How to build a thruster for a homemade submersible or ROV

by **Kajnjaps** on July 9, 2008

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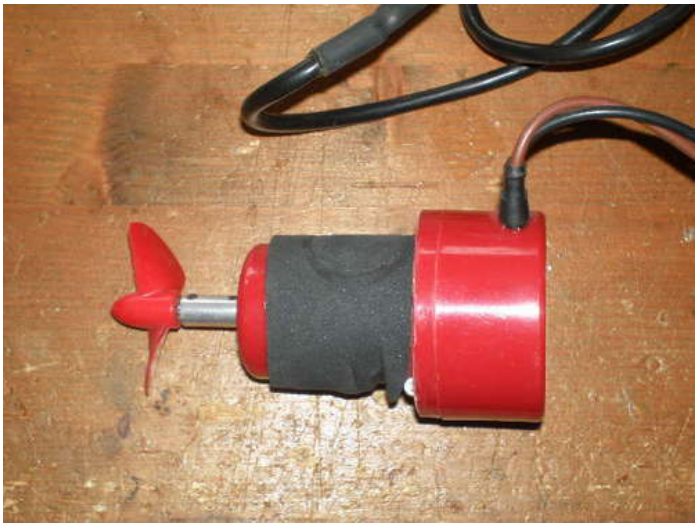
Intro: How to build a thruster for a homemade submersible or ROV

Some time ago I started building an underwater robot. One of the main difficulties (for me) was building the propulsion system. In this instructable I'll show you an easy to build a quite powerful 12VDC thruster. The original idea came from "Build your own underwater robot" by Harry Bohm and Vickie Jensen, but wasn't really worked out.So here it is.



Step 1: Tools and materials you'll need:

Materials:

- 1 Rule 1100 GPH 12VDC Bilge pump.
I used these because I could get them, other sizes or manufacturers might do fine too.

- 1 RC model boat propeller for example Graupner No. 455/10.
This is a 2-wing 70mm diameter prop with 4mm threading. Don't use to big propellers.
4-blade are also ok, but use a smaller one.

- 1 Coupling bush for smaller than 4mm diameter shaft. Graupner No. 3346 (3.2mm) is ideal.

- a 20mm long 4mm bolt with the head removed.

- a 4mm spring washer.

- Heat shrink tube of different sizes with glue or (better)a waterproof cable repair set like Raychem XBL22 (also, this is what I could get overhere).

- round circumference 2 conductor wire capable of carying 4A.

- adhesive rubber pads, like the stuff to put under furniture.
- waterproof cable gland (for example Velleman CPG135)

Tools:

- Hacksaw or dremel
- sharp knife
- electric paint stripper
- threading tool with 4mm bit.
- soldering iron
- pliers, screwdrivers etc...

Image Notes
1. RC boat propeller
2. coupler 3.2mm
3. waterproof cable gland
4. heat shrink tubing waterproof cable repair kit
5. threading tool
6. 4mm threading bit

Step 2: Prepare the bilge pump:

The bilge pump is actually a ready-made DC motor in a watertight housing. No idea how deep it'll stay watertight, but I'm hoping 10m.
Remove the lower blue part (klicks off). Remove the little propeller so the metal axis is free.
Take the hacksaw or dremel and cut around the white plastic,about a mm or so from the red area (don't cut in the red plastic).
Remove burrs with a sharp knife. You'll end up with a watertight motor in a nice red housing.
The black stuff in the picture is some adhesive rubber, which comes in handy to distribute the force once the motor is mounted on the robot (see further).

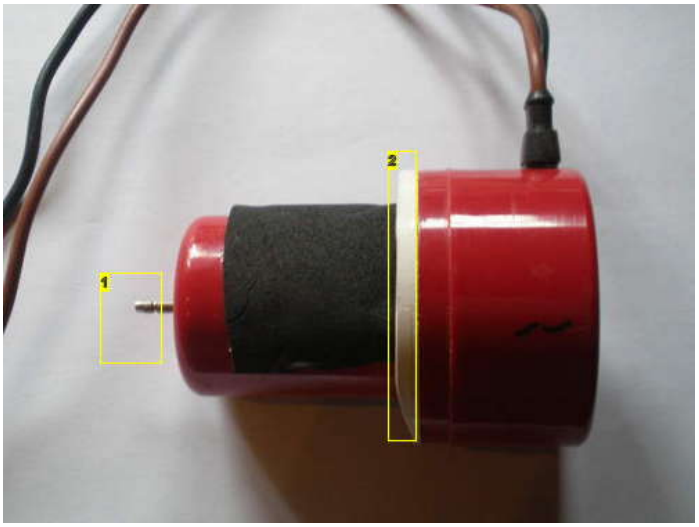
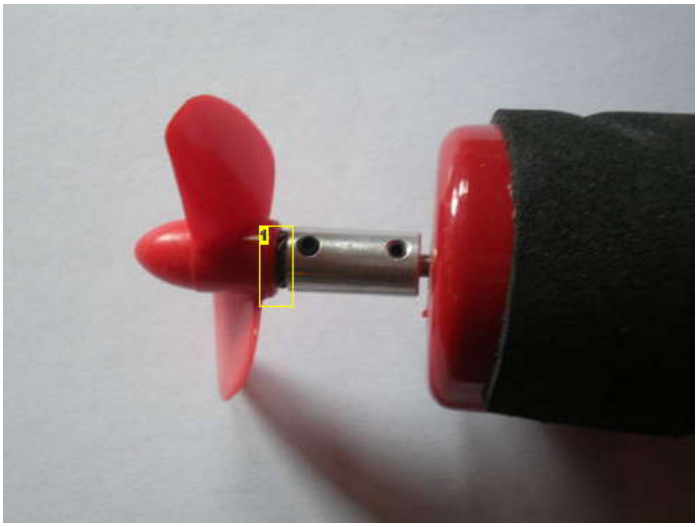


Image Notes
1. note axial has flat and round side!
2. cut away along the white plastic. stay clear of the red plastic.

Step 3: Prepare the propeller:

Take a 4mm 20 mm or so long bolt, saw the head of and make sure the threading still "works" on both ends (use a file if you have to). Using the threading-tool, make a 4mm thread in the coupling bush up to halfway deep. Insert the depacitated bolt. Like in the picture, now fasten a spring washer and the propeller. Put the propeller assembly on the motor axial, and fasten with the supplied little sideways screw. Note the motor axial has a flat side: that's where you want the sideways screw to be pressing against. Make everything really tight... done.



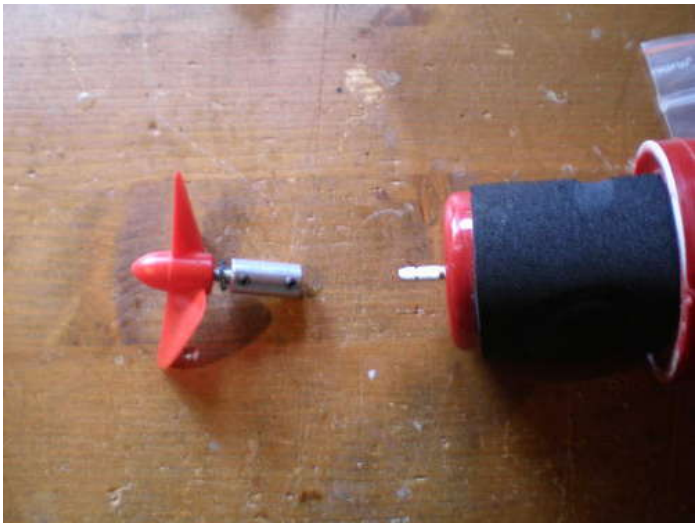


Image Notes
1. spring washer

Step 4: Assemble the cable (optional):

There are two wires coming out of the motor, it would be nice to have one round cable that you can put through a waterproof cable gland. I used the Raychem cable repair kit to make a waterproof connection to a round cable. You can also glue-filled heat-shrink tubing of different diameters. Soldering the connections is the safest way.

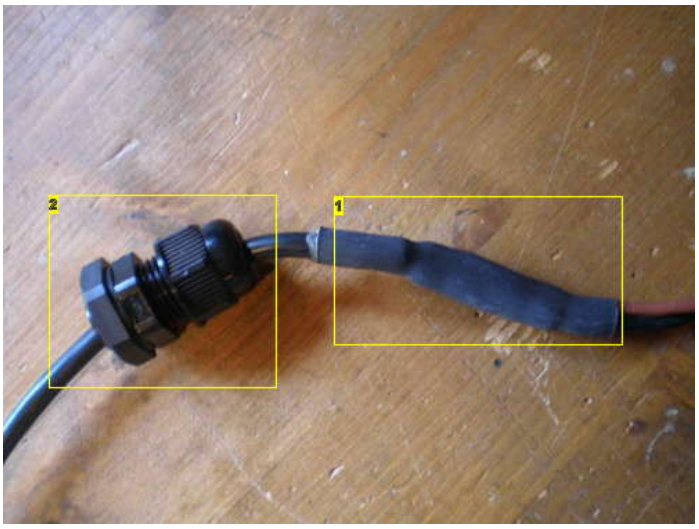


Image Notes
1. watertight cable connection using glue filled heat shrink tubing
2. waterproof cable gland

Step 5: Test your work:

Try it out in a bucket or a bathtub.

Step 6: Mounting on the ROV:

The robot I'm building is work in progress. Here's how the thrusters are mounted.
The motor is placed on a U shaped spacing filed on the end of a piece of PVC pipe.
A screw-clamp keeps it in position.

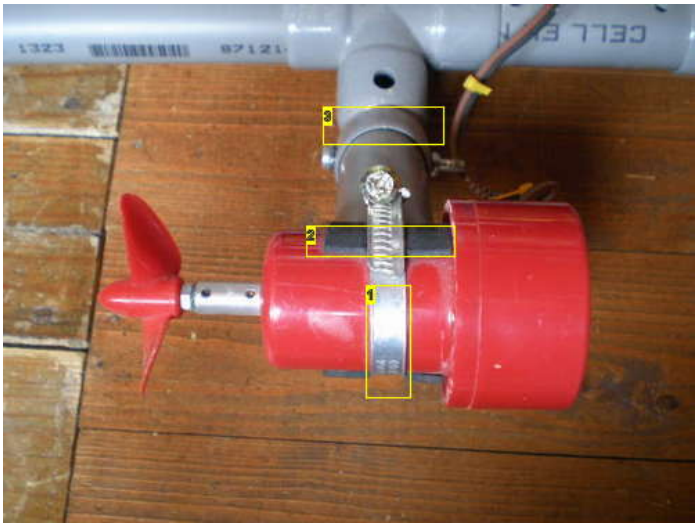


Image Notes
1. big clamp
2. adhesive rubber padding to distribute force on the motor housing
3. PVC pipe 30mm

Related Instructables

Jesuit Robotics J1 Thruster (video) by zero.gx

DIY PVC ROV underwater videobot (Photos) by daniel2008

ROV by roverman

Underwater ROV by SpaceShipOne

The Manta Drive: proof-of-concept for an ROV propulsion system. by Kiteman

ROV submersible (PVC) by daniel2008

Comments

50 comments **Add Comment** **view all 74 comments**

MINDFREAK9189 says: Aug 5, 2010. 11:55 PM **REPLY**
please suggest me a method for protecting my Rf module circuit.....without causing interference as the setup is wireless

Kajnjaps says: Aug 6, 2010. 2:29 AM **REPLY**
Did you do any reading on RF and water? Here's a very good link: http://www.qsl.net/vk5br/UwaterComms.htm

MINDFREAK9189 says: Aug 6, 2010. 6:14 AM **REPLY**
thanks for the article,its really gud.but i need some methodology to protect my circuit from water as the robot is under water.... thanks

Kajnjaps says: Aug 8, 2010. 12:40 PM **REPLY**
I used pvc tubing with endcaps as housing for all the electronics. pretty much standard.

MINDFREAK9189 says: Aug 5, 2010. 11:51 PM **REPLY**
can u please detail me about raychem cable repair kit..... i am not understanding that step. like i am getting dat two wires cumin frm pump.but a what after dat.

Kajnjaps says: Aug 6, 2010. 2:25 AM **REPLY**
The cable glands that I use in my housing are for a round cable. Therefore, a round cable is attached to the wires of the pump. The cable repair kit makes a watertight connection between the pump wires (two separate wires) and the cable (a round cable with two conductors in it).

MINDFREAK9189 says: Jul 28, 2010. 1:08 AM **REPLY**
i want to make a underwater robot.....can u suggest me any way to protect my circuits.....and wiring frm gtn sort.....and wer will i get dis bilge pumps of 12v dc

Kajnjaps says: Jul 29, 2010. 9:12 AM **REPLY**
do some research, check if there is a local distributor for the bilge pumps. I assume 'frm gtn sort' means 'from getting short circuited by the water', right? I used pvc tubing with endcaps and IP68 waterproof cable throughputs.

MINDFREAK9189 says: Jul 29, 2010. 10:09 AM **REPLY**
thanks so much. give me a procedure to protect my circuit or rf module which is wireless.

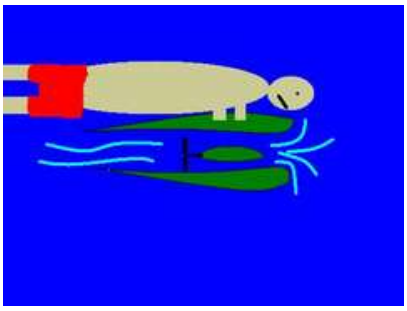
Kajnjaps says: Jul 30, 2010. 12:31 AM **REPLY**
The actual procedure will depend on the materials and tools you have access to.

MINDFREAK9189 says: Jul 30, 2010. 12:12 PM **REPLY**
i am using a RF module, a 12 v dc nd two propellers.....the Rf module is wireless,so i need some aarangemnt in whch the circuit is protected widout casuin interference in the signal

MINDFREAK9189 says: Jul 29, 2010. 11:11 AM **REPLY**
please explain hw to remove that white part, becs the white part ahs a outlet kinda thng which is missin in the main picture

Kajnjaps says: Jul 30, 2010. 12:33 AM **REPLY**
I'm not sure I understand your question. Once you remove the white part with a hacksaw, you end up with a watertight motor.

Hunter4000695 says: Mar 19, 2009. 4:27 PM **REPLY**
For all the people that wont to make skooters, ya thats what there called. Trollers will work, but I'm going to yoos RC air plane moders. The big ones and put then in a case. Basically a jet enjin, but with water in stead. the moders ar vary hi tork. Yes the pik is bad but I drue it in one minet.



Krenath says: Jul 22, 2010. 11:40 AM **REPLY**

Translated: "For all the people that want to make scooters (yeah that's what they're called) trolling motors will work, but I'm going to use RC airplane motors. The big ones, and put them in a case. Basically a jet engine, but with water instead. The motors are very high torque. Yes, the picture is bad but I drew it in one minute."

ErikSR71 says: Mar 13, 2010. 12:31 AM **REPLY**

I'm part of a robotics class at my high school. We have only ever competed on land before and this is our first time trying anything underwater. Our main problem has been figuring out our propulsion system, so I've found this article immensley helpful. The one question I have right away is, can the direction of the propellor's rotation be reversed?

Kajnjaps says: Mar 13, 2010. 10:06 AM **REPLY**

Hi,

yes, you can reverse the direction by reversing the applied voltage.
Good luck!

its_me_daniel says: Mar 5, 2010. 1:24 PM **REPLY**

Hi, could you give me a linky or a model number and price for the pump you used?

Thanks!! :)

Kajnjaps says: Mar 8, 2010. 1:15 AM **REPLY**

It's a Rule 1100 GPH 12VDC Bilge pump. Price will depend on where you buy them.

Poorandsore says: Apr 18, 2009. 7:05 PM **REPLY**

if i make 2 of these, could i use them to push an inflatable raft/boat carrying two people.?

woodNfish says: Mar 3, 2010. 3:25 PM **REPLY**

A 12V electric trolling motor will is what you need. The small ones are are 30lbs - 42lbs of thrust.

aflacgoose says: Jun 4, 2009. 2:50 PM **REPLY**

No way!

Kajnjaps says: Apr 22, 2009. 12:20 PM **REPLY**

No way, they are not powerful enough for that.

dabombmaker says: Jul 22, 2009. 3:43 PM **REPLY**

ps. In this instructable I'll show you an easy *way* to build a quite powerful 12VDC thruster.

nomejodaslavida says: Feb 28, 2010. 4:17 PM **REPLY**

If you're going to use the submersible bilge pumps as motors, why not use them as they are, without propellers, for jet propulsion? You could even increase the force of the jet by by graduating the discharge down to a smaller size.

Kajnjaps says: Mar 1, 2010. 12:20 AM **REPLY**

Using them this way, with propellers, seems to yield more thrust.

tmjones says: Feb 23, 2010. 12:52 AM **REPLY**
where did you get the propellers from?

Kajnjaps says: Feb 23, 2010. 2:20 AM **REPLY**
From some model shop.
The manufacturer is Graupner.
Check out www.graupner.de

roverman says: Dec 22, 2009. 4:50 PM **REPLY**
nice idea using a pump for the motor

six7evan says: Aug 24, 2009. 6:57 PM **REPLY**
Out of curiosity, what is the top speed and battery life of this? I would love to get something that can get me going 5-10 mph underwater.

Kajnjaps says: Aug 24, 2009. 11:42 PM **REPLY**
Battery life depends on battery capacity.
The motor consumes somewhere between 2 and 4 amps I guess.
Suppose you use a battery of 7 amp-hours, then it would be about 7/4amps= 1.75hours for one thruster.

Likewise speed is linked to other parameters; drag, propeller you use, watter currents etc. Force of thrust, expressed in force kg or newtons would be a better parameter.

I've seen my rov go about 1m/s with two of these.

best regards,
Kajnjaps

BJCK1990 says: Apr 13, 2009. 8:23 PM **REPLY**
Where is a cheap place to purchase bilge pumps or replacement cartridges?

Kajnjaps says: Apr 14, 2009. 5:09 AM **REPLY**
I bought them at a local boat supply shop. Maybe check Rule's webpage to find a local dealer.

daniel2008 says: Dec 27, 2008. 1:00 AM **REPLY**
hey, nice instructable.
would you consider submitting it to the new ROV group ?

awang8 says: Jan 12, 2009. 4:35 PM **REPLY**
Umm... Why don't you submit it? PS: Ha ha! I did it before you!

Kajnjaps says: Jan 14, 2009. 12:26 AM **REPLY**
Thanks ! I forgot to reply to your message. Indeed, this Instructable belongs in there.

SunShine.1111 says: Aug 2, 2008. 2:43 PM **REPLY**
is there any way to turn it into one of those things that scuba divers use to move around in water with? like maybe a bigger motor... and a cage or smthn to protect the diver from the propeller...

Kajnjaps says: Aug 4, 2008. 12:00 AM **REPLY**
if you want to build something like that, I'd recommend getting real trolling motors. The modified bilge pumps don't have enough power to drag a human through the water.

awang8 says: Dec 17, 2008. 2:15 AM **REPLY**
You could always connect 100 1500GPH pumps and that would be powerful enough...

manicmonday says: Oct 13, 2008. 8:31 AM **REPLY**
What is the max pressure in lbs? I want to use a bilge pump in a closed loop using home water pressure. How can I better water proof the motor so it can withstand higher pressure and higher temp? This is for a solar water heater circulation pump application.

Kajnjaps says: Oct 13, 2008. 11:23 PM **REPLY**

It's will be hard to make the motors more waterproof, given the fact that they are in a closed plastic casing. For the application you are talking about, I would use a garden pond pump. They come in all sizes.

manicmonday says: Oct 15, 2008. 3:48 PM **REPLY**

But are those garden pond pumps 12vdc? Thanks

Kajnjaps says: Oct 16, 2008. 11:46 PM **REPLY**

No idea, but it would be amazing if they didn't exist for 12V.

Senator Penguin says: Aug 7, 2008. 3:19 PM **REPLY**

We used to use these for my high school's AUV (autonomous underwater vehicle). They work pretty well for the price, but they are fairly inefficient, and our batteries couldn't take it. We eventually upgraded to some (relatively) expensive thrusters from Seabotix, who makes special ROV thrusters.

mspitze says: Aug 4, 2008. 1:32 PM **REPLY**

I built something similar but I used it to pull me around a lake with a mask and snorkel. I used an old trolling motor I picked up at a garage sale for $5.00. Trollers are the way to go like Kajnjaps said.

catwood says: Jul 10, 2008. 3:11 PM **REPLY**

Rule Bilge pumps are supposedly good to around 60 feet. At least that is what I have heard. I have not tested that however; on my deeper water ROV, I waterproofed my own motors. You should think about some shrouds for that propeller so it can't get tangled in your tether. Or in seaweeds/algae if you are going into more than a pool. Also a setscrew in the propeller would help to prevent the propeller from spinning off of the screw shaft. The spring washer should help some, but after a while it can come loose because of the forces exerted by the water when quickly changing directions.

bombmaker2 says: Jul 27, 2008. 6:45 PM **REPLY**

could you email me on how you did that @ pyrokid1010@hotmail.com

Kajnjaps says: Jul 12, 2008. 11:03 AM **REPLY**

thanks for the info! If they hold up to 60 feet that's good for me. Shrouds is something I still have to look into, but it is on my list.

conrad2468 says: Jul 9, 2008. 12:02 PM **REPLY**

ummmm why not just use the pump instead of mounting a propeller ect.? its simpler and waterproof

handyScrapper says: Jul 13, 2008. 7:42 PM **REPLY**

ummmmm did you read the other comments?

view all 74 comments