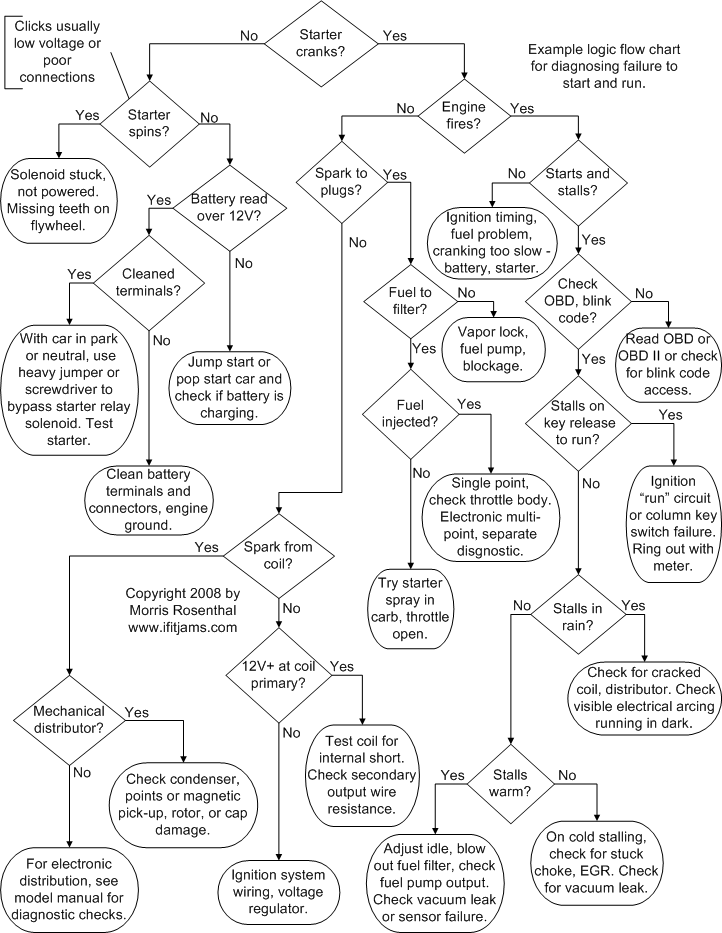
**[](#starting1)Diagnosing Car won’t start**

When you turn the key, does the starter crank and turn over the engine? It's possible that you left your automatic transmission in gear, and the neutral safety switch won't let you send power the starter to lurch the car forward. Sometimes you can't turn the key at all, or remove it from the lock if in gear. Manual transmission cars may have a neutral safety switch activated by the clutch pedal throw and shift sensor (after all, the car can be in neutral with the clutch out). If the neutral safety switch fails, the car won't start, but don't go jumping to any conclusions, we aren't near that point yet.

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Does the starter spin at high speed or make a clashing or grinding sound without turning the engine? The electric starter motor's job is to turn the pinion gear which is supposed to mesh with the teeth on the huge ring gear that forms the edge of the engine flywheel. Since the starter's pinion gear can't remain meshed with the flywheel when the car is running (would burn out the starter motor and kill your gas mileage), a [solenoid operated a throw-out arm that kicks the gear forward into to flywheel](https://www.ifitjams.com/solenoid.htm) when the key is turned to "start" and pulls it pack out when the key is released to the "run" position. If the solenoid fails, if the terminals on the solenoid are all corroded and the circuit is broken, or if the plunger or the throw-out arm plain sticks in place, the starter will spin but the engine won't turn over. Some guys have luck hitting the starter case with a hammer on the casting, where it won't dent in. Never worked for me, but thought I'd mention it.

But everything might be working right with the starter yet it will still sit and spin if you've lost a tooth or two on the flywheel where it happened to stop when you last shut down. This is more likely to cause problems with age, when a pieces of the teeth on the flywheel or the starter pinion gear may be broken off or worn away, of which a grinding sound is a good sign. But there are lots of teeth on the flywheel, several feet worth, so it's worth turning the engine over by hand to move the ring gear on the flywheel along a few teeth, and then seeing if the starter will engage. Use socket wrench on the main crankshaft pulley to do this, but for safety's sake, make sure you haven't left the key on "run" or you could break your arm and your head. Also, don't forget to take the wrench off the pulley before you try to start the car.

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Does the battery read above 12 Volts? Break down and buy a digital voltmeter if you don't already have one, they only cost a couple bucks these days. A test light won't tell you if the voltage is high enough. The battery should read above 12 V, somewhere around 12.8 V with the car off is normal. The voltage shouldn't drop below 12 V if you turn on the headlights. If it does, the battery is undercharged and you were just seeing a surface charge that can't supply starter current at the proper voltage. If the battery reads low and you can jump start (or pop start the car with a standard transmission), the problem is with the battery or the charging system. Check the battery water if it's not sealed, some people used distilled water to top off, like the stuff for cleaning contact lenses. You can use a cheap specific gravity test kit to check the battery acid if it's not taking a charge, but on the whole, batteries probably last somewhere from 80% to 120% of their design life, which is rated in months on the battery case. If the battery burbles or if one area gets hot when it's charging, you probably have a dead cell and should replace the battery before somebody ends up with battery acid in the eye.

When the car is running (in park or neutral with the parking brake on) check the battery voltage again. It should read something above 14 V while charging, alternator output varies with different makers. If it doesn't read above the battery voltage before you started running, there's something wrong in the charging circuit. The main suspects are the alternator and the voltage regulator, with the voltage regulator being the cheaper of the two and fairly easy to test. You'll need some schematic from the maker or from an aftermarket auto repair manual to identify the terminals on the alternator and voltage regulator to test, just remember that the alternator can't generate any electricity to charge the battery if the voltage regulator doesn't send it power to generate an electric field. The alternator shaft is always spinning, but no power is generated in the outer windings (stator) unless the rotor winding is powered. The most common failure with alternators, beyond the wiring harness, is probably when one of the rectification diodes fail. Without rectification, the alternator would be putting out AC that would alternately charge and discharge the battery!

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Have you cleaned the battery terminals switch? I actually forgot this one first time I did the flowchart because it's second nature, the first thing you'd do if you don't own a volt meter. If all you get is clicking from the starter relay when you turn the key, or if the car barely cranks over, there's a good chance that the battery terminals are oxidized or dirty, If the connectors on the posts (terminals) are at all loose, that's likely your problem, and you can often get enough juice to start the car simply by twisting the connector until it's in a tighter position. But the real fix is to remove the connectors, clean the posts up with some sandpaper or emory cloth, and do the same inside to the inside surface of the connector. If the bolt inside an old fashioned lead connector is corroded and broken, it need to be replace in the long run, but if you just need to get home, simply crushing the connector a little and then forcing it on the post so it's tight is a decent patch. Check the ground also. Remove the bolt on the battery ground (where the black battery cable ends up), clean it, and put it back in again. Check the engine to chassis ground strap while you're at it.

Cars and trucks use a starter relay switch so that the heavy wire supplying high current to the starter from the battery shouldn't need to be wired through the ignition switch. When you turn the key to "start", a magnetic solenoid in the starter relay switch plunges down and connects the positive output of the battery to the power cable running to the starter. If the relay fails or any of the fusing in the starter circuit before the relay fails (perhaps for good reason, like a short), the starter won't get any power. While there's always a chance it will cause damage, I'm in the habit of bypassing the starter relay with whatever is handy, to power up the starter. Less radically, you can bypass the ignition switch to power the solenoid to actuate the starter relay, if it is operational but not getting turned on with the ignition switch. Since this either of these approaches are bypassing the neutral safety switch and any other safety features, make darn sure the car is in park or neutral if you try it, or you may just run yourself over.

There's not much else to do other than remove the starter and check it outside of the car. Make sure you remove the ground cable from the battery before going to remove the starter or you can end up welding your tools if there's circuit problem. Check the starter terminals for corrosion, doesn't take much to keep electricity from flowing. When the starter is out of the car, you should be able to test it easily with a set of jumper cables, the ground on the case and the hot to the main terminal. Should spin the main motor and kick the pinion gear out.

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Does the engine fire and try to catch, or does it just crank over endlessly without ever trying to start. You don't want to spend minutes cranking an engine that makes no attempt to fire up, there's simply something wrong, it's not just cold. If it tries to start initially, but then just runs and turns without catching, it's most likely a fuel problem. Either it's flooded out or it's not getting any fuel. My old Omni has a tendency to dry out (gaswise) when it's been driven for more than a half hour or so and then sits overnight. Can't pump too much gas into that carburateur for starting, I think the bowl basically dries out or has some internal leak, but it's been that way for twenty years and gets great gas mileage, so why fiddle with it? If the engine backfires, it often indicates a timing problem. If the engine catches fire, a timing problem and a fuel leak could be at fault, but your first priority should be finding an extinguisher.

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Is a spark getting to the plugs? Some sickos just grab the boot of a plug and touch the engine block to see if they get a 20,000 Volt jolt, but that's no longer my idea of fun. I usually pull a spark plug wire, stick a screwdriver into the metal clip that would actually sit on the spark plug when the wire is installed, and then hold the screwdriver by the plastic handle with the metal shaft a quarter inch or so away from a good ground on the engine while having somebody crank it over. A good spark will be bright and cracking, you'll hear it zap. I only check one wire, I suppose it's always possible that the distributor contacts for some other wire have failed, but even if only a one or two of the spark plugs are getting spark, the engine should attempt to fire.

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Is there a spark from coil secondary? If you aren't getting any spark at the plugs, or if the spark looks or sounds weak, the problem is likely that the coil isn't operating properly. It's also possible that your spark plug wires are totally shot and the resistance is so high that it's eating the sparks, but that's not normally something that happens overnight. Good spark plug wires can last a decade. But to get a spark out of the coil, you don't just have to hold the secondary output near ground with the screwdriver trick, you also need to short the coil negative to ground (just touch and go) using an alligator clip and probe setup, to complete the circuit. Remember that any type of transformer (and coils are a type of step-up transformer) requires a changing current in order to operate, and grounding the coil negative intermittently is a hack way to get a current surge in the primary winding.

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Do you have a mechanical distributor? A mechanical distributor is easily identified by a round distributor cap with all the spark plug wires attached to towers spaced along the edge and the coil secondary wire plugged into the tower in the middle. Underneath the cap, held on by two clips or screws, is a rotor mounted on a shaft that is mechanically turned by by that shaft being geared into the camshaft. So the distributor rotor position is married to the valve positions for the cylinders, and the exact spark timing is set by turning the distributor cap relative to the shaft and securing it with a hold-down to the engine. Depending on how old the car is, there will either be points, which draw the spark by opening and closing the circuit when the distributor shaft lobe opens and closes the points, or a Hall effect pick-up, an electromagnetic pickup that feeds the distributor shaft position back to the spark control computer which has some say in advancing or retarding the spark.

You can clean the rotor contact, though the metal will slowly get corroded by the high voltage over time, increasing the gap to the cap until it needs replacing. The contacts on the cap (or the spark plug wire ends where they come through the cap to provide the contacts) may be slowly eaten away by the high voltage over the years. If that's the case with the wires, simply turning them over so the other side of the wire contact faces the rotor may extend their life a few years. The magnetic pick-ups do fail, the ones on my Chrysler 2.2 went every few years, with the usual symptom being the occasional stall (on the highway!) or very hard starting. You can test them in place if you find the shop manual instructions, but it's more complicated than most people will want to fool with for a $25 part. For true electronic distributors, see the manual for diagnostics, and don't neglect to check if there are any OBD II codes present.

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Reading 12V+ at coil primary? With the key on "run", you should see the battery voltage at the positive input terminal of the coil for the primary winding. If it's not there, the coil can't make sparks, so you'll have to trace it back through the ignition circuit. The "run" circuit and the "start" circuit for cars share a good chunk of the components, but the "run" circuit obviously eliminates the starter. I wouldn't suggest jumping direct from the battery to the coil and cranking to see if you get a spark, you could end up causing more damage if a fuse has already blown to protect the ignition system from a short circuit.

You should make a serious effort to obtain the wiring diagram for the car before trying to ring out the circuits backwards just by following wires. Modern cars all employ taped up up wiring bundles and harnesses, and the wire color coding can even change as it goes through splices inside the large connectors. Supplied with the wiring diagram, you'll be able to trace the circuit path and find the open circuit preventing current from reaching the coil just by checking the voltages or continuity through the connectors, without unwrapping any wire bundles or disconnecting any devices. The wiring diagrams also make it much easier to physically locate short circuits that are causing a fuse or fuseable link to blow. I've only had my car towed home twice, and the second time was due to a blown fuseable link I couldn't find the short for while standing around in the street. Turned out to be a wire from the carb switch that got crushed in between the carb and the air filter can months before, and simply wore through due to vibration at the wrong moment.

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Is fuel getting to the last fuel filter in line? There may be three or four fuel filters in some cars, starting with one in the gas tank and ending with a paper filter right before the carb or fuel injection unit. There are various ways to check for the presence of fuel flow to the final filter, professionals will use a gauge to check the pressure and make sure it's up to specs. Another way is to remove the paper filter, see if it's full of gas, and blow it out in the proper direction (flow goes towards the carb or fuel injector, there should be an arrow on the filter). I just blow through the filter with my mouth, you might want to pass on getting gasoline in your body, it's bad for you. If you can't blow through the filter, it's clogged. If there's no gas in it when you take it out, gas isn't getting there, which means either you're out of gas, you have a fuel pump failure, or you're suffering vapor lock or a blockage in the fuel line or previous filter. I suppose you could also have a hole and be squirting gas all over, but you'd probably smell that.

Some folks test fuel pump operation by redirecting the output line into a container and cranking the engine to test the flow. Needless to say, if you're smoking or sparking, you could go up like a torch. Modern cars also have vented gas caps and complicated vapor recovery systems. If any of these block up, you could end up with a vacuum in the tank or in the vapor recovery system pulling pack on the gas that the fuel pump is trying to move forward. Release the gas cap and see if you get a big "whoosh" sound, after which the car starts or runs better.

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Does the vehicle have electronic fuel injection or a carburateur? Fuel injected cars are subject to injector failures or blockages that can result in all sorts of starting and running problems. You can either have electronic multi-point fuel injection, where each cylinder of the engine is fed directly by a fuel injector, or a single point fuel injector throttle body, which is sort of an intermediate step between a carburateur and electronic fuel injection. You'll have to see a manual specific to the car model for diagnosing fuel injector problems, from computer logic to supply voltage, etc.

If you have an old fashioned carburateur, you can try some engine starter fluid spray down the carb throat (hold the throttle open) and see if it fires up. If it fires up and runs with the spray, you know you just have a fuel or carb problem. Carburateurs do get gunked up and carburateur cleaner is good stuff, but even if you spray it directly at the needle valve, it's not the same as taking the carb apart and cleaning it. With the replacement gaskets, needle and accelerator pump in a rebuild kit, you can make quite a bit of difference. But I have over a quarter million miles and twenty plus years on my carb and never had to rebuild it, so don't run to do it for no particular reason.

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Does the car start, run a few seconds (or longer) and then stall? If the engine fires just a little but won't catch and get going, it could be anything in the spark control system, including timing, or it could be that the engine needs to turn over a little faster to catch. If the car seems to crank very slow and fires without starting, it could be that the battery voltage is too low, the cables or connections are corroded, or the starter is motor needs rebuilding. Try jump starting it even if your battery voltage looks OK, the extra boost should make it crank faster, and if you start right up, that's the problem

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Check the OBD (On Board Diagnostic) or pre-OBD or OBD II code. Your owners manual may not have this information, so check the aftermarket manual or shop manual. Many cars, in addition to having an OBD or OBD II connector that gives garages and inspection stations access to the engine codes, can produce a failure code for various engine sensors and circuits by blinking a light in the instrument cluster. The instruction for getting these codes will be specific to your car, often leading you to turn the key to "run" and "off" a couple times in quick succession. If the car runs and displays a check engine light, some auto supply stores will check the stored codes for you in their parking lot. You can also buy a code reader for $70 or $100, depending on whether you just want the code numbers or want a cryptic English message as well.

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Does the engine fire right up but stall as soon as you release the key back to the "run" position? If so there's a good chance it's the ignition switch that's failed, but they're expensive, so before you rush to replace it, I'd get the schematic and ring out the system carefully. If you have an emergency, like you're out in the country being hunted by chainsaw wielding maniacs, you identify this problem, and you have a couple minutes before they find you, you might hotwire the car, which really just means connecting the run circuit so it's always on (eliminating the need for the switch)/ In some cars, this might cause damage, leaving the run circuit active when the car isn't running, aside from running down the battery, so I save it for life and death. Almost thirty years ago I had to rewire my Mustang after a major meltdown behind the dash (from overcranking the starter after an engine change). When I finished the wiring job, everything worked and the car ran fine, but it wouldn't turn off! I'd accidentally hotwired the car, connecting the coil positive directly to the battery, so once it was started it wouldn't quit.

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If the car stalls in the rain or in damp weather, it's very likely related the the high voltage section of the ignition, the coil, wires, or distributor cap. It's just that much easier to arc out when the air is wet rather than dry, and it's a common indication of a cracked coil, cracked or loose distributor cap, or failing wires or boots when the car stalls or runs bad in the rain. Check by opening up the hood while the car is running at night (running in park or neutral with the brake on, that is) and see if there are sparks arcing anywhere in the engine compartment. There isn't some "right" level of arcing, all of it is bad.

If the car stalls and runs bad or won't restart after hitting a puddle, it's likely that water splashed all the way up to the distributor or coil, and is causing excessive arcing until it dries out. If the distributor is mounted at the front of the engine, it really should have a plastic shield over it. If getting out of the car and drying off the ignition parts with your T-shirt fixes the problem, you know the solution is replace or shield those components, or avoid puddles from now on - without causing an accident.

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If the car stalls warm, it could be something as simple as the idle being set wrong on an old car, or something as awful as a failing ignition computer on a new car. Check the standard fuel problems which can always lead to stalling, but vacuum leaks at the intake manifold or in any tubing can cause stalling or lousy performance, as can any number of sensor failures. Newer cars are equipped with O2 sensors, MAP sensors (Manifold Absolute Pressure) and a dozen other sensors for combustion products and engine readings. Some sensor failures will prevent the car from starting, though these should show up in the OBD readings. Or sensors may misbehave, leading to poor running, hard starting, or decreased gas mileage. One of the best indications that something is wrong is if your gas mileage falls in the absence of any changes in driving habits.

If the car stalls cold, the first thing to check is for a stuck choke, which may be letting too much fresh air into the intake manifold. The EGR (Exhaust Gas Recirculation) valve is also suspect for cold stalling problems, as are the ever present vacuum leaks, especially on older cars. My own habit is to search for vacuum leaks by spraying starter fluid at the vacuum lines and seeing if the engine surges (RPMs shoot up) meaning the spray has been sucked into the manifold through a leak. Of course, if you do this with the engine hot, you may set the car or yourself on fire. In fact, even if you do it cold, you might cause a fire or an explosion, I just don't own a vacuum gauge to check for leaks.

For years, I had a cold starting problem that showed up at random, and only in very cold weather. When it finally began happening whenever the weather was freezing, I determined that I wasn't getting any spark at all, and the spark control computer was at fault. If I removed the fender from the sidewall, brought it inside and warmed it up with a heating pad, the car ran fine every time. Once it was warm, it never gave a problem, but I got tired of having to heat it up in bad weather and popped $100 for a new one, which solved the problem.

**CLIPS**

 (defrule duck

     (is-animal duck)=>

         (assert(sound-is quack)))

 (assert(is-animal duck))

(deffacts startup (animal dog) (animal cat) (animal duck) (animal turtle) (warm-blooded dog) (warm-blooded cat) (warm-blooded duck) (lays-eggs duck) (lays-eggs turtle) (child-of dog puppy) (child-of cat kitten) (child-of turtle hatchling))

(defrule animal (animal ?)=>(printout t "Animal Found" crlf))

(defrule animal-list (animal ?name) => (printout t ?name " found" crlf))

(defrule mammal

    (animal ?name)

    (warm-blooded ?name)

    (not(lays-eggs ?name))

    =>

    (assert(mammal ?name))

    (printout t ?name " is a mammal" crlf))

    (defrule mammal2

        (mammal ?name)

        (child-of ?name ?young)

        =>

        (assert (mammal ?young))

        (printout t ?young " is also a mammals" crlf))

(defrule remove-mammals

    ?fact <- (mammal)

    =>

    (printout t 'retracting '?fact crlf)

    (retract ?fact))

    (defrule what-is-child

         (animal ?name)

          (not(child-of ?name ?))

            =>

              (printout t "What is the child of " ?name)

              (assert(child-of ?name (read))))

(defrule bands

    (member-of ?band $?)

    =>(printout t "There is a band called " ?band crlf)

)