10-06-2016, 00:30 #1

SV THIRD DAY
Marine Service Provider

Sponsoring Vendor

Cruisers Forum Supporter

Join Date: Aug 2006
Location: La Paz, Mexico

Common DIY Water Maker Mistake...don't let it happen to you.

In the last week I have had three cruisers call me to help them with their DIY home built water makers that they could not get to work, and all three of them made the exact same costly mistake...so I thought it would be valuable to warn others because the sound of "I just blew $1000 silence" on the other end of the phone is painful to hear.

There are a flood of Cat 2SF35SEEL 3.5GPM Hp pumps hitting the Ebay and Craigslist sites lately from owners parting out their failed XXX-Brand water makers with energy recovery. The seller of the pump correctly told them that the pump was powered by a 1/2 Hp motor and the pump seems like a great deal. They then buy a 1/2Hp motor and sha-zam off they go to make water. Well...that is until they try to run the pump and it just

Boat: 1978 Hudson Force 50 Ketch
Posts: 3,836

stalls out and trips the breaker when they try to increase the pressure.

They spend days, weeks or even months thinking they have a RO Membrane blockage or plumbing mistake. Then they pick up the phone and finally call for help. I've helped out with enough of these DIY water makers to know that before I do ANY Troubleshooting or helping, I always ask the detail question about the equipment to make sure it all matches up from an engineering standpoint....gulp...

They then find out that to run a 3.5GPM Hp pump at 800psi you need a 2.0Hp motor! Well holy smokes, they can't power that with their inverter or Honda EU2000i like they planned. What's going on, the seller told them the pump was connected to a 1/2Hp motor...why am I now giving them the bad news that they need a 2.0Hp motor? As the guy this morning said, "the bastard lied to me, I'm going to report him to Ebay and get my money back from PayPal". Well good luck with that.

The seller didn't lie, it's just that both he and the buyers didn't understand what they were selling/buying. On the energy recovery systems the cat pump is not ran at pressure, it is just feeding into the energy intensifier pump so the pump and motor set-up is never ran at load. This lets the 1/2 Hp pump run the 3.5GPM pump...but as soon as you try and increase the pressure on the pump and dial up your 800psi...boom...splat the motor stalls out and trips the breaker due to a basic pump GPM vs motor Hp mismatch for the Hp application. It worked like a champ at no load but now..well....you get it.

We could play with some equations to size the Hp pump with the right motor, but when you boil it down at the end of the day to what's readily available for a DIY guy, here are the Hp motor sizes needed to drive a GPM pump at 800psi.

0.5gpm = 1/3Hp
0.8gpm = 1/2Hp
1.6gpm = 1.0Hp
2.3gpm = 1.5Hp
3.5gpm = 2.0Hp
4.2gpm = 2.5Hp

Now note, if you want to be able to run on a Honda EU2000i OR a 2000W inverter, you can't go larger than a 1.0Hp motor.

Double Note, a Yamaha 2000 generator WILL NOT start the low power draw 1.0Hp motors like the ones we use with a capacitor start and capacitor run. The Honda will all day long. Sorry, your Blue Yami isn't as good as the Red Honda...

So that helps avoid the powering side mistakes which are 1/3 of what I help DIY-ers with. Another 1/3 of the problem is their expectations of fresh water production. If I have heard it once, I have heard it 1000 times, that damn ROSA software and calculations that the engineering types flock to like the black meteor at Mecca. It has as much use to a Marine batch process water maker as garlic does in attracting dates. No one out there wants to publish this real world data and there is a well known water maker company out there that actually removes the pump manufacturers label from their pump to hide the pumps flow rate to make this data harder to figure out. Ask them these questions and they will say "that's proprietary". It keeps RO more black magic, but being a little contrarian to what is "normal" here we go.

This is a summary of fresh water production flow rates at 800psi, in 68-deg, 32K ppm (normal) sea water. Both from a single and then double (in series) standard SW30-2540 membrane.

1.6GPM Hp Pump = 21GPH for membrane No 1 and then 13GPH from Membrane No 2 in series.

2.3GPM Hp Pump = 23GPH for Membrane No 1 and then 18GPH from Membrane No 2 in series

4.2GPM Hp Pump = 25GPH from Membrane No 1 and then

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VENDOR SPOTLIGHT

25GPH from Membrane No 2 in series.

Now can you run less than 1.6GPM into a 40" Membrane, well you can but I don't recommend it for two reasons:
1. The membrane life will be significantly shortened due to not having enough brine flow to wisk away the salts, changing the Ph and allowing scale to form on the membrane and then plugging them up.
2. The pumps cost the same...the motors cost about the same...so why make 10GPH and have your membrane die in half the time for the same amount of money. Well the only answer would be because that is all you can power aboard your boat without a generator...ok...so that is a valid reason, but knowing just how hard it is in the real world of cruising to power a 1/3 Hp or 1/2 Hp motor on DC...I just don't like to sell them and then have to deal with the consequences later of someone not being happy. So no, the client isn't always right and I send those folks to a few other water maker companies that sell those type of units. That's the advantage of loving what I do, not needing to do what I do. It lets me say, no thanks and not just chase every crazy dollar.

One more thing to notice is how the flow rates change (or don't change) with the accompanying change in sea water inlet flow. The membrane has a sweet spot and that's what we try to exploit in our standard units. Also remember that increased GPM flow of your pump costs you Hp (or Amps) so why use a 2.0Hp motor when a 1.5Hp will do the job? Why use a 1.5Hp motor when a 1.0Hp will do the trick?

I didn't start this epic post planning to cover this, but heck, my daughter just graduated from High School tonight so I'm feeling happy. The final 1/3 of the DIY trouble shooting calls revolve around the issue of getting enough flow into the Hp Pump inlet. Piston pumps do not like to suck, they want to have a flooded head of sea water pushed into them through the prefilters. The problem becomes when the DIY guy specs out his boost pump, he actually believes the manufacturers rated flow rate. Well, ok...I should disparage the manufacturers, so let me rephrase that. The DIY guy doesn't realize HOW the manufacturers are rating the flow rate from their pumps, there that is better. The manufacturers rate their pumps with a flooded head of sea water on the inlet and with an open discharge on the other side. Sure some might give you a head lift curve but once you get the boost pump from paper to the real world of a boat...boom, your 4GPM pump that you were using for your 1.6GPM Hp pump only gets 1.0GPM to the Hp pump inlet after the prefilter and line loss pressure drop. We literally have a PILE of R&D boost pumps that looked great on paper but then bombed out big time when we installed them on the test bench and simulated a real installation. Not getting enough flow into the inlet of the Hp Pump will cause cavitation and can damage or destroy the membranes.

There you have it...
Little Thursday night DIY water maker tips session that will perhaps save me some troubleshooting calls down the road.

_____
Rich Boren owner of:
Cruise RO Water High Output Water Makers
Technautic CoolBlue Refrigeration
La Paz Cruisers Supply and Yacht Management

Quote Thanks

10-06-2016, 01:22 #2

Teknishn
Registered User

Join Date: May 2016
Location: Currently on Fla.'s Gulf coast heading north
Boat: 81 Hunter Cherubini 27
Posts: 329
Images: 3

Re: Common DIY Water Maker Mistake...don't let it happen to you.

Rich,
Thank you for the very informative post. Not really up on RO unit theory here, so you may have just helped solve a problem that I am having with a "new installation" that was done years ago (installed by someone else and was never fully commissioned and now I've been tasked with cleaning up their mess).

Booster pump discharge pressure (Booster pump was purchased

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MANTUS GIVEAWAY ends Nov 20th |...

seperately from the RO unit so now I suspect a mismatch) and pre-filter...in this case, pre-filters, as the owner is insisting on TWO pre-filters. No wonder we can't get the unit to make the rated output of 60 LPH.

LOL @ at it's your daughter's graduation and you are feeling good, so write an epic post about watermakers

Again, good post!

Quote Thanks

10-06-2016, 01:46 #3

Pauls
Registered User

Join Date: Oct 2008
Boat: Custom cutter, 42'
Posts: 477

Re: Common DIY Water Maker Mistake...don't let it happen to you.

Thanks Rich. Nice to have data from a guy who knows what he's talking about.

Quote Thanks

10-06-2016, 16:36 #4

Tellie
Sponsoring Vendor

Sponsoring Vendor

Join Date: Oct 2007
Location: Hollywood, Fl.
Boat: FP Athena 38' Poerava
Posts: 3,282

Re: Common DIY Water Maker Mistake...don't let it happen to you.

[QUOTE=SV THIRD DAY;2140643]

"that damn ROSA software and calculations that the engineering types flock to like the black meteor at Mecca. It has as much use to a Marine batch process water maker as garlic does in attracting dates."

LOL

Perfect! But I know you had a beer or two when you wrote that.

Quote Thanks

10-06-2016, 17:00 #5

SV THIRD DAY
Marine Service Provider

Sponsoring Vendor

Cruisers Forum Supporter

Join Date: Aug 2006
Location: La Paz, Mexico
Boat: 1978 Hudson Force 50 Ketch
Posts: 3,836

Re: Common DIY Water Maker Mistake...don't let it happen to you.

Ok....there were a few Rum drinks....

_____
Rich Boren owner of:
Cruise RO Water High Output Water Makers
Technautic CoolBlue Refrigeration
La Paz Cruisers Supply and Yacht Management

Quote Thanks

10-06-2016, 17:43 #6

fallingeggs
Registered User

Join Date: Aug 2014
Location: Astoria, NY
Boat: Sabre 38
Posts: 569

Re: Common DIY Water Maker Mistake...don't let it happen to you.

Brilliant!

I did learn something new. The second membrane might be worth the $600 if my GPH per amp hour goes down by about a third to a half.

Still have some time before I toss off the dock line and need the system, but I like having it planned out.

Sent from my iPhone using Cruisers Sailing Forum

_____
Stephen

s/v Carpe Ventum
1983 Sabre 38
My Intro

Quote Thanks

10-06-2016, 19:15 #7

barnakiel
Senior Cruiser

Join Date: Aug 2009
Location: between the devil and the deep blue sea
Boat: a sailing boat
Posts: 17,655

Re: Common DIY Water Maker Mistake...don't let it happen to you.

GREAT post!

Many thanks for the warning. We may have a RO unit here one day.

Regards,
b.

Quote Thanks

10-06-2016, 20:19 #8

smj
Registered User

Join Date: Nov 2007
Boat: Searunner 38 catamaran
Posts: 4,171

Re: Common DIY Water Maker Mistake...don't let it happen to you.

I'm guessing a watermaker may be in our future. I think I'll save the headache and just buy a Cruise RO.

Quote Thanks

10-06-2016, 21:10 #9

JstaRebel
Registered User

Join Date: May 2014
Location: Caribbean
Boat: IT40 Motorsailer. 40'
Posts: 226

Re: Common DIY Water Maker Mistake...don't let it happen to you.

Very good post Rich. Lots of good information about the motor size necessary to run a cat pump. Exactly why many using the cat pumps for their watermakers run them off of their engines using a 12v clutch assembly. Just way too much power consumption otherwise. Also correct about the ROSA program. Totally useless and also 10 years outdated. I was unaware that you have 68 degree water over there in Ca. The Caribbean never sees water that cold. In fact, when figuring system flow rates and membrane flux rates rates, we have to go the other way from the membrane design temp of 77 degrees because the water is normally 27 - 30 degrees Celsius or 81-86 degrees F here. This of course results in slightly higher permeate conductivity and higher flow rates overall. Again, Great Post!

Quote Thanks

11-06-2016, 18:28 #10

SV THIRD DAY
Marine Service Provider

Sponsoring Vendor

Re: Common DIY Water Maker Mistake...don't let it happen to you.

> Quote:
>
> Originally Posted by **fallingeggs**
> *I did learn something new. The second membrane might be worth the $600 if my GPH per amp hour goes down by about a third to a half.*

Bingo...
This is what makes the SM30, or dual pressure vessel water maker, our most popular selling water maker by a 4:1 margin.

Cruisers Forum Supporter

Join Date: Aug 2006
Location: La Paz, Mexico
Boat: 1978 Hudson Force 50 Ketch
Posts: 3,836

The SM20 makes it's 21GPH using 52Watts/Gallon of water
But since the second pressure vessel adds in 50% more fresh water production:
The SM30 makes it's 33GPH using 33Watts/Gallon of water

So the Dual pressure vessel water maker is 37% more efficient in the energy use per gallon of fresh water...but...if your No 1 criteria out of a water maker is energy used per gallon of water produced, then this is somewhat of a pointless exercise. Spectra blows away these numbers...no competition!

Since the operational mindset and general philosophy of an "energy hog" piston pump water maker is to make as much water as you can while your ships generator is running, to me what drives the value of adding the second Pressure Vessel and RO Membrane is the 50% increase in fresh water production. That translates into 50% less generator run time for the same amount of water or just having more water to use for those who have generator run times greater than those needed just for water making.

The other argument in favor of the dual membrane water maker is redundancy. Because if one of your two membranes were to fail while out cruising in the middle of nowhere then you can easily reconfigure the system to run on one pressure vessel. So your cruise doesn't end from lack of water.

_____
Rich Boren owner of:
Cruise RO Water High Output Water Makers
Technautic CoolBlue Refrigeration
La Paz Cruisers Supply and Yacht Management

Quote Thanks

11-06-2016, 19:12 #11

belizesailor
Registered User

Join Date: Dec 2010
Location: W Carib
Boat: Wildcat 35, Hobie 33
Posts: 10,213

Re: Common DIY Water Maker Mistake...don't let it happen to you.

Great post. Thanks much!

Quote Thanks

02-04-2018, 19:18 #12

Maia
Registered User

Join Date: Nov 2011
Location: now cruising New Zealand
Boat: catamaran Maia 50ft
Posts: 20

Re: Common DIY Water Maker Mistake...don't let it happen to you.

Any recommendations for a good booster pump?
I am looking for a mag drive centrifugal pump suitable for continuous operation in seawater of course.
I was thinking about a March 893-08 but the port connections seems to be to small. We like to feed a 1.6gpm pump.
Any other rec?
Cheers
Maia

Quote Thanks

02-04-2018, 19:31 #13

SV THIRD DAY
Marine Service Provider

Sponsoring Vendor

Re: Common DIY Water Maker Mistake...don't let it happen to you.

Quote:

> Originally Posted by **Maia**
> *Any recommendations for a good booster pump?*
> *I am looking for a mag drive centrifugal pump suitable for continuous operation in seawater of course.*
> *I was thinking about a March 893-08 but the port connections seems to be to small. We like to feed a 1.6gpm pump.*
> *Any other rec?*
> *Cheers*
> *Maia*

Cruisers Forum Supporter

Join Date: Aug 2006
Location: La Paz, Mexico
Boat: 1978 Hudson Force 50 Ketch
Posts: 3,836

This would be my choice if you can mount the boost pump below the water line. A SS centrifugal pump. We have used these for years with good results.

Jabsco Model 50840-0012
http://www.pumpagents.com/pdf/Jabsco...50840-0012.pdf

I'm not a fan of March pumps for a boost pump because they are really designed for Volume through a heat exchanger and NOT for pushing pressure through dirty prefilters. Plus....have you seen the prices of the march pumps.....talk about pricey!

_____
Rich Boren owner of:
Cruise RO Water High Output Water Makers
Technautic CoolBlue Refrigeration
La Paz Cruisers Supply and Yacht Management

Quote Thanks

02-04-2018, 20:04 #14

Maia

Registered User

Join Date: Nov 2011
Location: now cruising New Zealand
Boat: catamaran Maia 50ft
Posts: 20

Re: Common DIY Water Maker Mistake...don't let it happen to you.

Thanks,
yes that looks like a good and very strong solution. But it looks a bit oversized. And additional 3.5Amperes at 24Volt.
We know Echotech use a 2 ampere or less boosterpump but we do not know which one.
If we find a seal less magdrive one that would be the best.
Keep on searching.....

Quote Thanks

02-04-2018, 21:05 #15

SV THIRD DAY

Marine Service Provider

Sponsoring Vendor

Cruisers Forum Supporter

Join Date: Aug 2006
Location: La Paz, Mexico
Boat: 1978 Hudson Force 50 Ketch
Posts: 3,836

Re: Common DIY Water Maker Mistake...don't let it happen to you.

The 2A boost pump used by Echotech is undersized...remember they don't even include a boost pump as a standard option with their water maker. They put the burden on the user to select the "right one". The No 1 problem in high output water makers is getting enough flow to the Hp Pump. Going skiny on your boost pump is a headache that will cause pump cavitation, send pressure pulsations down the line and can KILL your RO Membranes. Amigo....don't do it. The logic flaw is BELIEVING the published flow rates of pumps that are ALL rated with an open suction and open discharge. Put dirty Dual Prefilters ahead of the Hp Pump and you will be happy to have all the boost pump flow/pressure you can get.

I just was troubleshooting the Mag drive pump today for someone over Sat phone on their way to the south pacific...they are just not a good choice for a water maker boost pump based on years of troubleshooting experience. What you "gain" in the seal-less mag drive you lose in the functionality of the mag drive in terms of pressure and dealing with debris that can stall them...a stalled boost pump es muche problem. When you troubleshoot and service water makers for a living like I do....you see what works and what to avoid.

_____
Rich Boren owner of:
Cruise RO Water High Output Water Makers
Technautic CoolBlue Refrigeration
La Paz Cruisers Supply and Yacht Management

Quote Thanks

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