

Topic 12 Pump Systems Pump types, performance, remote start, suction lines, supply lines

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Justin Leonard

Here we are in Webinar 2, and I'm looking forward to presenting on water tanks and pumps and spray systems as an augmentation to our protection systems. So, I guess the challenge with these types of systems is they're active. They're not passive systems like using the right types of materials that aren't affected by fire themselves. And in active systems, there's always the issue of, "will they operate?", "are they reliable?", "will they work under the conditions?"

So, let's move through both of those topics in this webinar. What we'll do is we'll start off with a bit of deep thought about where spray systems are appropriate, and what they aren't adequate at all for. And then in the second half of tonight's presentation, we'll move into how to actually make them reliable and design them so they'll actually hold up during the event itself.

Chair

We've got a person here who's concerned that their petrol pump is the weak link in the event that they have to defend their house. Have you got any advice about using a generator instead to maintain power and enhance their water supply?

Justin

In a Black Saturday context, over 90% of the pumping systems for houses that were supplying water for active defence or spray systems failed during the peak of the event. And that was everything to do with ingestion of embers into the filter, fuel lock because the pump itself got too hot, embers and debris landing on the electrical systems and burning it out like everything possible, and/or simply the air was too hot that was ingested into the pump and the pump simply stopped functioning either temporarily and needed to be manually restarted.

So, the idea of putting your pump in a protected enclosure that not only provides ember- but thermal-protection so it's a cool operating location for the pump, needs a fair bit of work. But one of the ideal solutions is you can put an electric pump out there in an enclosure and protect the electrical supply and whatnot. It can actually handle quite a lot of heat and doesn't need to breathe air through it to operate. Run your cables underground to a good safe location, like in an adequate spot where you can build an enclosure or run it in a shed or something like that, and have a generator run in that remote, more viable location rather than a location right out near your water source.

Chair

That scenario you painted there, I can add to that. What I had is a gravity-fed petrol pump from a dam. The pump functioned perfectly, but I wasn't aware that the poly pipe leading down to the pump was only 150mm under the ground, and when the tree roots caught fire, it put holes through the poly pump, and so the supply failed. And I learned a lesson there. Lost the house, learnt the lesson.

Justin Leonard

Yes, a lot of people actually think that water-filled poly pipe will do okay because it's got water on the other side. But, in fact, it prolifically fails when it's exposed to direct flame. And I guess the other angle to think about with pumps is: a lot of them are supplied with enough fuel to operate for an hour, possibly two, and they're often connected to a water supply that can last much much longer than that. And having that tank full in the first place is step one, but the prospects of refueling it while there's active embers in the air isn't very exciting, particularly if it's a petrol pump. So, that's another tick for the remote generator with a fairly significant-sized tank. Or, it's in a relatively protected environment that you can safely refuel it.

Chair

Has there been much investigation of sprinkler types and fire protection systems that have actually worked through a bushfire situation, that aren't theoretical but have really been seen working in real life?

Justin Leonard

Yes and no. A lot of domestic systems failed under, for instance, the conditions like Black Saturday. And they didn't necessarily fail because the spray systems themselves weren't adequate for the task, they failed quite prolifically because the petrol and diesel powered pumps couldn't handle the heat of the day, and in some cases the heat of the day and the heat of the fire. So, it's actually quite challenging to find the ones that worked and persisted throughout because they're quite rare. But where they do show up as being quite effective are metal pipework, wherever it's above ground. And very frequent spray heads either mounted on the house or in that perimeter array projecting back onto the house using an impact sprinkler are the other key ones that really do work. So, short distance fans on the house or distant impact-sprinklers that keep coming past.

Chair

You've addressed that the inadequacy of petrol pumps under those high temperature conditions. Do the diesel pumps behave in similar ways or are they are they better in that sense?

Justin Leonard

The diesel doesn't cause vapor lock like the petrol ones, so the vapor doesn't create the problem in the carby. So, they're a bit less heat affected and can run to a slightly higher ambient temperature than the petrol ones. However, the diesel ones are just as susceptible to ember attack or surface fire as the petrol one. So, if the diesel pumps suck in embers into their paper air cleaners, it'll cause a flaming ignition of that paper air cleaner and that will snuff out the diesel motor, just the same as it would a petrol one.

The diesel ones do have a slight advantage, and that is around the prospects of safely refuelling them mid-fire. I would feel a little bit more confident trying to refill a diesel fuel tank than a petrol one, only because it's far less volatile and more difficult to ignite from ember attack. Although I would be particularly nervous in either scenario because you're effectively trying to pour a fuel, diesel or petrol, into a tank on a very hot engine. And, of course, if you splash diesel on a hot engine it can burst into flames. And it can be up to a temperature where those embers can ignite and you could have a major problem on your hands. So, it does flag the issue that diesel is better than petrol but the question of how big your fuel tank is and what your prospects are to refuel it are key considerations in the design of your system.

Chair

Is it feasible to attach a larger external fuel container directly to a pump to get that extra fuel-tank size?

Justin Leonard

Yeah, most definitely. And I'd encourage that approach and actually to remotely mount the tank, like off the pump itself. That certainly avoids the additional risk of heating from the pump and the heat feedback, which is one of your problems with vapour lock for your petrol pumps. And it also solves the issue of vibration. So trying to mount a large fuel tank on a small pump that's vibrating is going to lead to fatigue and issues as well. So, definitely explore that remote mounting approach. Obviously still needs to be above the pump because they're made as a gravity feed.

Justin Leonard

So, what's a better system to the typical one? Well, why not electric? Electric pumps can be far more tolerant. They can handle a lot higher temperatures, they can be mounted in situ or remotely from the tank. But, obviously, you've taken the engine, the internal combustion engine, off the actual pump itself and replaced it with an electric motor. But how are you going to reliably provide electricity to that motor? And what you actually need is either a remote generator, which can be put in a far more convenient location any distance away from the tank. So there's a big improvement, that you've got flexibility for a really nice enclosure in your preferred location for your generator. Or you can think a bit more outside the square and think about a battery storage system and an inverter, and both of those things can be safely mounted in an appropriate shed or in the hat in your house itself, or in a basement, and of course they can work quite synergistically with the solar system and whatnot. So it's a bit of a maybe, if you're thinking about quite an advanced solar system and looking for a bit of battery backup and surviving through those blackouts, here's a sort of really obvious and interesting extension of that idea, to move to an electric system.

The other side-benefit of having an electric pump system is that point that was raised in the questions about automatic activation. And it's obviously a lot easier to automate the activation of an electric pump compared to having a starter battery and whatnot to get an internal combustion engine up and running on your system. So, I would say that that's inherently more reliable, and of course the gold standard system is to use some form of gravity-feed approach. And if you're lucky enough to be in an area like Marysville that actually has gravity-feed town water supply system, then you can start to think about having quite reliable water pressure. That being said, Marysville actually had a failure during the Black Saturday events from its gravity-fed water system, and that's because a car actually burned over a service manhole that was some critical valve in the system that shut the whole thing off. So, just like Malcolm's pine-tree root story for his main water supply, there's always potentially some weird and wonderful way you can take out an otherwise really reliable system.

Chair

Can you tell us what are the merits of these remote-controlled systems connected, say, to your mobile in order to operate a sprinkler system around the perimeter or on the roofline of your home?

Justin Leonard

I guess that cuts to the heart of this passive versus active system. And, I guess an active system needs to be turned on and ideally it doesn't need you to be physically there to turn it on. I mean, the ultimate life safety strategy is not being at your house. So, setting up a system that doesn't require you to be there to help defend your house by turning on your spray system, for example, is going to be prolifically better.

So, automated activatable systems, I think, are a fantastic idea. And they're certainly a step above the, "Oh well, I'm going to stay until x time before the fire turns up, turn everything on, and hope it continues for the duration, because that's another compromise you're making about your life safety by leaving it as late as you can to leave. Nothing's worth those life safety compromises. So, I would say once you get to a point of having a reliable water storage, a pumping system, you should go that extra step and have it as an automated activation.

Chair

One person says that they went to a major agricultural supplier looking for an electric pump compared with a petrol pump and they got brushed off. What should they look for in an electric pump? Where should they go, even?

Justin Leonard

I would go to a specialist. You really need to go to Davey or start leafing through the Davey catalogues and looking at the proper pumps. They're not going to be the types of pumps you typically use in a domestic supply, you're sort of going next level up. They're not necessarily expensive pumps, but you can find an electric pump to do pretty much any pressure or any volume task you need. You just have to work through that entire system and find the expert pump suppliers, like Davey. Davey have an incredible range, for example.

Chair

Plastic suction lines to the pump. Are they likely to fail?

Justin Leonard

Yeah. They rely on their rigidity. They're under suction means that the pipe's water pressure is doing everything it can to collapse the pipe, but it's got plastic ribbing and whatnot in the pipe to hold it open. If the water inside is hot or there's significant heat around it, then it might not be strong enough to keep itself open and it could collapse.

Chair

How do you provide radiant heat protection if you've got plastic pipe supplying a pump from an elevated tank?

Justin Leonard

I think my last three slides pretty much showed exactly how to do that. If you had a really long run and you were looking for a really durable approach, you could think about enclosing it or shielding it with some type of masonry type exterior cover. If you want a really long-term solution, but otherwise the lagging and covering approach I showed there was pretty straightforward.

Chair

Will smoke on its own stop a fire pump?

Justin Leonard

Really dense smoke that has most of the oxygen consumed will cause the pump to drop significantly in power and possibly cut out, but it won't permanently immobilize the pump. So, it might actually be able to be restarted.

Chair

Getting back to our sprinkler systems again, this participant was told that the copper sprinkler piping is unsuitable for bushfires. Will copper withstand the radiant heat and flames?

Justin Leonard

I found copper, and particularly copper with water in it, survives adequately in bushfires. So, I would challenge that as a suggestion.