

POWER DRILL BATTERY REBUILD BY TERRY BYLAND

The Hilti 36 volt 2400 mAh hammer drills are the best on the market, but if you're like me you wear out your batteries. I looked into buying a new battery and I was quoted over \$200 for a new battery that would wear out just as quick so I decided to look into having my battery rebuilt. There are several web sites you can send your battery to to have new batteries put in, but they only rebuild to stock power and I wanted more power. So I decided to look into building my own battery pack

I found a web site, www.batteryspace.com. They have several size batteries, chargers, and, question and answer, for an amateur such as myself. So I dug in and learned a lot. I decided to build my own system and before you are the reasons why and how.

First the problems with conventional battery packs are they use small batteries and when they are charged you don't get all the batteries charged evenly. When a battery pack is drained there will always be a few batteries in the pack that have some charge left. Then when you put them on a regular charger the charger charges all the batteries with the same current, which means a normal battery gets charged back up, but the battery that still has some charge gets over charged, which shortens the batteries life. If you feel a battery and it is real hot it is getting to much charge. These individual batteries in the pack will eventual die out, thus ruining your whole pack.

The only true solution to this problem is to charge each cell by itself, which would be very expensive and time consuming. The next best thing is to make small packs that can be charged separately.

Another problem was how do I hook the new pack to the Hilti drill. Well, through Yahoo chat I was advised to use the Hilti TE-6-A-BAP Battery Pack belt Adaptor and cut the cord where it attaches to the battery cap and I put in a 30-amp fuse incase of a short.

Another problem I had when I decided to build my battery pack was how was I going to charge them. Once again Www.batteryspace.com has the perfect solution, they sale "Smart Chargers". A Smart Charger is a charger that charges at a small trickle allowing the batteries to be evenly charged. When Nicd based batteries are being charged their voltage raises until they are nearly full, then the voltage drops. Smart chargers take advantage of this to detect when the batteries are full. It's called negative delta V detection. If two strings of cells are in parallel while being charged and one string fills first its voltage will drop and 'hog' all of the charge current. This will result in overcharging/overheating.

Www.batteryspace.com also recommends that you only charge 12 volts at a time. So I decided to build three separate battery cases, 12 volts each with 3000 mAh. Below are two different cases I built and my opinion of both.

PVC BATTERY CASE



First thing is to go shopping. I bought 30 3000-mAh batteries off Www.batteryspace.com and three smart chargers. Then I went to the local hardware and got PVC pipes and fittings, and the local auto parts store.

LIST OF MATERIAL

3 1 ½" PVC cap sockets .63 cents each
3 1 ½" PVC threaded plugs \$1.58
3 1 ½" PVC female adapter .68 cents each
5 feet PVC pipe 200 psi, cut into 3 sections of 19" each \$2.16
6 springs. Bottom big enough to fill caps .20 cents each
6 washes big enough to fit cap .05 cents each
6 1-inch bolts with washers and nuts
6 crimping ring terminals \$2.88 a pack
2 packs of 2 pole flat set trailer plugs. \$1.97 each. Cut in half.
30 –amp bus fuse and an in line fuse holder.
1 Hilit extend pack cord.... \$87.00(Prises varies, depending on where you get it.)
3 mutli current universal smart charger for 7.2 – 12v NiCad battery \$23.95 a piece.
3 more 2 pole flat set trailer plugs from your local auto parts store. \$1.97 if you want to use these ends on your Smart Chargers.



Time to build. First thing I did was drill a hole in each cap. Then solder a washer on the wide part of the spring. Next slide the bolt through the washer into the hole in the PVC cap, but do it from the inside. Next put a ring terminal on the bolt then the nut. Put a screwdriver through the spring and a wrench on the other side and tighten.



Once you have all six plug ends done then glue the three cap sockets and the three female adapters to the PVC pipe.

When I screwed the plugs into the pipe they wouldn't screw all the way in. So I started sanding down the threads. I never did get them to fit and ended up sanding most the threads away. This left me with a problem I solved with a better idea. I cut an "L" out of the female adapter then re inserted the plug. Where the bottom of the "L" ended I drilled a hole into the plug. I then took the plug out and inserted a bolt from the

inside, then I hot glued the bolt. So now I can push the plug down into the PVC pipe, which is hard and then turn to the left and it locks tight. This is better than a screw, because the connection needs to be tight and if your screwing the plug in the loaded spring can get twisted out of shape. I also drilled a hole in each pack to let out any heat.

Now that the case is done lets go on to the wiring. I like the 2-pole flat set trailer plug because it fits tight. If it stays tight on a trailer as it drives down the highway it should stay together while I drill some holes. As you can see in the pictures I cut each plug in half so I had several 1 pole plugs. I decide to make all male ends the positive, since the red wires came in both male and female ends. After stripping the wire I insert them into the crimping ring terminal and clamped down. Then I solder the wire in place and covered all exposed metal with hot glue to prevent shorting out. On one of the cases you need to add some extra 12-gauge wire to get the plug closer together.

Then load up the batteries. Once that's done test each pack with a volt meter to make sure you have

the right amount of volts then hook them all together and check again. You should have between 12 and 13 volts per pack.



Now that the case is done lets began the work on the drill. On one end of the Hilit extend pack cord is a flat plate that plugs into the drill. I cut this off. You will have a black, green and white wire. Ignore the green wire it goes to a sensor in the battery pack. On the white wire I attached a 30-amp fuze holder with a 30-amp fuze inside, this is the positive side, which you plug in the positive plug of the batteries and gets a female 2-pole plug. Now wire a male 2-pole trailer plug to the black wires.

Now to test. Talk about power, with the stock Hilti stock battery I would get six 10 inch 3/8 holes in limestone.

With the PVC pack I would get eight holes. Unlike the stock batteries, these don't shut off when they are low, but you can hear a difference and the drill quits moving inward.

There is one more thing I recommend. The smart chargers come with clips on them. I cut them off and soldered on more trail plugs. Once again since the batteries are using the male plug for positive you will need to use the female plug for the positive on the chargers, which on mine were the red wire. If you make a mistake you will pop a fuse that is on the charger wires. They give you plenty of fuses.

Building this kind of battery pack is all around cheaper, but it takes more time to construct and when you're done they look like pipe bombs. Another problem I found is as you read further on is with the next design I would get 12 holes instead of 8 holes. I believe you lose a lot of power to all the springs. This would be a good method for smaller packs.

PROJECT BOXES BATTERY CASES

I liked the results I got from the first pack so I decided to build another, but this time I wanted to build a better pack.



So I ordered three 12-volt 3Ah presoldered battery packs from www.batteryspace.com. I order the presoldered because if you solder a charged battery you take a chance of destroying it. Some have actually exploded. With the batteries soldered together you won't lose as much electricity

I did run into a problem with these packs. When www.batteryspace.com makes their battery packs they put in a 65-degree poly switch which shuts down the battery pack if it gets over heated. After I got my design done, the drill would run fantastic, but it would shut down after a while. This was the poly switch set at too low of a setting for what I wanted. So I had to go into the packs and cut the switches out then solder the battery together. Then I ran the drill

again and it worked like a charm, Next time I order a pack I'm going to order their regular rechargeable C batteries with tabs and do it myself. I think it would be a good idea to put in the poly switches to avoid destroying the batteries, but I couldn't find out the max heat. Hilti uses a cooling fan in the charger to keep their batteries cool. But on the other hand using the Smart Chargers I don't think you need to worry about over heating since they charge at a small trickle.

Now that I have the batteries I needed to design a box to carry them in. So off to Radio Shack I went to get some project boxes. I have used project boxes before, and have always had good luck with them.

Construction.



First thing I did was drill a 3/8 hole in the 3" side of the box about halfway down. Then I drilled a second hole in the lid just in case the battery need a heat vent to cool off. Then I hot glued a piece of short 1" plastic tube in the hole so the wires would be protected. Next I inserted the 2-plug trailer wire inside the tube and hot glued them. Once the glue was dry I soldered the wires to the battery wires in my box making the

male end the positive. Once again I tested the connection with a meter then screwed the lid on. The batteries are a little bigger than the box so it will be a tight fit.

Now all you have to do is plug the three boxes together then into the Hilit extend pack cord and give it a test run. You can imagine my excitement when I pushed on the drill trigger and the drill roared to life. I turned the drill loose and got 12 holes faster than the regular battery. I was happy.

This pack cost more, but far more effective. I'm going to build another pack, this time I will order the same batteries except with tabs and solder them myself then install into another set of the black plastic boxes.

LIST OF MATERIAL

3 C size 12V 3AH Nicad battery packs. (10 presolder batters wrapped in shrink-wrap). \$35.99 each.
\$107.97 total

3 black plastic boxes from radio shack. 6 x 3 x 2. \$3.79 each

2 packs 2- pole trailer plugs from your local auto parts store. \$1.97 each. Each pack has two sets. Cut each one in half separating the male end from the female end using a wire cutter.

TOOLS - Drill and bits, solder, hot glue, Electrical tape, wire strippers and meter.

