

# How to Convert Your N to 12V?

That's a small question with a huge answer. There are many ways to convert the charging system on an N to 12v. Some are more practical than others, but all mentioned here will work. What you choose will depend on the purpose for the conversion, your budget, your 'tinker' tolerance, and the expected electrical load on the new charging system.

First, you have two basic avenues to explore. You can keep a generator, or move to an alternator. To determine which is the better choice for you, decide what your intended electrical loads and uses for the tractor will be.

## ***Pro's and Cons:***

### ***Generator***

- PRO:** Can usually be installed either positive or negative ground.  
Will 'look' more original. (12v genny conversions are sometimes referred to as 'stealth' conversions by many people.)  
Typically generators are more robust when it comes to fault tolerance. Limited duration electrical shorts and reverse polarity hookups generally will not destroy a generator; however they may damage the voltage regulator.
- CON:** Generators aren't particularly efficient by today's power generation standards. At idle rpm's, they will barely produce power. Most units are limited to 11 amp to 25 amp outputs.  
Will require a matching external voltage regulator, generally in the price range of \$25 to \$40, depending on application and circuit type.  
May not be the cheapest route. New/rebuilt generators are generally about \$200 give or take.

### ***Alternator***

- PRO:** The most popular models are readily available have internal regulators and come in 2 basic wiring setups, 1 wire and 3 wire.  
Alternators typically charge better than generators at idle rpms, and at anything over idle rpms, charge exceptionally well.  
30-50+ amp models are easy to obtain sometimes pre-tested from junkyards at very affordable prices.
- CON:** Virtually all models will require negative ground.  
Due to their solid state circuitry, alternators are not very fault tolerant when it comes to short circuits and reverse polarity hookups.  
In general, it only takes a second or so for the important solid state parts (rectifier trio and regulator) to burn up in short circuit or reverse current fault situations.  
Usually requires a change over to a 5/8 pulley to match the N engine.

Below, you will find some information on both generator and alternator 12v conversions, and then afterwards, there will be some brief discussion on physically mounting, and the rest of the tractor's electrical system, and what will need to be modified to make it compatible with 12v.

## ***Converting to 12V with a Generator:***

For someone wanting their tractor to look more original, yet still have the benefit of 12v either for easier starting or more lighting, or to run other 12v accessories, you can convert your charging system to 12v by using a 12v generator. There are two ways to go about this. Either have your 6v generator re-worked by a competent rebuilder or simply locate a 12v generator from some other auto or tractor application that you can then adapt to your tractor. Later 8n's with the left side saddle mount genny may be easier to retrofit with respect to a non-OEM genny, however a little ingenuity and some simple do it yourself brackets will get the right side generator N's going just as well. You will also need a matching voltage regulator to go with your new or reworked generator. Your rebuilder should be able to provide you with the correct regulator, or direct you where to purchase one for your specific application. This avenue is more for the owner that wants an original looking N, but has some light duty need for a 12v electrical system.

## ***Converting to 12V with an Alternator:***

For the owner that has a more utilitarian use in mind, or who will need more power than a generator can muster, the alternator is the clear choice for the 12v system upgrade. The first task will be deciding if you want to purchase a ready-made kit, or if you will be piecing it together yourself. For those that don't mind medium difficulty tinkering, you can typically save about half the price of the kit by assembling it all yourself.

The first order of business is locating an alternator. The most common and easiest unit I have found to work with is the GM/DELCO 10/SI alternator. It is usually easy to find. Many junkyards keep tested units on the shelf for quite reasonable money. If you have to purchase a new or rebuilt one, ask the counter person for one that will fit a 76 Chevy, as they were used on similar GM products for many years. Also, you will need to decide if you want a 1 wire or 3 wire unit. What this refers to is the electrical hookup method. The 1

wire units, as the name implies, are simply physically mounted to the tractor and only require a single wire from the alternator's charge stud to connect to the tractor's electrical system. This seems simple enough, however the typical 1 wire units require a few moments of high engine rpm to get the alternator to self excite. It is not uncommon to need to rev the N engine to around 1800 rpm to get the alternator to excite. Once the alternator is excited, it will continue to charge even at low idle rpm's. Many owners do not like to rev their engine up while it is cold, and thus avoid the 1 wire units. If you desire a 1 wire unit, then there are a couple options you can try to help with the cold rev issue. First, the 12v battery will run your tractor for several hours on battery alone; you can simply allow your tractor to warm up for a while, then momentarily juice the engine to get the alternator going. This should be fine for most users that don't immediately need full electrical system output as soon as they start their tractor. Also, you can try to locate a different diameter pulley for your alternator so that it will run at a faster speed, thus meaning you don't have to rev your N engine as high to get the alternator to self excite. Lastly, there are some replacement voltage regulator modules that will allow the alternator to self excite at substantially lower rpm, usually for an additional cost.

The 3 wire unit's sound like they are harder to wire, but in practice, it is only 1 more wire to deal with. ( 3 wires ) You connect the alternators charge stud to the tractor electrical system as with the 1 wire unit. Now, locate a port with 2 male spade style connectors. They will be labeled 1 and 2; #1 is the field excite connector, and #2 is the voltage sensing connector. Make up a short jumper wire with a loop connector and a female spade connector. Attach the spade end to the #2 terminal and the loop end to the charge stud. In an automobile application, ideally, the #2 line would connect back to the battery, so that the alternator could sense the voltage drop in the car's long wire harness, and thus charge at a slightly higher voltage to make up for the loss. However, on your N, the wire harness is less than 3' long, and should be of a sufficiently large wire diameter so that there will be practically no loss. The #1 terminal will need power to turn the alternator on. There are several ways to accomplish this. The most popular will be discussed.

Since your N ignition system requires power from the key switch to run, you have to make sure that you electrically isolate the #1 terminal on the alternator from the ignition circuit, otherwise, you may find that you can turn your ignition key switch off but your N still runs. The reason for this is that the #1 terminal on the alternator will back feed 12v power to the ignition. There are several ways to alleviate this issue.

Using your standard N ignition switch, connect a #194 lamp to the switched (ignition) side of the switch, and then run this to the alternators #1 terminal. This is referred to as the 'idiot' lamp method. It works reliably and has 2 side benefits. When you turn your ignition key on, the 194 lamp will light up, once the engine is started and the alternator is producing power, the lamp will go out. This lets you know that your charging system is functioning. It also adds resistance to the #1 excite line. This allows you to turn the tractor off, and also protects the voltage regulator from being damaged by limiting back fed power thru the #1 line such as might happen if the charge wire became disconnected. Many people find that a trailer marker lamp that comes in a convenient plastic housing with a red or amber lens works great for an idiot lamp. It usually has mounting ears and is already equipped with wire pigtailed for easy hookup.

Another option is to use a diode to electrically isolate your #1 terminal from your tractor's ignition system. Think of a diode as a 1-way valve for electrons. As with the directions above, connect the diode to the switched side of the ignition switch, and to the alternator's #1 line. The diode will be marked with an indicator on the cathode side, generally just a slim band of a different color than the rest of the diode's package. Connect the cathode end of the diode to the alternator #1 terminal. The best part is if you accidentally hook it up backwards..... nothing bad happens, except that the 3 wire alternator probably won't excite until you re-orient the diode. Diodes can be mail ordered or picked up in retail electronics stores. Any diode capable of handling 1-2 amps and have a PIV ( peak inverse voltage) of 50+ will be sufficient. I generally buy a bulk pack of 1N914 diodes from Radio Shack. They are on the anemic side of the current and PIV range, however I have never had one electrically fail when used in an application such as this. A 1N5408 is another common diode and is more robust electrically, and is actually quite over rated for this application, however there are no downsides to that. I like to refer to this method as the 'automagic' option, as it is generally bulletproof.

If you have a non-OEM ignition switch, such as an automotive switch with an isolated ACCY lug, you can use that ACCY lug to excite your alternators #1 line; however you should still add the #194 lamp or the diode in line with it in order to protect the alternators regulator from excessive power back feeding in the case of a charge line that fails or becomes loose, etc.

The last detail you need to be concerned with on the alternator is the belt pulley. You will need to change the pulley to accept a 5/8 v-belt, if it is not already setup that way.

Now that you have your alternator type picked out, you need to mount it. As was stated earlier, you can purchase bracket kits for both the front ignition and side ignition N's. If you are handy, and have access to a drill, welder, a grinder plumber's propane torch, bench vise and some scrap metal, you can make your own brackets. You must first remove your existing generator. Mount your alternator on the same side as your existing generator was. Observe the mounting scheme used for the generator mounting bracket. Fabricate a bracket that will use the same mounting points and or bolts and surfaces as the OEM used. There are differences between the mounting points depending on whether this is a right or left side mounting, however the task will be similar for both.

On a left side setup, you can probably fabricate a very simple 'L' shaped bracket to attach to the engine block as a lower mount for the alternator, using the bent tang of the 'L' to bolt the alternators ear too. For the top bracket you have a few options. Either locate a water pump bolt, or use a head bolt or two to hold your bracket. A piece of 1/4" x 1" bar stock about 8" long can be used as a top bracket, depending on how 'clean' you want the conversion to look. If you use head bolts for the top mount bracket, lay the bracket across the bolts or studs and mark your holes to be drilled, then mark a line just clear of the head where you can bend the flat stock into alignment with the top alternator ear. When finished your quick and dirty bracket will have a twist in it, with one end flat for the head, and the other end twisted and bent flat for the alternator. Drill your holes for the head bolts / studs. Now, on the alternator end, drill a few holes down the stock so that you can adjust the belt. You may have to do additional bending on the stock to make it clear the alternators cooling fan. You may even have to cut it at an angle to make an arc shape at the top. An easier method would be to visit an auto store and find

a 'universal' top slotted bracket already bent into an arc, and then modify that for your needs, either by bending the base flat for mounting to the head, or welding it to a piece that can be mounted to the head. The possibilities are virtually endless here. I've seen angle iron used in the place of flat stock, everything from crude torch heating and bending, to relief cuts, nice angles and clean welds. All seem to work just fine if you measure correctly and allow clearance for the fan and belt.

On a right side mount, you will again, need to locate a suitable location to mount the lower bracket. Many people use the top far right bolt on the governor cover. A simple bracket can be made from 2 short pieces of flat stock with a hole drilled near each end. Use this to sandwich the lower ear on the alternator. Fabricating and attaching the top bracket will be similar in process as the left side mount. Just choose a convenient bolt and attach your bracket securely. Water pump bolts may allow for the use of a flat bracket, while head bolts will require a twisted bracket. Either are sufficient. I have seen both. Again, an 'arc' shaped top bracket will usually be required to make the alternator geometry correct and allow for proper alternator fan clearance and belt tensioning.

One of the main differences in the mounting of an alternator and a generator is size and clearance. The generators are usually longer and have smaller barrel shaped bodies and due to the original mounting schemes are tucked up high and close to the engine, allowing for plenty of clearance between the generator and steering arms.

Alternators are usually shorter and have significantly larger barrel bodies, and due to the improvised mounting methods, do not set as high or close in as the generator being replaced, and thus may drastically decrease the clearance between the alternator and the steering arms. Some of this may be overcome by creative "bracketry". However, I have noticed that the front ignition N tractors sometimes have belt clearance issues if you try to mount the alternator too high or close in. This can result in the alternator belt actually rubbing on the distributor, or the inability to sufficiently tension the belt. I have seen both of these situations, and neither are desirable. A worn front axle kingpin will usually add to this problem. In this case, you really should fix your axle king pin, but if you can't, at least for the time being, you can try to mitigate the problem somewhat by welding up stops on the front axle to limit its max upward travel, and you can also widen your front end to change the range of movement the steering arms can travel.

If this is not enough to prevent the steering arm from contacting the alternator, try adjusting the brackets to move the alternator closer in. If this results in not being able to properly tension the belt or the belt begins to rub on the distributor, then you may want to add an idler pulley to take up the slack and change the belt geometry a little. I did this modification on my 1946 2N. I added a small pulley and connected it to the same hardware used to connect the lower alternator ear. It was simple, and cost less than \$20 for a long grade 8 bolt, an off the shelf pulley, and a few set screw spacers. This allowed me to tension the belt, and get plenty of clearance at the distributor. As a downside, there is less contact area between the belt and the alternator pulley than would normally be optimal. However, I have never experienced belt slippage or any other negative effects even when the alternator was under loads exceeding 30 amps.

You have your new alternator or generator mounted and now you are ready to complete your conversion to 12V. You will now need to purchase a 12V battery, a new wire harness, or simply modify your existing one, a new 12v ignition coil, or the appropriate ballast resistors to allow the use of your existing 6v ignition coil, and new 12v lamps.

### **Generator:**

You can either keep the positive ground setup or change to negative ground. If you have a front mount ignition N, I would suggest keeping positive ground, due to the design of the ignition coil. Mount your battery with the positive post connected with the ground strap to the frame, and the negative post to your start switch or solenoid, depending on your hardware. Polarize your genny and regulator, per circuit type. Your rebuilder / dealer will give you instructions as to which circuit type you have, and how to correctly polarize your genny. If you are using your existing 6v front mount square coil and OEM ballast resistor, then you will need to add an additional dropping resistor in line. An 8NE10306 resistor is a good '12v to 6v' resistor for this application. Add that in the primary line to the coil. Now, change out your headlamps to 12v units and you are ready to go. Your points and condenser will not need to be changed. If you change to a front mount 12V coil, read the instructions for the coil to see if you need to keep some serial resistance in the line. Most of the 12v square coils I have seen still need extra serial resistance. The resistance needed seems to vary by manufacturer. Some 12v coils work well enough with the OEM ballast resistor, and some seem to prefer a 1/2 ohm dropping resistor. A sufficient 1/2 ohm dropping resistor can be made by purchasing a 2-pack of radio shack part number: 271-131 1-ohm / 10watt power resistors, and then wiring them together in parallel to make a 1/2 ohm / 20 watt resistor.

If you have a side mount ignition, you have the option of staying positive ground or changing to negative ground. If you stay positive ground, connect as listed above, and also add the 8NE10306 dropping resistor. If you decide to change to negative ground remember to change the wires at your ignition coil to match. On positive ground, if your coil lists a +/- then connect + to the distributor. On negative ground connect - to distributor. (f you have an old coil, it may list BAT/DISTRIB instead of +/- Substitute Bat and - and DISTRIB and + and hook up as the previous instructions state.) If you decide to upgrade to a 12v coil, then you may want to locate a true 12v coil instead of using a 6v coil with a ballast resistor. I have had very good luck with using NAPA part number IC14SB. This is about a \$15 coil. If you simply ask for IC14 you will get a \$50 coil..... so be specific!! Replace your lamps, and wire the new ignition coil, or old ignition coil and dropping resistor in, change out your lamps and you should be ready to go. The N 6v starter and starter solenoid / switch are robust enough to work on 12v for many years with few problems if properly maintained and used correctly.

### **Alternator:**

You will need to change to negative ground. The same ignition coil and resistor choices listed above will apply. Your alternator charge

line can be connected to the wire that used to connect to your old generator's voltage regulator 'BAT' tab. (the old VR can be removed).

### **Gauges:**

If you change ground polarity and notice that your ammeter now reads backwards, simply reverse the connections on the back of it (in the case of the original loop style meter just remove the wire and run it thru the other direction)

If you install a high amperage alternator, you may find that you can charge at a higher current than your ammeter can display. In general, this shouldn't be an issue as high charge rates usually only occur for a few seconds after startup. Also, due to the way most ammeters are made, running it out of range should not damage it. However, if it bothers you, simply replace it with a 0 center ammeter of sufficient resolution to fit your needs.

Alternately, some people instead prefer a voltmeter to monitor their 12v electrical system. If I could only have one gauge, I would personally prefer the ammeter; however the addition of a volt meter to be used in conjunction with the ammeter would be fine.

To add a voltmeter, simply connect the volt meters posts up. Pay attention to polarity..... one post will be positive, the other negative. On a positive ground tractor, connect the positive post to the chassis and the negative post to the switched side of the ignition switch. On a negative ground tractor, connect the negative post to the chassis and the positive post to the switched side of the ignition switch. Find a convenient spot to drill a new gauge hole, or add a gauge bracket to a convenient spot.

If you desire to replace the ammeter with a voltmeter then do as follows:

Step 1: Remove ammeter. If it is a loop style, go to step 2.

If it is a post style, connect those 2 wires together and insulate. (butt connector, wire nut, electrical tape, etc. )

Step 2: Connect the volt meter as listed above in the paragraph titled " To add a voltmeter"

If you do not follow step 1 correctly, you will not be able to start your N as you will not have ignition power.

A brief recap on resistor choices:

### ***Resistors, resistors, resistors... which ones do you need?***

Depending on your ignition setup, you could need any 1 or 2 of 3 possible resistor(s).

There is the infamous OEM ballast resistor part number:

A8NN12250B Resistor And Mounting Block Assembly 1939-47

A8NN 12250A Resistor And Mounting Block Assembly 1948-50

The 12to6v dropping resistor part number: 8NE 10306 Resistor (Used To Reduce 12 Volt To 6 Volt) And a current limiting resistor 'trick' cooked up by fellow YTMag.com'er 'Dell', which is merely a 2-pack of RadioShack 1 ohm 10 watt resistors (# 271-131 ) twisted together piggyback (in parallel ) to make a 1/2 ohm 20 watt resistor.

What you need depends on what you have as electrical equipment, and what the system voltage is. If your charging system is stock 6v, only the front mount distributors will need an ignition resistor, choose the correct ballast resistor for your tractors age. If you are running a 12v conversion, on a side mount distributor N, and you have a real 12v side mount round can coil, you don't need anything. For the front mount distributor, if you have a newer 12v front mount coil, use the 'trick' resistor Dell cooked up, or the OEM resistor, if the coil's instruction state to do so. If you have a 6v side mount round can coil, use the 12to6 dropping resistor. If you have a front mount square OEM 6v coil, you will need both the 12to6v dropping resistor and the appropriate ballast resistor

Have fun!

Soundguy / Chris Britton

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