cost of electricity and more specifically, the cost of hot water, they are completely unaware of the possible liability for the large one-off cost of replacing the entire hot-water system. Think about the cost of the tank and its installation.

Personally, I want to keep my off-peak hot-water storage system going for as long as possible because there is no guarantee I will be able to replace it with a similar unit when it eventually fails. Ultimately, I will probably replace it with a solar system but I would prefer to postpone that as far into the future as possible.

I also like to think that I am being "environmentally friendly" with such an approach. Sure, I am potentially saving money but then I am also saving the resources which would otherwise be required to replace the tank.

So here is our strong suggestion. Get your hot-water system's sacrificial anode inspected.

Leo Simpson