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And, should you decide that a given repair is a bit too tricky for you, the book will arm you with the knowledge necessary to discuss the work intelligently with your professional mechanic. Our goal is a simple one: We want to provide you with the information you need to keep that treasured car of yours in peak condition regardless of its make, model, or age. We know how much you love your car and how dedicated you are to maintaining it. We're hoping our book provides you with a way to put that dedication into action. Slowing to half speed, you continue to press forward through the deluge. Suddenly you realize that those flashing blobs are the warning lights of a stopped school bus, and children are running across the road in front of you. Fortunately, your brakes work infinitely better than your windshield wipers. 4 Once it's dry and sunny again, grab a tape measure and head for the garage. Lift one of the wiper arms—it's usually easier to grab the driver's side arm off the windshield against its spring tension and keep lifting until the pivot point locks the arm upright (Fig. 1). Look for contaminated rubber inserts, which can be caused by road film or car wash chemical adhesion. Check for a rubber insert that has been partially torn away from its metal support. It will slap the windshield with each wiping pass. Plain old dried-out, cracked rubber inserts mean they've seen better days. And rear window wiper blades are subjected to a lot more road grit than front blades. In the rear, you get aerodynamic backwash, with the rear tires kicking up all sorts of debris. And don't rule out an improperly installed refill. Maybe someone else had tried to replace the inserts before you got to them. Buy a pair of full-blade assemblies to get a factory fit. Also check the wiper ANTIs. If they're okay, proceed to replace the blades. Blade

Runner But first, measure the length of the wiper blade to the nearest inch Fig.

2. <http://www.biff.it/public/3gm30-parts-manual.xml>

Most vehicles today use blades anywhere from about 16 to 21 in. in length. However; some cars or minivans with very large windshields may exceed that by a few inches. Parts catalogs, even those for simple items like wiper blades, are full of all sorts of extraneous information. You may find three different types of refills and three different types of blades for almost every vehicle listed. The illustrations to the right show some of the reasons why it may not. Other reasons may involve components that work behind the scenes actually, behind the cowl or dashboard of your car. They include the splined shafts that the wiper arms pivot on, the mechanism that creates the backandforth pivoting motion and the electric wiper motor that drives the whole system. A small nut under a cosmetic plastic cover jams the wiper arm onto the splines of its shaft. The splines keep the shaft from slipping in the arm as it turns in one direction and then the other, over and over and over. This reciprocating motion is created by a metal cranktype linkage assembly that's attached to each wiper arm's splined shaft, and to the wiper motor with another splined shaft. Picture the chugging action of a steam locomotive's piston and drive wheels and you'll get the idea. Rear wipers found on minivans, SUVs and some sport coupes work the same way, except the reciprocating mechanism is much smaller and built into the motor. Wiper speed depends on the amount of voltage that's sent to the motor from the wiper switch low voltage equals low speed, high voltage equals high speed. Intermittent wiper action is created by a separate electronic module wired between the switch on your dashboard or steering column stalk and the motor. Some cars even have electronically controlled road speed sensitive wipers that wipe faster the quicker you go. TORN RUBBER PARK SET RUBBER DAMAGED SUPERSTRUCTURE ABRASIONWORN RUBBER 5 Fig. 3 Release the tab to disengage the the straightened arm.

If you don't know what brand of blade your car has, don't buy rubber insert refills. The refills may not fit the blades properly, and you'll get lousy wiper performance. If you do know what brand of blade is currently on the car, refills are okay as long as you buy the same brand and type. Experience has shown that mixing blade and refill brands doesn't lead to optimum wiper performance. But realistically, you're still better off just buying a pair of blades assembles no matter what the brand. The few extra bucks get you new, matched components that mount quickly and easily. Fresh Rubber Now that you've got new blades in hand, it's time to determine what method to use to mount the wiper blade to the wiper arm. There are many variations hooks lot connector, pin type arm, wide straight end, narrow straight end, side saddle, pin type blade, narrow dead locker, flat hook and rock to lock. At the very least, you'll need a small screwdriver to gently pry the blade off the arm or to unlock a tab of some sort. Sometimes a pair of needle nose pliers helps too, but the pliers tend to mar the wiper arm finish more than a screwdriver. Bear in mind that most wipers will stay raised in an upright position away from the windshield so you can work. A unit may simply lock onto the pin on them. Others will not. Sometimes, the box will contain a So if this is the case, you'll adapt a lock that locks in to the blade opening to hold the blade off and accepts pins in different sizes. The straightened connector can be If your car has wipers that tricky. So sometimes you need to lift a park behind a cowl or the tab on top of the existing blade with a lip of the hood, turn on the ignition, turn on the wipers screwdriver to clear the locking nub on the arm.

You may also need to and then shut off the ignition the old blade a few degrees out when the wipers are in operation with the arm to slide it off mid stroke so you can have the arm's end. The new windshield to protect blade may come with an adapter to fit blade from the glass in case the bare arm's end or it may just slide on. If you're replacing a rubber insert, For the hooks lot connector, you just grab it with needle nose pliers at the generally need to raise the arm off the open end. The other end generally has windshield to a working height. Then, some

sort of deadstop that prevents the swing the blade perpendicular to the insert from sliding out. You may need arm so that you have more light on the connector. You will find some sort of tab to unlock a tab or squeeze together the locking tabs of the insert before you at the connector that either needs to be lifted or pushed to release the lock that can begin pulling. Then, just hold the holds the blade pivot in the hook slot. Grab the new insert make sure that you've got to ward the base of the arm will slide the blade right out of the hook slot the right end if they're different line Fig. 3. Then, simply line up the new it up with the first set of guides on the blades mount there may be an adapter blade, then feed it in carefully. Make sure to engage each set of guides as in the box to create this mount with the hook slot and slide it in until it you go. Sometimes there are as many clicks. This means it's locked in place. A tune up is in order, so a fine Saturday morning find yourself on a deserted stretch of road. You figure a few miles of spirited driving should blow out the cobwebs and restore that ponycar performance. But what happens instead is a lot of noise and not much performance at all. Time to check the air cleaner which is plugged with dirt, bugs and leaves.

Housing Project Check your air filter at least once a year. All air filter housings are so messy underneath the hood Fig. 1. The housing cover may be held by wingnuts or spring clips pretty Fig. 1 Check your old filter element for dirt, oil or moisture, cracks and proper sealing at the gasket. Separate the cover from the housing and you can lift the filter out for inspection. Many filters, particularly the narrow cylindrical ones used on older rear drive cars and even on many of today's trucks, can be rotated. Clean the housings interior before assembly. Some heavy duty filters are designed to be cleaned several times, but automatic filters are not. Before you reuse a filter, however, inspect it for cracked pleats. The best way is to hold the dirty side of the filter in front of your eyes with good lighting on the opposite side with a cylindrical filter, hold a trouble light in the middle of the opening. Of course, you should see some translucence if you do not, the filter is plugged. But if you see even a single line of light, which indicates a hairline crack, discard the filter. A lot of unfiltered air can get through a crack, and it's the abrasive dust in the air that wears engines. Sure, that wear takes place over time, but if you're in a dusty area that time can be a lot shorter than you'd like. Buy a quality replacement filter. The top brands are different from the noname cheapies you may see. In addition, their pleats are more precisely spaced so the filter has the maximum surface area for the size of the housing. Metering the Air Just downstream of the filter housing, perhaps connected by a duct, will be the engine's airflow meter, or sensor. Some engines have no airflow meter. Instead, their computer calculates air intake using rpm, intake vacuum and barometric pressure.

Contamination of the airflow meter will give your engines computer inaccurate information about the amount of air the engine is burning. That could mean poor drivability, poor mileage and hard starting. Don't, however, try to clean the airflow sensor, save for blowing loose dirt and cobwebs with your breath. The calibration of these instruments is fragile, and you stand a good chance of mucking your sensor up irreparably. Duct Hunting Before you install the new filter, inspect the duct from the throttle body to the filter housing. Spread the flutes of the duct, look in for cracks. If the duct is cracked, it may be closed at idle but spread on acceleration, when the engine torques. The same thing can occur if the duct isn't properly fitted and clamped at each end. Find a crack Well, it's a duct, so you can repair it with duct tape Fig. 3. That's a move that no professional would make, because in time the tape will lose its grip in the heat of the engine compartment, as the duct flexes. But it's your call; and if you're unwilling to recheck periodically and retape as necessary, you can save the cost of the new part, or at least postpone the expense. Fit Is Important Carefully check the fit between the lips of the housing and the rubber gasket rimming the filter. This gasket not only seals the filter housing together, but also provides an airtight and dirt-tight seal between the filter and the clean side of the housing. Look carefully at the old filter's gasket. It should show a smooth,

clean line 360 around at the sealing face on both sides. The rim of the filter housing will have compressed the rubber gasket if everything is correct. If not, a little detective work is in order. Is the filter the correct part.

If not, is your replacement filter the correct part. Don't rely on just a visual comparison to look up the correct part number and crossreference. Admittedly, it's possible that another brand will fit better. Are all of the spring clamps properly latched. Some air cleaners use screws to hold them shut, while others use a large wingnut. All of the fasteners need to be tight, even that one 0 MAINTENANCE BASICS 8 Fig. 3 Check the air cleaner's ductwork for leaks and splits, especially if you're having driveability problems. Temporary repairs can be made with ordinary duct tape. DUCT TAPE bypass the filter and allow dirt into the engine. Buttoning Up you can hardly see or reach next to the battery. On a few vehicles, the housing is attached by a bolt or spring clamp that can be removed to allow the housing to be displaced an inch or two, permitting big hands to fit into a narrow space. Ready to install the filter element. Clean out the housing first, wiping the inner surface with a cloth lightly moistened with solvent. Insert the element so it seats properly. A filter has a specific side up or toward the throttle body, and you have to install it correctly so the end seal lines up with the shape of the housing or its cover. If it doesn't, you won't get a good end seal, and incoming air may take time to finish up. Install the cover or the halves of the filter housing. In addition to the spring clips and wingnuts that hold the pans together, there also may be alignment tabs in areas you can't reach with your fingers. Be sure the tabs are engaged as you fit the halves together, so the two parts of the housing form an airtight joint when you turn the wingnuts or engage the spring clips. A light coating of dirt actually improves the filtering ability of the paper. But soon the dirt builds up and even starts filling the bottoms of the pleats, restricting airflow.

In actuality, the layers of fibers form a maze and some of the dirt also is trapped within the layers of the paper. The intruding air produces REPLACING YOUR AIR FILTER some static electricity, which also causes some smaller dirt particles to adhere to the surfaces of the paper fibers. A point comes when not enough voids remain to pass the air needed to supply your engine. The result is inadequate oxygen to burn the fuel at wideopen throttle. With carbureted engines, this used to mean rich running. Modern fuelinjected engines meter the air admitted to the intake and add appropriate fuelmaking for a cleanrunning engine that eventually won't get out of its own way. At least carbureted cars coughed and sputtered to let you know that you had a problem. But with today's engines, a filter has to be really bad to restrict acceleration. Its late, of course, and in the middle of a frogchoking rain. You're stuck in the ankledeep mud on the shoulder of a deserted road. How deserted Our of cell phone coverage deserted, or you'd be sitting in the cab of a service truck while somebody else gets drenched. That's how deserted. Yes, you could drive a long the shoulder 0 11 the rim for a few miles to civilization, but insurance won't cover the damage to your expensive alloy rim. It's time to knockle down and put on the spare. A pressure can of flatfix foam can get you home if the problem is a simple puncture, and that may be a viable option, especially for smaller individuals or the elderly who would have a tough time changing a tire.. Just remember two things This stuff is a temporary solution, and the flat will need to be attended to by a tire technician at the earliest opportunity. Be sure to warn the technician that you've used this stuff. The propellant is flammable, and unless he's warned, he stands the chance of causing a nasty explosion.

Aerosol flatfix, however, is no help if the problem is a tire unseated from the wheel rim after an encounter with a pothole. Check the manual and find the vehicle's jacking points. You'll probably need to lie on the ground to find them, but this will be a lot more palatable now in your driveway than later on the shoulder of some mud bog. Grunting Helps Furthermore, you'll never be able to change a tire if you don't have the basics a jack and a lug wrench Fig. 2. Go back into their hiding hole and confirm their existence Fig. 3. While you're there and you have enough light to read the

owners manual, figure out how to unscrew them and make sure the most common difficulty in changing a tire is lugs that are tightened far too tightly. A casual rattle with a mechanics air wrench can deliver a tightening torque that only a pro wrestler could remove with the stock lug wrench. Wheel lugs need to be tightened to no more than the manufacturer's recommended torque to ensure they won't loosen. Check your Fig. 2 loosening lug nuts calls for a lot of upperbody strength. An inexpensive 4-way lug wrench can substantially increase your leverage and break loose overly tightened lugs. Be Prepared First of all, remember to check the pressure in your neglected spare tire Fig. 1 whenever you check the pressure in the other four, which you do faithfully every month or so, right. A flat spare is no help. And if you're like most people who save a plugged or nearly worn tire for the spare, it's likely that the spare has a slow leak, which would leave you stranded. 10 MAINTENANCE BASICS LUG WRENCH Fig. 3 Locate the jack and other tire tools and make sure you know how to use them. A few drops of engine oil or grease on the threads and the lug chamfer where the lug touches the wheel, not the threads will prevent galling and seizing. When removing a wheel, first loosen all of the lugs in a crisscross pattern a halfturn or so.

It may be necessary to use the mechanics favorite cheater bar Fig. 4a piece of water pipe or thick wall pipe about 4 ft. Remove them one at a time and lube them if they squeak. Retighten them in three stages, again in a crisscross pattern. Black And Round Many carmakers, in an attempt to reduce vibration by making sure the wheels are more concentric with the hub, use a protruding lip that mates closely with the centerhole on the rim. This works well for a CHANGING A TIRE Fig. 4 A cheater bar helps loosen lugs. Never use it to tighten them. Correct this now, and you won't need to try it in the field. Jack up the corner of the car to take the load off the wheel and kick the wheel, alternating sides until it pops loose. No joy, and now your feet hurt. Be sure the lugs are only a single turn from tight, lower the car and move it a foot forward and back, rapping the brakes smartly to break the wheel loose. A shot of penetrating oil may help in an hour or two. Clean up the corrosion with emery paper Fig. 5 and coat all the surfaces lightly with wheel bearing grease, Vaseline or, best of all, antiseize compound. You'll need a few things besides the onboard tools for your emergency tire change. Pack a flash light with good batteries or, better yet, a cigarettelighterpowered trouble light, an emergency triangle, a couple of road flares, some gloves and a poncho or ground cloth. Toss in three pieces of scrap 2 x 4 as well, each about a foot long, and a piece of thick plywood 2 x 2 feet. That Fateful Day When changing a tire the first, and most important, thing to do is to get the vehicle to a safe area, far enough from the road to save you from becoming road pizza particularly if the flat is on the left side and your back side will be poking out into traffic while you work. Set your triangle or Fig. 5 Remove corrosion from the centering hole with emery cloth or a wire brush. 11 jack, and there's probably flares 100 ft. Be sure to set the hand brake.

Block the get it on the mating chamfer as wheel diagonally opposite the well as on the threads. Now you can tighten the flat a full turn. Take the lugs to their correct torque. Measure jack. In the unlikely event the carefully. If the lug is dry and car falls off the jack, it will only unlubricated, it may take a lot fall onto the spare not your more force to tighten the lugs. If the mechanics torque wrench. If Be sure you don't have anything As you're putting away your tools you've got a different style of jack than like a stone or mud trapped and jack, be sure you haven't left the one pictured here Fig. 7, check your owners manual for specifics. In fact, if the mud COI1 presses later, the lugs could lose their stored. If they're a mess, clean them piece of plywood under the jack point, and the jack on top of the wood. Be torque and the wheel could fly off. If and relubricate at your earliest opportunity you need to, remove the wheel again unit y. Don't forget to pick up your sure everything is level. Jack the car up until the flat clears the ground by in the morning to remove the debris, safety triangle. And don't let dark, or accidental y scattered into him overtighten your lugs with his Hint There should be some grease to the weeds by your feet. be found on the jackscrew of your fancy air wrench. 9 Pull the flat off and put it halfway under the

car. Hang the spare on the studs. No studs Youve got lug bolts common on many European cars and youll need to juggle the wheel while you get the top one started. The easy way is to sit down on the ground facing the hub and balance the spare on your legs while you start the first lug bolt. If you begin with the top bolt, the wheel will hang gracefully from it and you can start the rest. Fingertighten all the lugs and then lightly tighten them with the lug Fig. 7 The correct jack point on the frame of your vehicle may be difficult to reach.

12 MAINTENANCE BASICS EASY Replacing Your Tailpipe raketlights flicker suddenly in front of you, followed rapidly by the screeching of tires. Cars before you swerve to the left and right as you slow as safely and rapidly as practical. Despite your best efforts, the source of the pandemonium, what appears to be half of a cement block, disappears directly under your front bumper at a high speed. Thump. And as it exits from your rear bumper, you B REPLACING YOUR TAILPIPE follow it in your rearview mirror for a few seconds. It has company. Your muffler or at least most of your muffler has apparently developed a lasting relationship with the aforementioned cement block. They re-elooping at high speed toward the curb, inextricably intertwined. The next thing you notice is the sound of what seems to be a B29 landing in the next lane as you press back down on the gas. Actually, its your engine minus its muffler waking LIp again as you try to negotiate through the traffic, back home to safety, family and something tall and cold that will make your hands stop shaking. To add insult to injury, you replaced your exhaust system from the catalytic converter back only last spring. Inspection of the underside of your car reveals good, solid pipe most of the length of the vehicle, terminating in shards of muffler. Heres your chance to replace a few feet of pipe and the missing muffler yourself. How do you remove the Swiss cheese pipe without ruining the other two. By using a power cutting wheel and a very steady hand Fig. 1. The preferred tool is an airpowered die grinder with a cutoff wheel, but a highspeed electric drill will work, albeit more slowly. Use antiseize compound on everything to ease removal the next time.

The other type of coupling is made up of a larger pipe slipped over a smaller one or a smaller pipe slipped into a larger one, depending on which Now That Youre Home Actually, it may not be road debris that removes your muffler and tailpipe. Rust never sleeps, and cars in shorttrip service may rust out the farthest, coolest portions of the exhaust system in as little as 18 months. The following scenario is typical of vehicles that have had part of their exhaust system replaced at least once. The saga begins with a section of the original exhaust plumbing behind the catalytic converter rusting out and making a ruckus. Because the original exhaust pipes are welded together, however, all the pipes from the cat back need to be Fig. 2 Peel up the corners of the old pipe to slide in the new piece. replaced. Theres no practical way to remove just the rotted section because of all the welds. If you had the wherewithal, you could probably cut out just the rusted portion and have a pipe customfitted. But that would be extremely labor-intensive and not particularly economical over the long haul. Also, exhaust work just isnt done that way. So, generally, two or three aftermarket pipes and the muffler are clamped together behind the converter Fig. 3 After installing all the parts, adjust for fit and tighten the clamps. Then you drive around for a while the coupling is facing. Both may Sizing It Up another year or two in peace and be present in the same exhaust system. Get the back of the car up on jackquietunaware that the replacement. The important thing to remember with chocks securing the front stands, pipes hanging under you tend to rust because that you may need to save the wheels. Be sure to wear safety goggles. Different rates. Sometimes, the midpipe, so use a gentle touch with inner exhaust systems tend to drop gles, as the pipe of the three you installed goes the cutting wheel.

If the outer pipe razer sharp flakes of rust that are first. Other times, the muffler at the needs to be saved, theres nothing you seemingly attracted to your eyes. Still do to keep from cutting it. But can Get under the vehicle to see what other times, the flanged pipe bolted to why youre going to use a cutthats kind of couplings youre dealing the cat is the first to go bad. In a lling wheel

instead of an impact chisel. The flanged type is easy. Just cases, though, you want to replace it makes for a neater, smoother cut. Problem is, the 14 MAINTENANCE BASICS outer pipe like a tin can. That will give you enough play at the crimped area to wiggle the pipes apart. Spread em Fig. 4 Smear muffler cement over the joint after you install the clamp. Slice, Dont Dice To begin, remove the bad pipes clamps. Then, make a lengthwise mark 1 to 2 in. Put on a pair of goggles, get a good doublehanded grip on the cutter tool and start it up. Slowly raise the spinning wheel to the mark on the pipe. With gentle pressure, score the mark. REPLACING YOUR TAILPIPE If youre saving the inner pipe, repeat this step until youre through the outer pipe. With the cut made, use a screwdriver or a chisel to pry open the fitting a new pipe over an old one is no problem. Fitting a new pipe in to an old one sometimes is, because of the crimp from the old clamp. If you're having trouble, use an exhaustpipe expander to gain some extra clearance. Then, simply fit the pipes together as if they were both new after smearing a little muffler cement on the joint. If you saved the outer pipe, it now has a 1 to 2 in. Use an ohmmeter to chase high resistance points. Popping open the jewel box, you react for the CD, only to find out that Juniors has liberally lubricated it with peanut butter and jelly.