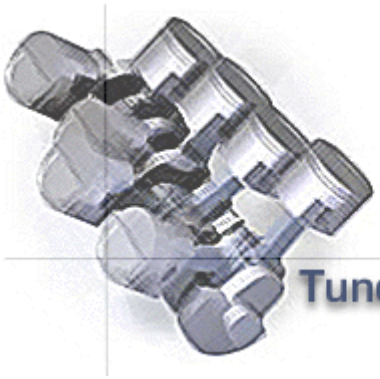


Technical Information Bulletin Rev. AK 9-7-08

How to Tune a Q-Jet (basic)

by Lars Grimsrud
Lafayette, CO

This tech paper will discuss basic set-up and tuning of QuadraJet carbs for optimum street performance and drivability.

The procedure outlined here differs from other I have seen, and is based on my years of experience doing this work in the quickest, least painful, most economical way. It is recognized that other people will have different methods of doing things, and may disagree with specific methods and procedures that I use. This article is not intended as an all-inclusive article about the Q-Jet design and setup – there are several excellent in-depth publications on the market that deal with the design and modification of these carbs. Rather, this article is intended as a general guide and overview for the novice enthusiast to assist in setting up a Q-Jet in a logical and understandable manner.

The latest revision to this article includes information on choke setup, and the carb listing has been expanded and corrected.

Overview

The Rochester QuadraJet, in its various forms and configurations, has been used by various GM Divisions for various applications since the mid sixties. The last passenger car version of the carb appeared as an ECM-controlled carb in 1981 (1980 California Q-Jets were also ECM-controlled).

The Q-Jet is a highly versatile, tunable carb that will provide outstanding performance and reliability once set up correctly. This paper will discuss the tuning and setup, and will provide you with adequate data to make good decisions when jetting and adjusting the carb. This paper will not discuss basic rebuilding sequences, nor will I discuss operations involving machining operations and other severe alterations to the carb. There are many books on the market that deal with these subjects in depth. Rather, I will describe the various systems, their purpose, and a good tuning sequence to help you get each system and parameter set up correctly in the easiest way possible.

Before ever touching the carb, keep my saying in mind that, “90% of all carb problems are ignition problems.” Although this may be a slight stretch, it’s not far from the truth: The carb seems to get blamed for any tuning & drivability issue that cannot be otherwise identified. Ignition timing, timing curve, and vacuum advance operation has a huge effect on the carb’s operation: Timing affects carb, but carb does not affect timing. So always set up your timing curve before doing any carb tuning. See my papers on “How to Set Timing” and “Vacuum Advance Control Units and Specs” for a complete rundown on this.

QuadraJet carbs have three basic tuning variables, and these get people all confused: Primary Metering Jet, Primary Metering Rod, and Secondary Metering Rod. Attempting to cure problems by tuning the wrong variable results in lots of frustrations for tuners and car owners.

These systems at times overlap in their operation. Not only does each system need to be properly tuned, but its timing and “overlap” with other systems is critical to proper performance.

When tuning, we think of each of these variables as controlling a different operating range: The primary jet size determines the fuel mixture at Wide Open Throttle (WOT). The primary metering rod determines fuel mixture at cruise speed and determines responsiveness of the idle mixture screws and off-idle performance. The secondary rods are a high-rpm compliment to the primary side, and are used for final "tweaking."

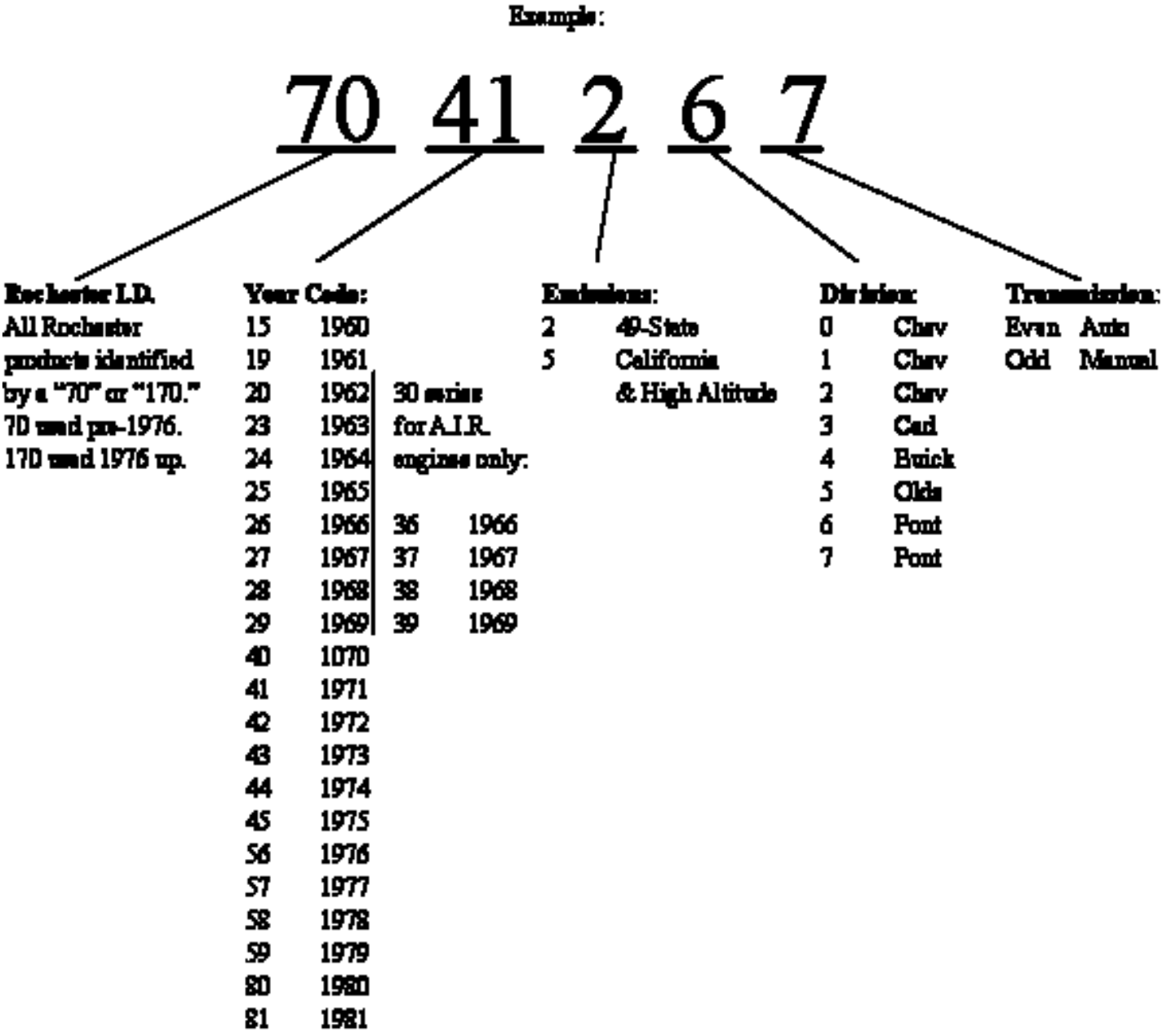
On a Q-Jet, we see that we can control the fuel mixture throughout the operating range. This is different from a Holley: A Holley has a given main jet size which meters fuel throughout the rpm range, including cruise. At WOT, the power valve unseats, and opens a fixed orifice, dumping a fixed amount of fuel in addition to the main jet. Crude, but simple and effective.

The Q-Jet meters fuel through the main jets. Metering rods, suspended from a power piston, "plug off" part of the area of the main jets by being inserted into the jets. These rods have a "fat" diameter and a "skinny" diameter: The number stamped into the side of every metering rod is the "fat" diameter indicated in thousands of an inch. This part of the rod is pulled into the main jet at cruise, at idle and at other high-vacuum operating conditions (light throttle). It produces a lean operating condition for good fuel economy and good throttle response. When engine vacuum is lost, indicating a high-power condition, the rods are pushed out of the jets by spring pressure, and only their "skinny" tips, or power tips, remain in the jets. This richens the fuel mixture for peak power. All primary metering rods have the same power tip diameter (.026"). This fact is crucial to remember when tuning: Primary metering rod sizes have no effect on WOT performance. (**NOTE**: Some post-1975 Q-Jets for truck applications have metering rods stamped with an "M" designation following the number size. The "M" rods have .036" diameter power tips, and are not suitable for performance tuning in a passenger car carb unless the tuner takes this larger power tip diameter into consideration when calculating resultant metering area at WOT.)

Identification

Q-Jets are identified by a number stamped into the Float Bowl casting on the driver's side of the car just above the secondary throttle linkage. If the carb is a Carter manufactured under license from Rochester, the number will often be inside a round metal foil tag on the driver's side of the carb just above the primary throttle linkage. Other times, the Carter-built carbs have the number stamped in the same location as the Rochester carbs, less the "70" prefix (i.e. a "7041267" carb will be stamped as "41267" only).

Rochester QuadraJet Identification



Metering Area

WOT fuel mixture is controlled only by the main jet size. Performance at cruise and at idle is then controlled by the rods. We can establish each of these mixtures independently of the other by knowing and understanding the concept of Metering Area.

Jet and rod sizes are always referred to by their diameter in thousands of an inch. But fuel flow doesn't "see" diameters: The fuel "sees" the total metering *area*. So we must convert the diameter into a resulting area. We remember that the formula for area is πr^2. Thus a jet with a diameter of .070" has a metering area of:

Radius = ½ diameter

Radius = .035"

$\pi.035^2 = .00384$"

Thus, the metering area of a #70 jet is 3.84 thousands of a square inch.

But wait! There is a rod inserted into the jet, so we must subtract the *area* of the rod. Let's say we have a #40 rod in that #70 jet. The area of the rod is:

Radius = ½ diameter

Radius = .020"

$\pi.020^2 = .00125$"

Thus, the area that a #40 rod "plugs off" is 1.25 thousands of a square inch.

The resulting metering area of the #70/#40 combination is thus 3.84 minus 1.25. The total metering area is 2.59 thousands of a square inch. This is the metering area of this rod/jet combination with the rod fully inserted in the jet. In other words, this is the metering area at cruise speed and at idle. (**NOTE**: This assumes that the rod's "fat" part is fully inserted into the jet at cruise. Although this is not actually true on most Q-Jets, we will use this assumption for comparative jetting purposes. See the section on Power Piston Setup for a full explanation of this).

To see the metering area at WOT, we know that all rods have a .026" diameter power tip (except as noted with the "M" series rods). So we run the same calculation for a .026" diameter rod inserted in the jet.

It is these numbers that we will use in all comparisons when making jet changes. We will use these numbers also to look at the *percent* differences in jet changes.

So that you won't need to run around with a calculator, my Carb Listing in Table 1 shows the metering areas for every carb listing at both cruise and at WOT (assuming rods with .026" diameter power tips). The number is the metering area in thousands of an inch for a single jet/rod in the carb. This number is effectively how rich/lean the carb is really jetted, and you can directly compare these numbers to see how the various carbs were set up by the factory. By dividing one area into another area, you can see the percentage difference in the jetting.

Figure 2 is a table showing you what the metering area is for every possible jet/rod combination. Each grouping of jets starts off with the rod power tip diameter of .026" so you can see the WOT metering area of that jet size. It then jumps to the first usable rod size.

Tech Tip #1
Before you go trying to fix all the errors of the previous carb tuner, set your carb up to the stock spec for your carb part number. A carb jetted and set up to its stock specs will usually run pretty good on just about any application, and this gives you a good starting point. From there, you can start doing refinements as outlined in this paper.

The carb number on a Q-Jet is usually stamped into the bowl casting on the driver's side of the carb in the area above the secondary throttle shaft. The number starts with either "70…" or "170…". If the carb is a Q-Jet manufactured under license by Carter, it will sometimes have the carb number stamped into a foil circle on the driver's side of the bowl just above the primary throttle shaft.

The carb listing (Figure 1) is a partial listing of popular Q-Jets that I have compiled over the years. It is not a complete listing of every Q-Jet carb. Most notably, I have very few of the truck carbs listed, yet there are many truck carbs running around on passenger cars. I also have not started compiling all the Cadillac, Olds and Buick applications in this chart, but I do update it at irregular intervals. For the latest version with latest updates, drop me an e-mail on occasion to make sure you have the latest chart.

Tech Tip #2
What has a greater effect on performance: primary or secondary jetting? I constantly see people swapping around secondary rods, trying to get the best performance out of their cars. The secondary rods are very easy to change, and since the secondaries are so BIG, the secondary metering has to be the most important, right?

Wrong.

Most Q-Jets are 750 cfm carbs. This is more airflow than most small block engines can ever handle. Yet, GM used Q-Jets on everything from Overhead Cam 6-cylinder Pontiacs and Buick V-6's, to 500 cube Caddys. How?

The secondary airvalve on the Q-Jet effectively makes the Q-Jet a variable-cfm carb. The spring windup of the airvalve combined with the bleed-off of the choke pulloff diaphragm allow the secondaries to open only as much as the engine can handle. Thus, if the engine can't handle all of the cfm, the secondaries simply don't open all the way.

The primary side, however, is used throughout the rpm range. It is always in use, and provides the metering for the majority of the power produced by the engine. Let's look at the scenario:

You're at the stoplight. You bring the rpm up slightly against the torque converter – 1500 rpm. You're on the primary side of the carb only, and this is what is producing all of your torque right now. The light changes, and you put the pedal to the metal. All of your torque at launch is being produced by the primaries only, as the secondaries don't see enough airflow to open. The rpm comes up quickly: 2000, 2500, and now the secondaries might be starting to crack. Almost all of the air is still passing through the *primaries*, and the secondaries are now starting to *compliment* it just a tad. 3000, 4000 rpm, and the secondaries might be half-way open. The primaries are *still* providing most of the airflow and metering. 5000, 5500 and you hit redline just as the secondaries hit about ¾ open. Second gear, your rpm drops, partially closing the secondaries back up, and you're back to sucking the majority of the air through the primaries once again.

So we see, the secondaries provide only a compliment to the primaries. The primaries provide the vast majority of the fuel metering, and primary jetting is absolutely the most critical to proper performance. You cannot compensate for poor primary jetting by re-jetting the secondaries. So we are going to concentrate on jetting the primary side for peak performance, and then we will set up the secondary side to provide a proper compliment to the correct primary jetting.

Tech Tip #3

How can you tell if an off-idle stumble is caused by a lean or a rich condition?

A carb running rich, as well as a carb running lean, can cause an off-idle stumble or hesitation upon acceleration. To narrow it down, tap the roll pin out of the accelerator pump lever by using a small pin punch or a small finish nail. I actually use a small, broken drill bit that's just the right size. Using a hammer, gently tap the roll pin in towards the choke air horn wall. Don't jam the pin right up against the wall: Leave just a little bit of a gap so you can get a screwdriver blade in between the wall and the pin to pry it back again. With the pin tapped out, remove the accelerator pump lever. I like to do this with the engine running so I won't have any trouble starting the engine without the accelerator pump. Now, rev the engine a little with the throttle. Notice if the engine seems quicker and more responsive, or if the hesitation & stumble is worse. If the engine actually feels more responsive with the accelerator pump disconnected, you have a rich condition. If the hesitation is worse than before, you have a lean condition. If there is no change whatsoever, you have a non-functional accelerator pump.

To verify a suspected lean condition after this test, simply hold your cupped hand lightly over the choke air horn area with the engine running at idle, restricting the air flow. If the idle speed and idle quality momentarily increases, you have a verified lean condition. You need to select a jet/rod combination that will give you a little more Cruise Metering Area. Make these changes in less than 10% increments using the Figures provided in this paper.

Tech Tip #4

How can you tell if your power piston spring is too stiff and not allowing the power piston to "seat" at idle?

If your engine does not produce enough manifold vacuum at idle and/or cruise (due to a lumpy cam or other engine parameters), it is possible that the power piston is not being pulled all the way down to its seated position due to the power piston spring being too stiff. The result is that the car will run very rich at idle, and the idle mixture screws will have little effect or response. Idle speed may also "float," with idle speed starting high and gradually decreasing until the engine stalls due to the engine getting "loaded up." There will typically be a puff of black smoke out the tailpipes when you "flick" the throttle.

To test for this, pop the top off the carb, remove the power piston/rod assembly, and remove the power piston spring from its bore. Re-install the rod/piston assembly without the spring and put the carb back together. The carb will now run in the full-lean condition all the time, and you can actually test drive it in this condition. You can also test for this condition very quickly (although you cannot actually drive the car) by inserting a long pin punch or a small long screwdriver down through the vent tube: Angle the pin punch slight forward, and you will hit the top of the power piston. You can now depress the power piston and/or verify if it is pulled down into its fully seated position. Be very careful when doing this so you do not jam the punch or screwdriver through your float. If this clears up the idle, improves idle mixture screw response, and eliminates the black smoke when you flick the throttle, you need to install a softer spring. Edelbrock has a complete power piston spring assortment available. You can also get many of the springs from GMPartsDirect using the GM part number shown in the carb listing chart.

Tech Tip #5
How can you tell how stiff the power piston spring needs to be, and how can you tell one spring from another?

If you have a few springs of various kinds laying around, it is not readily apparent which spring is stiffer than another. You can arrange them and order them from softest to stiffest as follows:

Using your carb, or a junk float bowl from another carb, as a testbed, remove the carb air horn (the "top" of the carb) and remove the power piston and its spring. Remove the primary metering rods from the piston. Now, drop a spring into the power piston bore and install the piston. Find a Phillips screwdriver, and place the handle of the screwdriver on top of the power piston with the shank of the screwdriver pointing straight up. Use a screwdriver that is light enough to NOT compress the power piston and its spring, but close. Now, drop flat washers onto the shank of the screwdriver and keep stacking them up until the piston compresses the spring and seats in the bore. Count the number of washers it took to compress the spring and label the spring as a "6-washer spring," for instance. Do the same with the other springs you want to test. You'll end up with a comparative rating of springs, like "4-washer," "6-washer," or "10-washer" springs. You now know exactly how to arrange them from softest to stiffest.

But which one should you use? You'll need a junk Q-Jet float bowl for this test, and you'll need to have your engine in running condition.

Using a stripped down, bare Q-Jet float bowl, you'll notice that there is a hole in the bottom of the bowl right underneath the power piston bore. This is the vacuum hole that applies manifold vacuum to the power piston. Hook up a long vacuum hose to a manifold vacuum source on your engine. Now, install a power piston spring from your arranged spring selection into the piston bore and install a power piston on top of the spring. Start your engine, and stick the end of the vacuum hose onto the hole in the bottom of the stripped down float bowl. With the engine at idle, the vacuum applied to the bowl should immediately pull the power piston down against the spring pressure and seat the power piston firmly in its bore. If the piston does not fully seat, you need a softer spring from your arranged spring selection. If you have an automatic, put the transmission in "drive." Make sure the power piston stays seated.

If you really want to do some testing, you can string the vacuum hose into the car, and with an assistant, drive the car around and observe under what conditions the power piston starts to unseat: While you drive, have the assistant stick the vacuum hose onto the bottom of the bowl, and observe what the piston does under various engine loads. Make sure you have a spring that's stiff enough to make the piston pop up when your engine is under load, yet soft enough to keep the piston fully seated at idle, at cruise and under light acceleration. This makes for some really fun testing, and the results will pay off in a precisely matched power valve spring for some outstanding throttle response.

Of course, if you buy the power piston spring assortment kit from Edelbrock, the springs will be identified and labeled as to their vacuum rating. Select and use a spring with a rating about 1.5" to 2" lower than the idle vacuum of the engine (in drive).

Tech Tip #6
The idle metering circuit on a Q-Jet is not an independent, stand-alone circuit. The idle mixture screws in the throttle plate receive their fuel through the main metering jets. Thus, a change in the main metering circuit (jets and/or rods) will affect the idle circuit, even though the Idle Fuel Restrictor Tube (IFR) orifice is smaller than the restriction in the main metering circuit. The idle mixture screws cannot meter more fuel than the IFR will allow, and although the main jet/rod restriction is much larger than the IFR, there is a pressure drop caused when the fuel passes through the jet/rod on its way to the IFR. If this pressure drop is excessive (main jet/primary rod combo too lean), you may find that your idle mixture screws are ineffective. If your idle surges, is rough & unstable, and adjusting the screws seems to make no difference (but you can kill the engine by turning them all the way in), chances are good that your cruise metering area is too lean and causing an excessive pressure drop in the idle fuel system – not letting the IFR and the mixture screws flow enough fuel at idle. You can verify this by running your mixture screws out to the point where additional turns have no effect on idle. Then cover the choke area of the carb with your hand. If idle speed & quality increases as you restrict the air flow, your jet/rod combination may be too lean or your power piston may be adjusted too deep in the jets (see below).

The idle mixture screws in the throttle plate receive their fuel through the main metering jets and through the IFR tubes. Although the jet/rod is not the most restrictive part of the system, the sizing has an effect on fuel flow to the IFR, thus altering available idle mixture range. Thus, a change in the main metering circuit (jets and/or rods) will affect the idle circuit. The idle mixture screws cannot meter more fuel than the IFR will allow with the pressure drop caused by the main jets/rods.

There are other issues, too, that may make the idle mixture screws ineffective, such as plugged IFR orifaces, warped airhorn causing poor sealing of the idle fuel circuit, and other issues as outlined in my paper, "Q-Jet Problems I have Seen." Be sure to read that article for a full range of other idle circuit issues.

Procedure

Here is my recommended sequence and procedure for doing a basic Q-Jet set-up:

1. Set the float level.

You'll be amazed how many people try tuning a Q-Jet without ever checking the float level. An incorrect float level can give you all kinds of symptoms and problems, so get this one set right off the bat. Also, many commercially rebuilt Q-Jets have brass floats. I do not recommend use of a brass float in a Q-Jet. Use the correct "NitroFill" float available from NAPA/Echlin. Part number for most pre-75 Q-Jets is 2-440. Part number for most 75-80 Q-Jets is 2-442. Very early Q-Jets have unique float numbers – be sure to check for correct application.

You have to pull the top of the carb off to set the float level. With the top removed, remove the big phenolic spacer that covers the area around the needle/seat. Hold the float hinge clip firmly seated and push down lightly on the float where it contacts the needle. Measure from the top of the float bowl to the top of the float at the rear edge of the float. Float level should be .375" for a street-driven car using a 1968 – 1974 carb; you can run it at .250" for racing. Early Q-Jets (1968-1972) can be successfully run on the street with the high float level, but you may see some fuel saturation of the air horn gasket with associated gas fumes. Later carbs (1975 and newer) do not run well in street applications with the high float level – run the 1975 + carbs at .420" on the float level. Adjust the float level by removing the float and bending its lever arm. Never raise the float level by forcing the float against the needle/seat to bend it – this will damage the needle.

2. Determine main jet size.

If you have a stock engine, always start with the stock jet size **for the carb number you are using** and work from there. If you have the typical street modifications like headers, good exhaust system and a free-flowing intake, you can start with a main jet size 2 sizes larger than stock.

Since we want to work on the primary side only, we don't want the secondaries interfering with the jetting process. Chevy Q-Jets have a secondary lockout lever on the passenger side of the carb right at the secondary throttle shaft. This lever is actuated by the choke linkage, and prevents the secondaries from opening when the engine is cold. I call this the "primary jet tuning lever." Use a piece of wire or string to engage the lever with the secondaries so that the secondaries cannot be opened.

You now need to find a short flat stretch of road to test drive the car. You need to be able to measure time-to-distance and/or speed-at-distance. I usually find a repeatable stretch of road about 300 feet long. This gets me through 1st gear and into 2nd. Make two or three runs on the car through this stretch and make note of time and speed to distance. Also note the seat-of-your-pants feel of the car (it's going to feel pretty slow with the secondaries locked out…).

I recommend making jet changes in less than 10% increments. Go to Figure 2 and determine your WOT metering area for your current jet size. This will be the metering area of the jet with the .026" rod. With this number, go to the Jet % Change Chart and find the closest metering area match in the left vertical Metering Area column (Use the "Area" column and not the Jet Size column. The Jet Size column can only be used on carbs that do not employ a metering rod, such as Holley and Weber.). Follow the row across until you get into the "green" zone and find the closest number to 10%, but not greater than 10%. Now go straight up until you get to the new metering area number. This is your target. Take this number and go back to Figure 2 and find the closest jet size that will produce this metering area with a .026" rod. This is the first jet size you want to try, and this will increase your fuel mixture by the percentage indicated in the chart.

Now, to keep your off-idle mixture unaltered, you also need to check your cruise metering area. Go to Figure 2 and find your old main jet & rod combination. Note the resulting metering area for this combination. Now, go to your new main jet size that you're going to be using and find the rod needed to produce the same cruise metering area you had before. Use this rod with the new jet.

By doing this, you are now changing only 1 parameter at a time: WOT mixture only. Idle, off-idle, and everything else is now unchanged, and you will be able to see the results from the mixture change at WOT only. With the secondaries still locked out, run the car 2 – 3 times down the same stretch and record results. If the numbers get better, you're going the right way with the main jet size. If the numbers are worse, you need to make changes to the lean side instead of rich. Repeat this operation until you determine the main jet size that produces the best numbers. On many stock cars, you may be surprised to learn that you end up with the stock jet size. You have now optimized main jets.

3. Determine main metering rod size.

NOTE: There are two different "series" of primary metering rods. Q-Jets up through 1974 (the "4MV" series carbs) use the early series rods. 1975 and later Q-Jets (the "M4M" series carbs) use the second series rods. Pre-'75 (up through '74) Q-Jets use metering rods that are approximately 2.47" long overall (total length from the metering tip to the extreme top of the rod). 1975 and newer Q-Jets use rods that are about 2.40" long. You cannot interchange the two different rod series. The late style rods are also available in the "M" series rods, designed for truck applications. These have fat, .036" diameter power tips on them, and should not be used unless you re-calculate the resultant WOT metering areas and account for this in your tuning. For example: A regular '76 Vette carb might have a 77/48 jet/rod combination with the correct .026" diameter power tip rods. This gives you a WOT metering area of 4.12 thousands of an inch. If you use a 48M rod in the same carb, you end up with a WOT metering area of only 3.63 thousands. This is the same as if you dropped the main jet size down to a size 73 with the standard-tipped rods. Keep these relationships in mind when playing with rods. Currently, there are no second-series .026" power tip primary rods available from any source – all second series rods are "M" series truck rods, including those sold by Edelbrock.

When switching main jets around in Section 2 above, you were also swapping out metering rods to keep the cruise metering area unchanged. You did this to make sure that your off-idle throttle response remained unchanged so that the throttle response off idle did not affect the tuning results from the main jet re-sizing. Now, with your new main jets, your cruise metering area is exactly the same as it was before, but that's not to say it's right.

There are several indicators of correct cruise metering area. First, check out Tech Tip #5 regarding the idle circuit. This is a good indication of a lean condition. But here's another good indicator of correct cruise metering area:

A Q-Jet, when set up with the correct metering rod for cruise & idle, will produce a slight hesitation upon acceleration if the accelerator pump is disconnected. Using a small pin punch or a finish nail, carefully knock out the roll pin securing the accelerator pump arm to the top of the carb. I do this with the engine running so I don't have any trouble starting the engine without the accelerator pump. With the pump disconnected and with the engine running in neutral, "flick" the throttle just a little. If the engine actually feels ***more*** responsive with the pump disconnected, your cruise metering area is too rich, and you need to install a fatter set of rods. If you get a severe stumble, or if the engine dies, you're on the lean side and need smaller rods. When the rods are correct for the jets in use, you will get a slight hesitation when the pump is disconnected.

Once you have set the rod size up like this, verifying both the idle as shown in Tech Tip #5 and using the disconnected accelerator pump, a road test is in order. If the car is a little "flat" on light acceleration, or if it has a slight "surge" at steady cruise, you need to richen up the metering area slightly. If it is smooth and responsive on light acceleration, and feels smooth at cruise, you have the rod size nailed down.

Again, use the charts to keep all changes limited to 10% at a time. This will prevent you from "over-shooting." Remember, with the main jet size determined, your rod sizing is affecting idle, off-idle, light acceleration, and cruise. In most cases, when there are problems with stumbles, poor idle, idle speed that starts out high and then degrades, and surging at cruise, the rods are too big and are causing a lean condition. On the other hand, if the rods are too small, causing a rich condition, the throttle will feel "lazy" or "slow" when you rev the engine, and you may get a puff of black smoke with a hesitation when you "flick" the throttle. Correct rods will produce crisp, clean and instant throttle response.

4. Determine secondary rod size.

You are now finally ready to unlock the secondaries. But before you start changing the rods, you want to get the secondary opening rate set up. This is determined by the spring windup.

It is a very common "speed trick" to loosen the secondary windup spring so that the secondaries will open very quickly. This is the single most common cause of a severe stumble or hesitation upon acceleration or transition into the secondaries.

The secondary spring windup is adjusted with a small, slotted-head screw on the passenger side of the carb, right at the top of the carb on the secondary side. The screw head points right out to the side. 90 degrees from this, on the bottom, there is an allen-head lock screw that keeps the slotted screw from turning. If you have trouble seeing it, place a mirror under the area until you spot it. With a small slotted screwdriver holding the adjustment screw, loosen the allen screw about ¼ turn. This will allow you to turn the slotted adjustment screw. Counting the turns, allow the slotted screw to slowly unwind until all spring tension is gone. You can use your mirror to see the spring disengage contact from the pin lever underneath the air horn. If the spring tension was lost after only ½ turn, the windup was too loose. Bring the spring into contact with the lever. Note when it *just barely* touches. From this point, wind the spring up between ¾ turn and 7/8 turn. This is a good starting point, and will prevent any bogs or hesitations due to premature secondary opening.

Now, you need to adjust the secondary rod hanger height. You've read all about the different letter numbers for the secondary hangers, and how a "Y" hanger will make your car faster than an "M" hanger or whatever. Fact is, you can bend and adjust any hanger to any hanger height you want, so it doesn't make a heck of a lot of difference what hanger you choose to use. Just get it set up right:

With the secondary airvalve held wide open and the secondary rods pulled all the way up, measure the distance from the top of the rear wall of the choke horn to the secondary rod hanger hole in the hanger. This distance should be 41/64". Bend the hanger to adjust – you have to adjust each of the two sides independently. You now have a "performance" rod hanger.

With this set, you can now play with secondary metering rods. A common speed trick mistake is to always install thinner (richer) secondary rods. Some engines and carbs will produce a secondary "lag" if the rods are too thin. On about half of the engines I work on, I obtain better performance by installing fatter "non-performance" rods. Again, a quick road test is the only way to set this up, so go back to your 300-foot stretch and make a few runs with rods both richer and leaner. Once you have found the rods producing the smoothest secondary transition and the best numbers, you can start unwinding the secondary airvalve spring. Relax the spring tension in 1/8 turn increments until the car stumbles on acceleration, then tighten up 1/8 turn again. You have now determined the quickest secondary opening rate that your engine can handle, and your secondary mixture is set.

Note that secondary metering rods come in three different tapers: long tip, short tip, and medium tip (see Figure 3). Most of the available after-market metering rods have the long tips, and these will produce a full-rich mixture upon the slightest opening of the secondaries. Many street engines will produce better performance by using the short tipped rods. A short tipped rod does not allow a full-rich mixture until the secondaries are opened quite a ways, keeping the mixture a little lean initially. This can produce smoother and crisper performance in many applications. Next time you see a junk Q-Jet laying around, make sure you yank the rods and jets out of it: many old truck carbs have some really good short-tipped secondary rods in them. Figure 3 lists all the secondary rod letter codes, part numbers, and measurements.

Quickie Performance Setup

Don't want to spend the time and hassle of a detailed fine-tune setup? Here is a procedure for a good, solid performance setup that will make almost any Q-Jet run very well on most street performance cars. This is the basic process I use on my "Tuning for Beer" technical seminar series:

First, check your carb number and find the stock jet/rod setup. Make note of the stock setup numbers. Pull the carb off the engine and set it on a workbench.

Remove the secondary rods and compare the stamping to the stock rods for the carb. If needed, get the right rods for the carb.

Pop the airhorn off the carb and pull the phenolic float bowl filler out of the bowl. If the carb has a brass aftermarket float, get the right float for it. NAPA sells excellent reproduction NitroFill floats for all model Q-Jets. Most early Q-Jets take part number 2-440. Most post-75 carbs take a 2-442, but check for the correct part for your specific carb number.

Push the power piston all the way down and note how far down it goes: An adjustable power piston (see section in this paper on this) should be set up so that about .020"-.030" of the inner brass sleeve is visible above the top inner lip of the plastic retaining collar. Do the adjustment per the section in this paper to obtain this setting. Then remove the power piston from the bowl. Check the number stamped into the rods and compare this to the correct stock jetting for the carb. Make sure you do not have "M" rods in a post-75 passenger car carb designed for "K" rods. Make sure the power piston spring is not damaged – compare it to a correct part number spring for the carb number if you can.

Check the float level. 4MV (early divorced choke) series carbs should be at .375" for street use, and M4M (later integral choke) carbs should be .420" for good performance. For track use, you can raise the early carbs to .250" and later carbs to about .300."

After adjusting it, pull the float out, making note of how the needle clip is attached to the float: Most are installed incorrectly. The needle clip should be hooked around the rounded rear edge of the float arm (side towards the float) – not through the hole in the float arm.

Remove the main metering jets and note their size compared to the stock setup. If your car has headers, a good aftermarket intake, true dual exhaust on a single-exhaust stock car, or other performance mods which have improved it's "breathing," install a pair of jets 2 sizes larger than the stock size for the carb number. If your carb came stock with #77 jets, keep the stock jets.

Count the number of turns that the idle mixture screws are adjusted *out* from lightly seated. Most 4MV carbs will run well with a base setting of about 4 turns out. Most M4M carbs will run well at about 6 turns out. Compare these recommended settings to the number of turns on your screws, and set both of your screws to the same number of turns out from lightly seated.

Remove the throttle plate ("base plate") from the float bowl. Open the throttle lever fully and observe the secondary throttle plate opening: When the secondary throttles are fully open, they should be open *just short of vertical*. Not vertical, and not past vertical. There is a tang on the primary throttle linkage, pointing straight back, which determines how far the secondary throttle opens. You can bend this slightly to obtain the just-short-of-vertical setting on the secondary throttle.

Put the throttle plate back onto the float bowl, and "stuff" all the float parts and power piston/rod parts back into the bowl. Flip the airhorn ("top of the carb") upside-down and observe the secondary airvalve spring on the passenger side of the carb. Loosen the allen-head lock screw on the bottom surface of the airhorn and rotate the slotted adjustment screw in the side of the airhorn until the spring loosens from the "tang" on the airhorn shaft. Rotate the adjustment screw until the spring just barely contacts the shaft tang, and then rotate it another ¾ turn. Lock down the lock screw.

Install the airhorn to the carb, and slap the carb back on the engine. This "baseline blueprint" setup will produce a very good level of performance on most street engines. Also, the carb teardown will have exposed any damaged/altered/missing parts in your carb – there are a lot of carbs with badly altered and damaged parts due to the age of these carbs now. Picking up a few parts carbs from swap meets and junkyards is a pretty good idea…

Start the engine and let it warm up. Adjust the idle mixture screws evenly to obtain best quality idle. If you have a little bit of an ear and a feel for the car, you don't need a vacuum gauge to do this: just listen and feel for what the engine wants. Run the screws as lean (inward) as possible for best idle quality. If you need to pass an emissions test, run the screws in (lean) to obtain a 50rpm idle speed drop after best idle quality is achieved. Set idle speed, and you're ready to go!

Parts

If you don't have a stash of used Q-Jets in your basement to rob jets and rods out of, you can get parts from Edelbrock. Your local parts store should be able to order them for you. Following is a partial listing of Edelbrock Q-Jet parts and part numbers:

Primary Metering Rods (pairs) for 1974 & earlier:

.035"	#1936	.039"	#1939	.043"	#1944
.037"	#1937	.041"	#1942	.045"	#1946

Primary Metering Rods (pairs) for 1975 & later (NOTE: These are "M"-series rods with .036" power tips!):

.048"	#1941	.052"	#1945
.050"	#1943	.054"	#1947

Secondary Metering Rods (pairs) for all years:

CC	#1950	CK	#1952	CL	#1954
CE	#1951	AY	#1953		

Primary Metering Jets (pairs) for all years:

.068"	#1968	.072"	#1972	.076"	#1976
.069"	#1969	.073"	#1973	.077"	#1977
.070"	#1970	.074"	#1974		
.071"	#1971	.075"	#1975		

You can also order a very few original GM parts from GMPartsDirect on the Internet. The following is a complete listing of the GM part numbers for all available Q-Jet jetting components. These parts are being discontinued quickly, so some parts may no longer be available. Any parts available from GMPartsDirect are also available from any GM dealer (if they want to order them for you). You can also get most of these parts from Carbs Unlimited, although they only offer the early primary metering rods:

Primary Metering Rods, '74 & earlier:
All GM rods have been discontinued

Primary Metering Rods, '75 and later:
There are no post-'75 passenger car (.026" power tip) available from GM at this time.

Secondary Rods:

Code	P/N	Dia of Tip	Tip Length (Short, Medium, Long)
AX	7033549	0.0400	S
BG	7034822	0.0400	M
AH	7033812	0.0530	M
AN	7034320	0.0700	S

Primary Metering Jets:
7031969
7031970
7031971
7031973
7031974
7031975
7031978

The last good aftermarket source for Q-Jet parts is from Carbs Unlimited. They carry a full line of jets and the rods for the early applications. They also carry parts such as choke pulloffs, inlet fittings, springs, and linkages. Go to their website to see a full line of parts.

Figure 1: Carb part number listing & stock jetting
(Green highlights show parts that are still available from GM)

Carb #	Application As of 9-26-07: Green highlight = GM parts still available	Main Jet	Main Rod	Spring	Sec. Rod	Jet Area (1 Jet, .001") Cruise	Jet Area (1 Jet, .001") WOT
7025200	Chev 65 396 AT EARLY	71	44	7029922	7031208	2.4387	3.4283
7025201	Chev 65 396 MT EARLY	71	41	7029922	7031208	2.6389	3.4283
7025220	Chev 65 396 AT LATE	71	44	7029922	7031208	2.4387	3.4283
7025221	Chev 65 396 MT LATE	71	44	7029922	7031208	2.4387	3.4283
7026200	Chev 66 396 AT	71	44	7029922	AX	2.4387	3.4283
7026201	Chev 66 396 MT	71	41	7029922	AX	2.6389	3.4283
7026202	Chev 66 327 AT EARLY	71	45	7029922	AK	2.3688	3.4283
7026203	Chev 66 327 MT	71	43	7029922	AK	2.5070	3.4283
7026204	Chev 66 427 AT	71	46	7029922	AX	2.2973	3.4283
7026205	Chev 66 427 MT	71	41	7029922	AX	2.6389	3.4283
7026210	Chev 66 327 AT LATE	71	45	7029922	AK	2.3688	3.4283
7026250	OLDS 66 400 & 455 STD wo/A.I.R	71	44	7029922	AU	2.4387	3.4283
7026254	OLDS 66 330 STD wo/A.I.R	71	44	7029922	AT	2.4387	3.4283
7026256	OLDS 66 400 & 455 Jetaway wo/A.I.R	71	44	7029922	AU	2.4387	3.4283
7026255	OLDS 66 330 Jetaway wo/A.I.R	71	44	7029922	AT	2.4387	3.4283
7027200	Chev 67 396/427 AT W/O A.I.R.	71	44	7029922	AX	2.4387	3.4283
7027201	Chev 67 396/427 MT W/O A.I.R.	71	41	7029922	AX	2.6389	3.4283
7027210	Chev 67 396/427 AT	71	44	7029922	AX	2.4387	3.4283
7027211	Chev 67 396/427 MT	71	41	7029922	AX	2.6389	3.4283
7027216	CHEV 67 396/427 W/O A.I.R.	71	44	7029922	AX	2.4387	3.4283
7027218	CHEV 67 327/350 W/O A.I.R.	71	45	7029922	AX	2.3688	3.4283
7027262	Pont 67 400 AT & MT GTO	70	41	7002071	BF	2.5282	3.3175
7027263	Pont 67 400 MT w/o A.I.R.	70	39	7002071	BF	2.6539	3.3175
7028207	Chev 68 327/350 MT VETTE	71	46	7036019	AN	2.2973	3.4283
7028208	Chev 68 327/350 AT VETTE	71	46	7036019	AN	2.2973	3.4283
7028209	Chev 68 427 HIGH PERF MT VETTE	71	45	7036019	AX	2.3688	3.4283
7028210	CHEV 68 396 & 427 STD AUTO	71	49	7036019	AX	2.0735	3.4283
7028211	CHEV 68 396 & 427 STD MANUAL	71	45	7036019	AX	2.3688	3.4283
7028212	Chev 68 327/350 AT	71	46	7036019	AN	2.2973	3.4283
7028213	Chev 68 327/350 FULL-SIZE & TRUCK MT	71	46	7036019	AN	2.2973	3.4283
7028216	Chev 68 427 HIGH PERF AT VETTE	71	47	7036019	AX	2.2242	3.4283
7028217	Chev 68 396 HI PERF MT VETTE & TRUCK	71	45	7036019	AX	2.3688	3.4283
7028218	Chev 68 396 HIGH PERF AT VETTE	71	47	7036019	AX	2.2242	3.4283
7028219	Chev 68 HIGH PERF MT VETTE	66	36	7036019	BG	2.4033	2.8903
7028229	Chev 68 HIGH PERF MT CHEVY II	66	36	7036019	BG	2.4033	2.8903
7028240	Buik 68 430 AT	70	44	7011957	AY	2.3279	3.3175
7028262	Pont 68 400 STD AT	73	43	7037305	BE	2.7332	3.6545
7028263	Pont 68 400 MT GTO	72	40	7037305	BE	2.8149	3.5406
7028267	Pont 68 400 H.O. MT GTO	72	41	7037305	BE	2.7512	3.5406
7028268	Pont 68 400 & 400 H.O. AT GTO	73	42	7037305	BE	2.7999	3.6545
7028268	Pont 68 GTO Best Tuned Condition	71	42	7037305	DA	2.5737	3.4283
7028270	Pont 68 400 RAM AIR AT after Jan 68	72	41	7037305	BE	2.7512	3.5406
7028270	Pont 69 400 AT RAM AIR III	72	41	7037305	BE	2.7512	3.5406
7028273	Pont 68 400 RAM AIR MT after Jan 68	72	42	7037305	BE	2.6861	3.5406
7028273	Pont 69 400 MT RAM AIR III	72	42	7037305	BE	2.6861	3.5406
7028274	Pont 68 400 AT EARLY RAM AIR	73	41	7037305	BE	2.8651	3.6545
7028275	Pont 68 400 MT EARLY RAM AIR	72	40	7037305	BE	2.8149	3.5406
7029200	CHEV 69 CAMARO, VETTE 396/427 AUTO	71	49	7036019	BC	2.0735	3.4283
7029201	CHEV 69 CAMARO, VETTE 396/427 MAN	71	45	7036019	BC	2.3688	3.4283
7029202	Chev 69 350 300HP AT VETTE	67	42	7036019	AN	2.1402	2.9947

7029203	Chev 69 350 300HP MT VETTE	67	38	7036019	AN	2.3915	2.9947
7029204	CHEV 69 CAMARO, VETTE 396/427 AUTO	71	47	7036019	AX	2.2242	3.4283
7029207	Chev 69 350 325HP VETTE	66	36	7036019	BG	2.4033	2.8903
7029214	CHEV 69 396 TRUCK	71	45	7037851	BC	2.3688	3.4283
7029215	Chev 69 396/427 MT	71	45	7036019	AX	2.3688	3.4283
7029223	CHEV 69 350 TRUCK M/T	67	38	7037851	AN	2.3915	2.9947
7029224	CHEV 69 350 TRUCK A/T	67	38	7037851	AN	2.3915	2.9947
7029230	CAD 69 472 STD W/O A/C	70	44	7037298	BH	2.3279	3.3175
7029231	CAD 69 472 STD A/C	70	44	7037298	BH	2.3279	3.3175
7029232	CAD 69 472 EL DORADO W/O A/C	70	42	7037298	BH	2.4630	3.3175
7029233	CAD 69 472 EL DORADO A/C	70	42	7037298	BH	2.4630	3.3175
7029263	Pont 69 400 MT GTO	71	44	7037305	BE	2.4387	3.4283
7029268	Pont 69 400 AT GTO	71	44	7037305	BE	2.4387	3.4283
7029270	Pont 69 400 AT RAM AIR IV	69	38	7037305	BP	2.6052	3.2084
7029273	Pont 69 400 MT RAM AIR IV	69	37	7037305	BP	2.6641	3.2084
7036250	OLDS 66 400 & 455 STD w/A.I.R	71	44	7029922	AU	2.4387	3.4283
7036254	OLDS 66 330 STD w/A.I.R	71	44	7029922	AT	2.4387	3.4283
7037200	Chev 67 396/427 AT A.I.R.	71	46	7029922	AX	2.2973	3.4283
7037201	Chev 67 396/427 MT A.I.R.	71	41	7029922	AX	2.6389	3.4283
7037210	CHEV 67 396/427 aT A.I.R. LATE	71	46	7029922	AX	2.2973	3.4283
7037211	CHEV 67 396/427 MT A.I.R. LATE	71	41	7029922	AX	2.6389	3.4283
7037213	Chev 67 327 & 350 2nd type MT w/o A.I.R.	71	43	7029922	AN	2.5070	3.4283
7037216	CHEV 67 396/427 A.I.R.	71	46	7029922	AX	2.2973	3.4283
7037218	CHEV 67 327/350 A.I.R.	71	45	7029922	AX	2.3688	3.4283
7037262	Pont 67 400 AT w/A.I.R. GTO	70	40	7002071	BF	2.5918	3.3175
7037263	Pont 67 400 MT w/A.I.R. GTO	70	38	7002071	BF	2.7143	3.3175
7037271	Pont 67 400 RAM AIR after 6 Feb 67	70	38	7002071	BF	2.7143	3.3175
7040200	CHEV 70 CHVL, VETTE BB AUTO	78	49	7036019	BG	2.8926	4.2474
7040201	CHEV 70 CHVL, VETTE BB 4-SPD	78	48	7036019	BG	2.9688	4.2474
7040202	CHEV 70 CHEVELLE, CAMARO 350 AUTO	76	44	7036019	BA	3.0159	4.0055
7040203	CHEV 70 CHEVELLE, CAMARO 350 4-SPD	76	44	7036019	BA	3.0159	4.0055
7040204	CHEV 70 CHVL, VETTE BB AUTO	78	49	7036019	AX	2.8926	4.2474
7040205	CHEV 70 CHVL, VETTE BB 4-SPD	78	49	7036019	AX	2.8926	4.2474
7040206	CHEV 70 TRUCK 396 FED	75	42	7036019	BG	3.0324	3.8869
7040207	CHEV 70 350 FEDERAL VETTE M/T	76	44	7036019	BA	3.0159	4.0055
7040208	CHEV 70 TRUCK 350 FED	75	39	7036019	BA	3.2233	3.8869
7040213	CHEV 70 VETTE 350 4-SPD	76	44	7036019	BA	3.0159	4.0055
7040221	CHEV 70 CHVL, VETTE BB 4-SPD	78	48	7036019	BG	2.9688	4.2474
7040251	OLDS 70 455	70	49	7037734	AU	1.9627	3.3175
7040253	OLDS 70 CUTLASS & 442 455	69	7040699	7037734	AU	##########	3.2084
7040263	Pont 70 400 MT FEDERAL GTO	71	44	7037305	CC	2.4387	3.4283
7040264	Pont 70 400 AT FEDERAL GTO	70	41	7037305	BP	2.5282	3.3175
7040267	Pont 70 455 MT FEDERAL GTO	71	42	7037305	CC	2.5737	3.4283
7040268	Pont 70 455 AT FEDERAL GTO	71	42	7037305	CC	2.5737	3.4283
7040270	Pont 70 400 & 455 RAM AIR AT GTO	70	39	7037305	CC	2.6539	3.3175
7040273	Pont 70 400 & 455 RAM AIR MT GTO	70	39	7037305	CC	2.6539	3.3175
7040500	CHEV 70 CHVL, VETTE BB AUTO CALIF	78	49	7036019	BG	2.8926	4.2474
7040501	CHEV 70 CHVL, VETTE BB 4-SPD CALIF	78	48	7036019	BG	2.9688	4.2474
7040502	CHEV 70 CHVL, CAM 350 AUTO CALIF	76	44	7036019	BA	3.0159	4.0055
7040503	CHEV 69 350 300hp CAMARO Best Tuned	74	43	7036019	AK	2.8486	3.7699
7040503	CHEV 70 CHVL, CAM 350 4-SPD CALIF	76	44	7036019	BA	3.0159	4.0055
7040504	CHEV 70 CHVL, VETTE BB AUTO CALIF	78	49	7036019	BG	2.8926	4.2474
7040505	CHEV 70 CHVL, VETTE BB 4-SPD CALIF	78	49	7036019	BG	2.8926	4.2474
7040507	CHEV 70 VETTE 350 4-SPD CALIF	76	44	7036019	BA	3.0159	4.0055
7040509	CHEV 70 TRUCK 396 CALIF	78	49	7036019	BG	2.8926	4.2474
7040511	CHEV 70 TRUCK 350 CALIF	76	44	7036019	BA	3.0159	4.0055
7040513	CHEV 70 VETTE 350 4-SPD CALIF	76	44	7036019	BA	3.0159	4.0055
7040521	CHEV 70 CHVL, VETTE BB 4-SPD CALIF	78	48	7036019	BG	2.9688	4.2474
7040563	Pont 70 400 MT CALIFORNIA GTO	68	36	7037305	BU	2.6138	3.1008

7040564	Pont 70 400 AT CALIFORNIA GTO	68	38	7029922	BU	2.4976	3.1008
7040567	Pont 70 455 MT CALIFORNIA GTO	70	40	7029922	BU	2.5918	3.3175
7040568	Pont 70 455 AT CALIFORNIA GTO	69	37	7029922	BU	2.6641	3.2084
7040570	Pont 70 400 & 455 RAM AIR CALIF.	67	33	7037305	CC	2.6704	2.9947
7040573	Pont 70 400 & 455 RAM AIR MT CALIF.	67	33	7037305	CC	2.6704	2.9947
7041200	CHEV 71 CHEVELLE 402/454 AUTO	77	49	7036019	BG	2.7709	4.1257
7041201	CHEV 71 CHEVELLE 402/454 MAN	77	49	7036019	BG	2.7709	4.1257
7041202	CHEV 71 CHEVELLE 350 AUTO	74	44	7036019	AR	2.7803	3.7699
7041203	CHEV 71 CHEVELLE 350 MAN	74	44	7036019	AR	2.7803	3.7699
7041204	Chev 71 454 AT VETTE	77	49	7036019	BG	2.7709	4.1257
7041205	Chev 71 454 MT VETTE	77	49	7036019	BG	2.7709	4.1257
7041206	CHEV 71 402 SERIES 20 & 30 TRUCK	74	42	7036019	BG	2.9154	3.7699
7041208	CHEV 71 350 SERIES 20 & 30 TRUCK	74	39	7036019	BA	3.1062	3.7699
7041209	CHEV 71 402 SERIES 10 TRUCK	77	49	7036019	BG	2.7709	4.1257
7041211	CHEV 71 350 SERIES 10 TRUCK	74	42	7036019	BA	2.9154	3.7699
7041212	CHEV 71 Vette 350 A/T	74	44	7036019	AR	2.7803	3.7699
7041213	CHEV 71 Vette 350 M/T	74	44	7036019	AR	2.7803	3.7699
7041230	CAD 71 472 & 500 STD	71	47	7036019	CE	2.2242	3.4283
7041231	CAD 71 472 & 500 LIMO	71	47	7036019	CE	2.2242	3.4283
7041232	CAD 71 472 & 500 EL DORADO	67	39	7036019	CF	2.3311	2.9947
7041262	Pont 71 455 AT GTO	71	43	7037305	BU	2.5070	3.4283
7041263	Pont 71 400 MT GTO	75	47	7037305	BU	2.6829	3.8869
7041264	Pont 71 400 AT GTO	71	46	7037305	BP	2.2973	3.4283
7041267	Pont 71 455 H.O. MT GTO	73	38	7037305	BP	3.0513	3.6545
7041268	Pont 71 455 H.O. AT GTO	74	43	7037305	BP	2.8486	3.7699
7041270	Pont 71 455 AT RAM AIR	74	43	7037305	BP	2.8486	3.7699
7041273	Pont 71 455 MT RAM AIR	73	38	7037305	BP	3.0513	3.6545
7041273	Pont 71 455 H.O. Best Tuned Condition	72	38	7037305	BP	2.9374	3.5406
7042202	CHEV 72 350 CHVL & VETTE FED A/T	74	45	7036019	DA	2.7104	3.7699
7042203	CHEV 72 Vette Fed M/T 350	74	45	7036019	DA	2.7104	3.7699
7042206	CHEV 72 402 TRUCK SERIES 20 & 30 A/T	72	43	7036019	DA	2.6193	3.5406
7042207	CHEV 72 402 TRUCK SERIES 20 & 30 M/T	72	43	7036019	DA	2.6193	3.5406
7042208	CHEV 72 350 TRUCK SERIES 10 FED A/T	71	36	7036019	CP	2.9413	3.4283
7042210	CHEV 72 350 TRUCK G-10 FED ALL	74	43	7036019	DA	2.8486	3.7699
7042211	CHEV 72 350 TRUCK SERIES 10 FED M/T	74	43	7036019	DA	2.8486	3.7699
7042215	CHEV 72 CHEVELLE MAN	77	45	7036019	CM	3.0662	4.1257
7042216	CHEV 72 Vette A/T 454	77	49	7036019	CM	2.7709	4.1257
7042217	CHEV 72 Vette M/T 454	77	45	7036019	CM	3.0662	4.1257
7042218	CHEV 72 402 TRUCK SERIES 10 A/T	77	45	7036019	CM	3.0662	4.1257
7042219	CHEV 72 402 TRUCK SERIES 10 M/T	77	45	7036019	CM	3.0662	4.1257
7042220	CHEV 72 CHEVELLE AUTO	77	49	7036019	CM	2.7709	4.1257
7042238	cad 72 LIMO 472 & 500 CI	69	43	7029529	BC	2.2871	3.2084
7042262	Pont 71 455 AT CALIFORNIA	72	43	7037305	CR	2.6193	3.5406
7042263	Pont 72 400 MT GTO	72	45	7037305	CS	2.4811	3.5406
7042264	Pont 72 400 AT CALIFORNIA	74	47	7037305	CR	2.5659	3.7699
7042270	Pont 72 455 H.O. AT	71	45	7037305	CR	2.3688	3.4283
7042272	Pont 72 455 AT GTO	72	43	7029922	CR	2.6193	3.5406
7042273	Pont 72 455 H.O. MT	71	43	7037305	CR	2.5070	3.4283
7042273	Pont 73 455 S.D. MT Early	71	43	7037305	CR	2.5070	3.4283
7042274	Pont 72 400 AT FEDERAL	74	47	7029922	CS	2.5659	3.7699
7042276	Pont 72 455 AT HI ALTITUDE	71	43	7037851	CR	2.5070	3.4283
7042278	Pont 72 400 AT HI ALTITUDE	72	46	7037851	CS	2.4096	3.5406
7042902	CHEV 72 Vette Fed A/T 350	74	45	7036019	DA	2.7104	3.7699
7042903	CHEV 72 Vette Calif. M/T 350	74	45	7036019	DA	2.7104	3.7699
7042910	CHEV 72 350 TRUCK SERIES 10 CA A/T	74	43	7036019	DA	2.8486	3.7699
7042911	CHEV 72 350 TRUCK SERIES 10 CA M/T	74	43	7036019	DA	2.8486	3.7699
7043200	CHEV 73 454 all A/T & Truck	77	50	7036019	DA	2.6931	4.1257
7043201	CHEV 73 454 all M/T & Truck	77	48	7036019	DA	2.8471	4.1257
7043202	CHEV 73 350 all Auto & Truck	73	44	7036019	DA	2.6649	3.6545

7043203	CHEV 73 350 all M/T & Truck	73	44	7036019	DA	2.6649	3.6545
7043207	CHEV 73 454 TRUCK FED C20, 30 & P-30	69	39	7036019	DA	2.5447	3.2084
7043208	CHEV 73 350 TRUCK ALL C, P, K 20 & 30	68	36	7037305	DA	2.6138	3.1008
7043210	CHEV 73 350 TRUCK A/T G SERIES 10	73	42	7036019	DA	2.7999	3.6545
7043211	CHEV 73 350 TRUCK M/T G SERIES 10	73	42	7036019	DA	2.7999	3.6545
7043212	CHEV 73 Vette Hi Perf. Auto	74	44	7036019	DA	2.7803	3.7699
7043213	CHEV 73 Vette Hi Perf. M/T	74	44	7036019	DA	2.7803	3.7699
7043215	CHEV 73 350 G&P SERIES 30 MOTORHOME	72	39	7037305	DA	2.8769	3.5406
7043216	CHEV 73 454 P-30 SUBURBAN FED & CAL	77	48	7036019	DA	2.8471	4.1257
7043250	OLDS 73-74 350 CUTLASS A/T	69	7047907	7040498	AS/CG	##########	3.2084
7043262	Pont 73 455 AT	71	41	7029529	CR	2.6389	3.4283
7043263	Pont 73 400 MT	71	43	7037851	CS	2.5070	3.4283
7043264	Pont 73 400 AT	72	43	7029529	DB	2.6193	3.5406
7043265	Pont 73 455 Firebird M/T	71	44	7029922	CR	2.4387	3.4283
7043266	Pont 73 400 LATE AT	72	45	7029529	DB	2.4811	3.5406
7043270	Pont 73 455 S.D. AT	76	51	7029529	BV	2.4936	4.0055
7043272	Pont 73 455 AT HI ALTITUDE	70	41	7029529	CR	2.5282	3.3175
7043273	Pont 73 455 SD MT	75	49	7029529	BV	2.5321	3.8869
7043274	Pont 73 400 AT HI ALTITUDE	72	45	7037851	DB	2.4811	3.5406
7043507	CHEV 73 454 TRUCK CAL C20, 30 & P-30	70	34	7036019	DA	2.9405	3.3175
7044201	CHEV 74 454 CHVL ALL M/T	75	39	7036019	DH	3.2233	3.8869
7044202	CHEV 74 CHEVELLE 350 AUTO & TRUCK	75	46	7029529	CH	2.7560	3.8869
7044203	CHEV 74 CHEVELLE 350 MAN & TRUCK	75	46	7029529	CH	2.7560	3.8869
7044206	CHEV 74 Vette & Nova Fed A/T	75	46	7029529	CH	2.7560	3.8869
7044207	CHEV 74 Vette & Nova Fed M/T	75	46	7029529	CH	2.7560	3.8869
7044208	CHEV 74 350 Camaro Hi Perf. A/T	75	43	7036019	DA	2.9657	3.8869
7044209	CHEV 74 350 Camaro Hi Perf. M/T	75	43	7036019	DA	2.9657	3.8869
7044210	CHEV 74 Vette 350 Hi Perf. A/T	75	43	7036019	DA	2.9657	3.8869
7044211	CHEV 74 Vette 350 Hi Perf. M/T	75	43	7036019	DA	2.9657	3.8869
7044212	CHEV 74 454 TRUCK C20, 30, P30 MTRHM	69	34	7037298	DH	2.8314	3.2084
7044213	CHEV 74 350 TRUCK CK20 & C30	68	36	7037305	CP	2.6138	3.1008
7044214	CHEV 74 350 TRUCK G30 VAN FED	72	39	7037305	CP	2.8769	3.5406
7044215	CHEV 74 350 TRUCK P30 MOTORHOME FED	72	39	7037305	CP	2.8769	3.5406
7044216	CHEV 74 350 TRUCK P20, 30 FED	68	36	7037305	CP	2.6138	3.1008
7044217	CHEV 74 454 TRUCK C30 EXC MTRHM A/T	69	34	7037298	DH	2.8314	3.2084
7044218	CHEV 74 350 VAN & VANDURA FED A/T	75	46	7029529	CH	2.7560	3.8869
7044219	CHEV 74 350 TRUCK ALL FED M/T	75	43	7036019	CH	2.9657	3.8869
7044221	CHEV 74 454 VETTE ALL M/T	75	39	7036019	DH	3.2233	3.8869
7044223	CHEV 74 454 MONTE, VETTE & TRUCK FED A/T	75	41	7036019	DH	3.0976	3.8869
7044224	CHEV 74 350 SPORTVAN, RALLY FED A/T	75	43	7029529	CH	2.9657	3.8869
7044225	CHEV 74 454 VETTE FED A/T	75	41	7036019	DH	3.0976	3.8869
7044226	CHEV 74 WAGON 400 AUTO	73	44	7029529	DL	2.6649	3.6545
7044227	CHEV 74 454 SUBURBAN A/T FED	74	37	7036019	DH	3.2256	3.7699
7044262	Pont 74 Firebird 455 Fed A/T	71	41	7029529	CR	2.6389	3.4283
7044266	Pont 74 ALL AT	72	45	7029529	DB	2.4811	3.5406
7044268	Pont 74 350 AT	72	43	7029529	DB	2.6193	3.5406
7044269	Pont 74 350 MT	68	35	7037851	DB	2.6696	3.1008
7044274	Pont 74 ALL HI ALTITUDE	72	45	7037851	DB	2.4811	3.5406
7044500	CHEV 74 454 MONTE, VETTE & TRUCK CA A/T	75	41	7036019	DH	3.0976	3.8869
7044502	CHEV 74 CHEVELLE 350 A/T CA & TRUCK	75	46	7037851	CH	2.7560	3.8869
7044503	CHEV 74 CHEVELLE 350 M/T CA & TRUCK	75	46	7037851	CH	2.7560	3.8869
7044505	CHEV 74 454 VETTE CA A/T	75	41	7036019	DH	3.0976	3.8869
7044506	CHEV 74 Vette & Nova Calif. A/T	75	46	7037851	CH	2.7560	3.8869
7044507	CHEV 74 Vette & Nova Calif. M/T	75	46	7037851	CH	2.7560	3.8869
7044513	CHEV 74 350 TRUCK CK20 & C30 CALIF	68	36	7037305	CP	2.6138	3.1008
7044512	CHEV 74 454 TRUCK 20, 30, MTRHM CA	69	34	7037298	DH	2.8314	3.2084
7044514	CHEV 74 350 TRUCK G30 VAN CALIF	72	39	7037305	CP	2.8769	3.5406

7044515	CHEV 74 350 TRUCK P30 MOTORHOME CA	72	39	7037305	CP	2.8769	3.5406
7044516	CHEV 74 350 TRUCK P20, 30 CALIF	68	36	7037305	CP	2.6138	3.1008
7044517	CHEV 74 454 TRUCK P30 EXC MTRHM CA	69	34	7037298	DH	2.8314	3.2084
7044527	CHEV 74 400 C20 SUBURBAN ALL TRANS	72	40	7037851	DL	2.8149	3.5406
7044518	CHEV 74 350 MOTORHOME CALIF A/T	75	42	7037851	CH	3.0324	3.8869
7044519	CHEV 74 350 TRUCK ALL CALIF M/T	75	42	7037851	CH	3.0324	3.8869
7044520	CHEV 74 454 SUBURBAN A/T CALIF	75	42	7037851	DH	3.0324	3.8869
7044526	CHEV 74 400 CHVL CA	73	42	7037851	DL	2.7999	3.6545
7044568	PONT 74 350 AT CALIFORNIA	72	43	7029529	DB	2.6193	3.5406
7045183	OLDS 75 350 CUTLASS A/T A/C FED	67	41	7040498	CV	2.2054	2.9947
7045200	Chev 75 454 AT Chevelle/Monte	76	43	7041477	CJ	3.0843	4.0055
7045202	CHEV 75 CAMARO & BLAZER 350 FED A/T	72	46	17052057	CH	2.4096	3.5406
7045203	CHEV 75 CAMARO & BLAZER 350 FED M/T	72	46	17052057	CH	2.4096	3.5406
7045206	CHEV 75 350 NOVA FED A/T	72	46	17052057	CH	2.4096	3.5406
7045207	CHEV 75 350 NOVA FED M/T	72	46	17052057	CH	2.4096	3.5406
7045210	Chev 75 FEDERAL AT HIGH PERF VETTE	72	44	17052057	CH	2.5510	3.5406
7045211	Chev 75 FEDERAL MT HIGH PERF VETTE	72	44	17052057	CH	2.5510	3.5406
7045212	CHEV 454 C10, 20, 30 P30 MTRHM FED	68	33	7037298	DH	2.7764	3.1008
7045213	CHEV & GMC Truck 75-76 Non-CA, HD	68	32	7029862	CP	2.8274	3.1008
7045214	CHEV 350 TRUCK G20, 30 FED	71	39	7037305	CP	2.7646	3.4283
7045215	CHEV 350 P30 MOTORHOME FED	71	39	7037305	CP	2.7646	3.4283
7045216	CHEV & GMC Truck, 75-76 Reg Chassis	68	32	7029862	CP	2.8274	3.1008
7045217	CHEV 454 P30 REG CHASSIS FED	68	33	7037298	DH	2.7764	3.1008
7045218	CHEV 75 350 G-10 VAN A/T	71	44	7041459	CH	2.4387	3.4283
7045219	CHEV 75 350 G-10 VAN M/T	71	44	7041459	CH	2.4387	3.4283
7045220	CHEV 454 TRUCK C-10 FED	70	38	7041477	CJ	2.7143	3.3175
7045221	CHEV 75 454 CHVL & MONTE CNDA A/T	70	38	7041477	CJ	2.7143	3.3175
7045222	Chev 75 AT ALL VETTE	72	46	17052057	CH	2.4096	3.5406
7045223	Chev 75 FEDERAL MT VETTE	72	46	17052057	CH	2.4096	3.5406
7045224	Chev 75 CHVL, MONTE 400 CA A/T	71	46	7037851	DL	2.2973	3.4283
7045225	CHEV 75-76 400 TRUCK G20, 30 FED	71	36	7037305	DL	2.9413	3.4283
7045228	Chev 75 400 FEDERAL AT Chevelle/Monte	71	47	17052057	DL	2.2242	3.4283
7045229	Chev 75 400 MT Truck K-10, 20 FED	69	36	7029862	DL	2.7214	3.2084
7045294	CHEV 75 350 CHVL & MONTE CNDA A/T	72	46	17052057	CH	2.4096	3.5406
7045502	CHEV 75 CAMARO 350 CA A/T	72	46	17052057	CH	2.4096	3.5406
7045503	CHEV 75 CAMARO 350 CA M/T	72	46	17052057	CH	2.4096	3.5406
7045504	Chev 75 350 AT CALIFORNIA	72	46	7037851	CH	2.4096	3.5406
7045506	CHEV 75 350 NOVA CA A/T	72	46	17052057	CH	2.4096	3.5406
7045507	CHEV 75 350 NOVA CA M/T	72	46	17052057	CH	2.4096	3.5406
7045512	CHEV 454 C10, 20, 30, P30 MTRHM CA	67	30	7036019	CJ	2.8188	2.9947
7045512	CHEV 454 P30 EXC MTRHM CA	67	30	7036019	CJ	2.8188	2.9947
7045583	CHEV & GMC Truck, 75-77 Calif.	73	42	7029862	CP	2.7999	3.6545
7045584	CHEV 350 TRUCK G20, 30 CALIF	72	40	7037305	CP	2.8149	3.5406
7045585	CHEV 350 P30 MOTORHOME CALIF	72	40	7037305	CP	2.8149	3.5406
7045586	CHEV & GMC Truck, 75-77 Reg Chassis CA	73	42	7029862	CP	2.7999	3.6545
7045588	CHEV 75-76 400 TRUCK G20, 30 CALIF	73	38	7037305	DL	3.0513	3.6545
7045589	CHEV 75-76 400 TRUCK K10, 20 CALIF	73	33	7037305	DL	3.3301	3.6545
17054919	CHEV SERV REPL 73 VETTE, NOVA, CAM	74	44	7036019	DA	2.7803	3.7699
17054920	CHEV SERV REPL 74 350 VETTE, CAM, CHVL	75	46	7029529	CH	2.7560	3.8869
17054923	GMC SERV REPL 71 350 ALL	74	39	7036019	BA	3.1062	3.7699
17054927	CHEV 72 350 Srv Repl Vette, Camaro, GMC	74	43	7036019	DA	2.8486	3.7699
17054928	CHEV 73 350 TRUCK ALL TRANS	73	42	7029862	DA	2.7999	3.6545
17054929	CHEV 74 350-400 CHVL, VETTE, MONTE	73	42	7037851	CH	2.7999	3.6545
17055038	CHEV 75 Serv Repl Truck, Vette, Nova	72	46	17052057	CH	2.4096	3.5406
17056200	CHEV 76 454 FULL SIZE A/T	79	46	7041477	DR	3.2398	4.3707
17056202	CHEV 76 350 CAMARO FED A/T	77	48	17052057	CH	2.8471	4.1257
17056203	CHEV 76 350 CAMARO FED M/T	77	48	17052057	CH	2.8471	4.1257
17056206	CHEV 76 Vette & Nova A/T	77	48	17052057	CH	2.8471	4.1257

17056207	CHEV 76 Vette & Nova M/T	77	48	17052057	CH	2.8471	4.1257
17056208	CHEV 76 350 TRUCK C10 A/T FED	77	48	17052057	CH	2.8471	4.1257
17056209	CHEV 76 350 TRUCK C10 M/T FED	77	48	17052057	CH	2.8471	4.1257
17056210	Chev 76 FEDERAL AT VETTE HIGH PERF	77	51	17052057	CH	2.6138	4.1257
17056211	Chev 76 FEDERAL MT VETTE HIGH PERF	77	51	17052057	CH	2.6138	4.1257
17056218	CHEV 76 350 G10 VAN A/T FED	76	47	17052057	CH	2.8015	4.0055
17056219	CHEV 76 350 G10 VAN M/T FED	76	47	17052057	CH	2.8015	4.0055
17056221	CHEV 76 FED HD TRUCK 454 AUTO	77	45	7041477	DR	3.0662	4.1257
17056226	Chev 76 FEDERAL AT A/C VETTE HI PERF	77	51	17052057	CH	2.6138	4.1257
17056228	Chev 76 MONTE CARLO, CHVL 400 AT	77	48	17052057	DP	2.8471	4.1257
17056281	CHEV 76-77 CHVL, CAMARO CANADA	77	48	17052057	CH	2.8471	4.1257
17056282	CHEV 76 NOVA, VETTE CANADA	77	48	17052057	CH	2.8471	4.1257
17056283	CHEV 76 350 TRUCK C10 CANADA NO CAT	77	48	17052057	CH	2.8471	4.1257
17056284	CHEV 76 350 G10 VAN CANADA NO CAT	76	47	17052057	CH	2.8015	4.0055
17056286	CHEV 76 454 A/T CANADA	77	45	7041477	DR	3.0662	4.1257
17056502	CHEV 76 350 CAMARO CA A/T	77	48	17052057	CH	2.8471	4.1257
17056503	CHEV 76 350 CAMARO CA M/T	77	48	7037851	CH	2.8471	4.1257
17056506	CHEV 76 Vette & Nova A/T Calif	77	48	17052057	CH	2.8471	4.1257
17056507	CHEV 76 Vette & Nova M/T Calif	77	48	7037851	CH	2.8471	4.1257
17056508	CHEV 76 350 TRUCK C10 A/T CALIF	77	48	7037851	CH	2.8471	4.1257
17056509	CHEV 76 350 TRUCK C10 M/T CALIF	77	48	7037851	CH	2.8471	4.1257
17056512	CHEV 76 CALIF HD TRUCK 454 AT & MT	72	38	7036019	DR	2.9374	3.5406
17056517	CHEV 76 FED P-30 TRUCK 454 AUTO	72	38	7036019	DR	2.9374	3.5406
17056518	CHEV 76 350 G10 VAN A/T CALIF	76	47	7037851	CH	2.8015	4.0055
17056519	CHEV 76 350 G10 VAN M/T CALIF	76	47	7037851	CH	2.8015	4.0055
17057202	CHEV 77 CHVL, MONTE, VETTE 350 AUTO	77	52	7029529	CH	2.5329	4.1257
17057203	Chev 77 FEDERAL MT NON-A/C VETTE	77	52	7029529	CH	2.5329	4.1257
17057204	CHEV 77 CHVL, VETTE 350 AUTO A/C	77	52	7029529	CH	2.5329	4.1257
17057210	Chev 77 HIGH PERF NON-A/C VETTE	77	53	17052057	CH	2.4504	4.1257
17057211	Chev 77 HIGH PERF A/C & NON-A/C VETTE	77	53	17052057	CH	2.4504	4.1257
17057213	Chev 77 HD Truck 350 C-K-G-10-20-30 Fed	64	40	7036019	DP	1.9604	2.6861
17057215	Chev 77 HD P-30 Motor Home 350 Federal	64	40	7036019	DP	1.9604	2.6861
17057216	Chev 77 HD P-30 Conv Chassis 350 Fed	64	40	7036019	DP	1.9604	2.6861
17057222	Chev 77 G10 VAN FED A/C A/T	77	52	7029529	CH	2.5329	4.1257
17057234	CAD 77 LATE 425 ALL EXCEPT ELDO	72	52	7044432	DU	1.9478	3.5406
17057235	CAD 77 LATE 425 ELDO FEDERAL	70	48	7044432	DU	2.0389	3.3175
17057533	CAD 77 LATE 425 ELDO CALIF	70	39	7044432	DS	2.6539	3.3175
17057514	Chev 77 HD G-20-30 Van 350 Calif	73	39	7036019	CP	2.9908	3.6545
17057228	Chev 77 FEDERAL A/C VETTE	77	53	17052057	CH	2.4504	4.1257
17057502	CHEV 77 350 NON A/C AUTO CALIF	72	41	7036019	CH	2.7512	3.5406
17057504	CHEV 77 350 VETTE, NOVA AC AUTO CALIF	72	41	7036019	CH	2.7512	3.5406
17057582	CHEV 77 350 HI ALT NON A/C	72	41	7036019	CH	2.7512	3.5406
17057584	CHEV 77 MONTE CARLO, HI ALT. A/C	72	41	7036019	CH	2.7512	3.5406
17058202	CHEV 78 VETTE 350 FED NO A/C A/T	77	52	7029529	CH	2.5329	4.1257
17058203	CHEV 78 FED VETTE A/C & NON-A/C 4-SPD	77	52	7029529	CH	2.5329	4.1257
17058204	CHEV 78 VETTE 350 FED A/C A/T	77	52	7029529	CH	2.5329	4.1257
17058210	CHEV 78 FED VETTE NON A/C AUTO	77	53	17052057	CH	2.4504	4.1257
17058211	CHEV 78 FED VETTE H.P. A/C & NON 4-SPD	77	53	17052057	CH	2.4504	4.1257
17058213	CHEV 78 GMC HD Truck & '79 Canada HD	63	40	7036019	CP	1.8606	2.5863
17058228	CHEV 78 FED VETTE H.P. A/C AUTO	77	53	17052057	CH	2.4504	4.1257
17058229	CHEV 78 400-454 HD TRUCK FED A/T	64	39	7036019	DG	2.0224	2.6861
17058250	BUICK, OLDS 403 NON A/C FED	73	55	7044432	CV	1.8096	3.6545
17058253	BUICK, OLDS 403 A/C FED	73	55	7044432	CV	1.8096	3.6545
17058258	BUICK, OLDS 403 A/C HI ALT	70	50	17051705	CV	1.8850	3.3175
17058282	CHEV 78 CANADA Z-94 CAMARO NO AC	77	52	7029529	CH	2.5329	4.1257
17058284	CHEV 78 CANADA Z-94 CAMARO AC	77	52	7029529	CH	2.5329	4.1257
17058502	CHEV 78 VETTE 350 CA NO A/C A/T	71	41	7036019	CH	2.6389	3.4283
17058504	CHEV 78 VETTE 350 CA A/C A/T	71	41	7036019	CH	2.6389	3.4283

17058553	BUICK, OLDS, PONT 403 CALIF	74	52	17051705	CV	2.1771	3.7699
17058582	CHEV 78 VETTE 350 HI ALT. NO A/C A/T	71	41	7036019	CH	2.6389	3.4283
17058584	CHEV 78 VETTE 350 HI ALT. A/C A/T	71	41	7036019	CH	2.6389	3.4283
17059203	CHEV 79 FED VETTE A/C & NON 4-SPD	72	40	7036019	CH	2.8149	3.5406
17059205	CHEV 79 350 TRUCK, NON-A/C, AUTO	72	52	7036019	DP	1.9478	3.5406
17059207	CHEV 79 305 EL CAMINO M/T	72	40	7036019	CH	2.8149	3.5406
17059210	CHEV 79 VETTE L-82 H.P. NON-A/C AUTO	77	53	17052057	CH	2.4504	4.1257
17059211	CHEV 79 VETTE L-82 H.P. A/C & NON 4-SPD	77	53	17052057	CH	2.4504	4.1257
17059212	CHEV 79 454 TRUCK, ALL FED	72	52	7036019	DH	1.9478	3.5406
17059216	CHEV 79 305-350 CAMARO A/C	72	40	7036019	CH	2.8149	3.5406
17059217	CHEV 79 305-350 CAMARO NO A/C	72	40	7036019	CH	2.8149	3.5406
17059218	CHEV 79 305 MALIBU 2.29 AXLE NO AC	71	40	7036019	CH	2.7026	3.4283
17059222	CHEV 79 305 MALIBU 2.29 AXLE AC	71	40	7036019	CH	2.7026	3.4283
17059228	CHEV 79 VETTE L-82 H.P. A/C AUTO	77	53	17052057	CH	2.4504	4.1257
17059282	CHEV 79 CANADA Z-94 CAMARO NO A/C	77	51	7029529	CH	2.6138	4.1257
17059284	CHEV 79 CANADA Z-94 CAMARO A/C	77	51	7029529	CH	2.6138	4.1257
17059298	VOLVO PENTA, MARINE, 305	69	40		CJ	2.4826	3.2084
17059501	CHEV 79 454 C-20/25 TRUCK, MT	72	46	7036019	DP	2.4096	3.5406
17059504	79 SKYLARK, NOVA, CAMARO VETTE CA	72	40	7037305	CH	2.8149	3.5406
17059506	CHEV 79 350 TRUCK, NO A/C, AUTO, CALIF	73	51	7029529	DP	2.1426	3.6545
17059508	CHEV 79 350 TRUCK, A/C, AUTO, CALIF	73	51	7029529	DP	2.1426	3.6545
17059509	CHEV 79 350 TRUCK, NO AC, AUTO, HI ALT	72	50	7029529	DP	2.1080	3.5406
17059510	CHEV 79 350 TRUCK, A/C, AUTO, HI ALT	72	50	7029529	DP	2.1080	3.5406
17059512	CHEV 79 454 TRUCK, ALL CALIF	72	52	7036019	DH	1.9478	3.5406
17059520	CHEV 79 454 TRUCK, FED & CA, AC, AT	72	47	7036019	DP	2.3366	3.5406
17059521	CHEV 79 454 TRUCK, FED & CA, NO AC,AT	72	47	7036019	DP	2.3366	3.5406
17059582	CHEV 79 305 MALIBU NO A/C	71	41	7036019	CH	2.6389	3.4283
17059582	CHEV 79 VETTE 350 HI ALT. NO A/C	71	41	7036019	CH	2.6389	3.4283
17059584	CHEV 79 305 MALIBU A/C	71	41	7036019	CH	2.6389	3.4283
17059584	CHEV 79 VETTE 350 HI ALT. A/C	71	41	7036019	CH	2.6389	3.4283
17080201	CHEV 80	71	48	7036019	DR	2.1496	3.4283
17080202	CHEV 80	71	42	7036019	CH	2.5737	3.4283
17080204	CHEV 80	72	42	7036019	CH	2.6861	3.5406
17080205	CHEV 80	72	51	7036019	DP	2.0287	3.5406
17080206	CHEV 80	72	51	7036019	DP	2.0287	3.5406
17080207	Chev 80 VETTE M/T	71	42	7036019	CH	2.5737	3.4283
17080212	CHEV 80 Truck	72	52	7036019	DH	1.9478	3.5406
17080213	CHEV 80	72	50	7036019	DP	2.1080	3.5406
17080215	CHEV 80	72	50	7036019	DP	2.1080	3.5406
17080224	CHEV 80	72	48	7036019	DR	2.2619	3.5406
17080228	CHEV 80 Vette L82 A/T	72	41	7036019	CH	2.7512	3.5406

Figure 2: Metering Areas of Jet & Rod Combinations

Jet	Jet Area	Rod	Rod Area	Total Area
0.060	0.00282743	**0.026**	0.00053093	**0.0022965**
0.060	0.00282743	**0.030**	0.00070686	**0.00212058**
0.060	0.00282743	**0.031**	0.00075477	**0.00207267**
0.060	0.00282743	**0.032**	0.00080425	**0.00202319**
0.060	0.00282743	**0.033**	0.0008553	**0.00197213**
0.060	0.00282743	**0.034**	0.00090792	**0.00191951**
0.060	0.00282743	**0.035**	0.00096211	**0.00186532**
0.060	0.00282743	**0.036**	0.00101788	**0.00180956**
0.060	0.00282743	**0.037**	0.00107521	**0.00175222**
0.060	0.00282743	**0.038**	0.00113411	**0.00169332**
0.060	0.00282743	**0.039**	0.00119459	**0.00163284**
0.060	0.00282743	**0.040**	0.00125664	**0.0015708**
0.060	0.00282743	**0.041**	0.00132025	**0.00150718**
0.060	0.00282743	**0.042**	0.00138544	**0.00144199**
0.060	0.00282743	**0.043**	0.0014522	**0.00137523**
0.060	0.00282743	**0.044**	0.00152053	**0.0013069**
0.060	0.00282743	**0.045**	0.00159043	**0.001237**
0.060	0.00282743	**0.046**	0.0016619	**0.00116553**
0.060	0.00282743	**0.047**	0.00173494	**0.00109249**
0.060	0.00282743	**0.048**	0.00180956	**0.00101788**
0.060	0.00282743	**0.049**	0.00188574	**0.00094169**
0.060	0.00282743	**0.050**	0.0019635	**0.00086394**
0.061	0.00292247	**0.026**	0.00053093	**0.00239154**
0.061	0.00292247	**0.030**	0.00070686	**0.00221561**
0.061	0.00292247	**0.031**	0.00075477	**0.0021677**
0.061	0.00292247	**0.032**	0.00080425	**0.00211822**
0.061	0.00292247	**0.033**	0.0008553	**0.00206717**
0.061	0.00292247	**0.034**	0.00090792	**0.00201455**
0.061	0.00292247	**0.035**	0.00096211	**0.00196035**
0.061	0.00292247	**0.036**	0.00101788	**0.00190459**
0.061	0.00292247	**0.037**	0.00107521	**0.00184726**
0.061	0.00292247	**0.038**	0.00113411	**0.00178835**
0.061	0.00292247	**0.039**	0.00119459	**0.00172788**
0.061	0.00292247	**0.040**	0.00125664	**0.00166583**
0.061	0.00292247	**0.041**	0.00132025	**0.00160221**
0.061	0.00292247	**0.042**	0.00138544	**0.00153702**
0.061	0.00292247	**0.043**	0.0014522	**0.00147027**
0.061	0.00292247	**0.044**	0.00152053	**0.00140194**
0.061	0.00292247	**0.045**	0.00159043	**0.00133204**
0.061	0.00292247	**0.046**	0.0016619	**0.00126056**
0.061	0.00292247	**0.047**	0.00173494	**0.00118752**
0.061	0.00292247	**0.048**	0.00180956	**0.00111291**
0.061	0.00292247	**0.049**	0.00188574	**0.00103673**
0.061	0.00292247	**0.050**	0.0019635	**0.00095897**

0.062	0.00301907	**0.026**	0.00053093	**0.00248814**
0.062	0.00301907	**0.030**	0.00070686	**0.00231221**
0.062	0.00301907	**0.031**	0.00075477	**0.0022643**
0.062	0.00301907	**0.032**	0.00080425	**0.00221482**
0.062	0.00301907	**0.033**	0.0008553	**0.00216377**
0.062	0.00301907	**0.034**	0.00090792	**0.00211115**
0.062	0.00301907	**0.035**	0.00096211	**0.00205696**
0.062	0.00301907	**0.036**	0.00101788	**0.00200119**
0.062	0.00301907	**0.037**	0.00107521	**0.00194386**
0.062	0.00301907	**0.038**	0.00113411	**0.00188496**
0.062	0.00301907	**0.039**	0.00119459	**0.00182448**
0.062	0.00301907	**0.040**	0.00125664	**0.00176243**
0.062	0.00301907	**0.041**	0.00132025	**0.00169882**
0.062	0.00301907	**0.042**	0.00138544	**0.00163363**
0.062	0.00301907	**0.043**	0.0014522	**0.00156687**
0.062	0.00301907	**0.044**	0.00152053	**0.00149854**
0.062	0.00301907	**0.045**	0.00159043	**0.00142864**
0.062	0.00301907	**0.046**	0.0016619	**0.00135717**
0.062	0.00301907	**0.047**	0.00173494	**0.00128413**
0.062	0.00301907	**0.048**	0.00180956	**0.00120951**
0.062	0.00301907	**0.049**	0.00188574	**0.00113333**
0.062	0.00301907	**0.050**	0.0019635	**0.00105558**

0.063	0.00311725	**0.026**	0.00053093	**0.00258632**
0.063	0.00311725	**0.030**	0.00070686	**0.00241039**
0.063	0.00311725	**0.031**	0.00075477	**0.00236248**
0.063	0.00311725	**0.032**	0.00080425	**0.002313**
0.063	0.00311725	**0.033**	0.0008553	**0.00226195**
0.063	0.00311725	**0.034**	0.00090792	**0.00220933**
0.063	0.00311725	**0.035**	0.00096211	**0.00215513**
0.063	0.00311725	**0.036**	0.00101788	**0.00209937**
0.063	0.00311725	**0.037**	0.00107521	**0.00204204**
0.063	0.00311725	**0.038**	0.00113411	**0.00198313**
0.063	0.00311725	**0.039**	0.00119459	**0.00192265**
0.063	0.00311725	**0.040**	0.00125664	**0.00186061**
0.063	0.00311725	**0.041**	0.00132025	**0.00179699**
0.063	0.00311725	**0.042**	0.00138544	**0.0017318**
0.063	0.00311725	**0.043**	0.0014522	**0.00166504**
0.063	0.00311725	**0.044**	0.00152053	**0.00159671**
0.063	0.00311725	**0.045**	0.00159043	**0.00152681**
0.063	0.00311725	**0.046**	0.0016619	**0.00145534**
0.063	0.00311725	**0.047**	0.00173494	**0.0013823**
0.063	0.00311725	**0.048**	0.00180956	**0.00130769**
0.063	0.00311725	**0.049**	0.00188574	**0.0012315**
0.063	0.00311725	**0.050**	0.0019635	**0.00115375**

0.064	0.00321699	**0.026**	0.00053093	**0.00268606**
0.064	0.00321699	**0.030**	0.00070686	**0.00251013**
0.064	0.00321699	**0.031**	0.00075477	**0.00246222**
0.064	0.00321699	**0.032**	0.00080425	**0.00241274**
0.064	0.00321699	**0.033**	0.0008553	**0.00236169**

0.064	0.00321699	**0.034**	0.00090792	**0.00230907**
0.064	0.00321699	**0.035**	0.00096211	**0.00225488**
0.064	0.00321699	**0.036**	0.00101788	**0.00219911**
0.064	0.00321699	**0.037**	0.00107521	**0.00214178**
0.064	0.00321699	**0.038**	0.00113411	**0.00208288**
0.064	0.00321699	**0.039**	0.00119459	**0.0020224**
0.064	0.00321699	**0.040**	0.00125664	**0.00196035**
0.064	0.00321699	**0.041**	0.00132025	**0.00189674**
0.064	0.00321699	**0.042**	0.00138544	**0.00183155**
0.064	0.00321699	**0.043**	0.0014522	**0.00176479**
0.064	0.00321699	**0.044**	0.00152053	**0.00169646**
0.064	0.00321699	**0.045**	0.00159043	**0.00162656**
0.064	0.00321699	**0.046**	0.0016619	**0.00155509**
0.064	0.00321699	**0.047**	0.00173494	**0.00148205**
0.064	0.00321699	**0.048**	0.00180956	**0.00140743**
0.064	0.00321699	**0.049**	0.00188574	**0.00133125**
0.064	0.00321699	**0.050**	0.0019635	**0.0012535**

0.065	0.00331831	**0.026**	0.00053093	**0.00278738**
0.065	0.00331831	**0.030**	0.00070686	**0.00261145**
0.065	0.00331831	**0.031**	0.00075477	**0.00256354**
0.065	0.00331831	**0.032**	0.00080425	**0.00251406**
0.065	0.00331831	**0.033**	0.0008553	**0.00246301**
0.065	0.00331831	**0.034**	0.00090792	**0.00241039**
0.065	0.00331831	**0.035**	0.00096211	**0.00235619**
0.065	0.00331831	**0.036**	0.00101788	**0.00230043**
0.065	0.00331831	**0.037**	0.00107521	**0.0022431**
0.065	0.00331831	**0.038**	0.00113411	**0.00218419**
0.065	0.00331831	**0.039**	0.00119459	**0.00212372**
0.065	0.00331831	**0.040**	0.00125664	**0.00206167**
0.065	0.00331831	**0.041**	0.00132025	**0.00199805**
0.065	0.00331831	**0.042**	0.00138544	**0.00193286**
0.065	0.00331831	**0.043**	0.0014522	**0.00186611**
0.065	0.00331831	**0.044**	0.00152053	**0.00179778**
0.065	0.00331831	**0.045**	0.00159043	**0.00172788**
0.065	0.00331831	**0.046**	0.0016619	**0.0016564**
0.065	0.00331831	**0.047**	0.00173494	**0.00158336**
0.065	0.00331831	**0.048**	0.00180956	**0.00150875**
0.065	0.00331831	**0.049**	0.00188574	**0.00143257**
0.065	0.00331831	**0.050**	0.0019635	**0.00135481**

0.066	0.00342119	**0.026**	0.00053093	**0.00289027**
0.066	0.00342119	**0.030**	0.00070686	**0.00271434**
0.066	0.00342119	**0.031**	0.00075477	**0.00266643**
0.066	0.00342119	**0.032**	0.00080425	**0.00261695**
0.066	0.00342119	**0.033**	0.0008553	**0.0025659**
0.066	0.00342119	**0.034**	0.00090792	**0.00251327**
0.066	0.00342119	**0.035**	0.00096211	**0.00245908**
0.066	0.00342119	**0.036**	0.00101788	**0.00240332**
0.066	0.00342119	**0.037**	0.00107521	**0.00234598**
0.066	0.00342119	**0.038**	0.00113411	**0.00228708**

0.066	0.00342119	**0.039**	0.00119459	**0.0022266**
0.066	0.00342119	**0.040**	0.00125664	**0.00216456**
0.066	0.00342119	**0.041**	0.00132025	**0.00210094**
0.066	0.00342119	**0.042**	0.00138544	**0.00203575**
0.066	0.00342119	**0.043**	0.0014522	**0.00196899**
0.066	0.00342119	**0.044**	0.00152053	**0.00190066**
0.066	0.00342119	**0.045**	0.00159043	**0.00183076**
0.066	0.00342119	**0.046**	0.0016619	**0.00175929**
0.066	0.00342119	**0.047**	0.00173494	**0.00168625**
0.066	0.00342119	**0.048**	0.00180956	**0.00161164**
0.066	0.00342119	**0.049**	0.00188574	**0.00153545**
0.066	0.00342119	**0.050**	0.0019635	**0.0014577**
0.067	0.00352565	**0.026**	0.00053093	**0.00299472**
0.067	0.00352565	**0.030**	0.00070686	**0.00281879**
0.067	0.00352565	**0.031**	0.00075477	**0.00277088**
0.067	0.00352565	**0.032**	0.00080425	**0.0027214**
0.067	0.00352565	**0.033**	0.0008553	**0.00267035**
0.067	0.00352565	**0.034**	0.00090792	**0.00261773**
0.067	0.00352565	**0.035**	0.00096211	**0.00256354**
0.067	0.00352565	**0.036**	0.00101788	**0.00250778**
0.067	0.00352565	**0.037**	0.00107521	**0.00245044**
0.067	0.00352565	**0.038**	0.00113411	**0.00239154**
0.067	0.00352565	**0.039**	0.00119459	**0.00233106**
0.067	0.00352565	**0.040**	0.00125664	**0.00226902**
0.067	0.00352565	**0.041**	0.00132025	**0.0022054**
0.067	0.00352565	**0.042**	0.00138544	**0.00214021**
0.067	0.00352565	**0.043**	0.0014522	**0.00207345**
0.067	0.00352565	**0.044**	0.00152053	**0.00200512**
0.067	0.00352565	**0.045**	0.00159043	**0.00193522**
0.067	0.00352565	**0.046**	0.0016619	**0.00186375**
0.067	0.00352565	**0.047**	0.00173494	**0.00179071**
0.067	0.00352565	**0.048**	0.00180956	**0.00171609**
0.067	0.00352565	**0.049**	0.00188574	**0.00163991**
0.067	0.00352565	**0.050**	0.0019635	**0.00156216**
0.068	0.00363168	**0.026**	0.00053093	**0.00310075**
0.068	0.00363168	**0.030**	0.00070686	**0.00292482**
0.068	0.00363168	**0.031**	0.00075477	**0.00287691**
0.068	0.00363168	**0.032**	0.00080425	**0.00282743**
0.068	0.00363168	**0.033**	0.0008553	**0.00277638**
0.068	0.00363168	**0.034**	0.00090792	**0.00272376**
0.068	0.00363168	**0.035**	0.00096211	**0.00266957**
0.068	0.00363168	**0.036**	0.00101788	**0.00261381**
0.068	0.00363168	**0.037**	0.00107521	**0.00255647**
0.068	0.00363168	**0.038**	0.00113411	**0.00249757**
0.068	0.00363168	**0.039**	0.00119459	**0.00243709**
0.068	0.00363168	**0.040**	0.00125664	**0.00237504**
0.068	0.00363168	**0.041**	0.00132025	**0.00231143**
0.068	0.00363168	**0.042**	0.00138544	**0.00224624**
0.068	0.00363168	**0.043**	0.0014522	**0.00217948**

0.068	0.00363168	**0.044**	0.00152053	**0.00211115**
0.068	0.00363168	**0.045**	0.00159043	**0.00204125**
0.068	0.00363168	**0.046**	0.0016619	**0.00196978**
0.068	0.00363168	**0.047**	0.00173494	**0.00189674**
0.068	0.00363168	**0.048**	0.00180956	**0.00182212**
0.068	0.00363168	**0.049**	0.00188574	**0.00174594**
0.068	0.00363168	**0.050**	0.0019635	**0.00166819**
0.069	0.00373928	**0.026**	0.00053093	**0.00320835**
0.069	0.00373928	**0.030**	0.00070686	**0.00303242**
0.069	0.00373928	**0.031**	0.00075477	**0.00298451**
0.069	0.00373928	**0.032**	0.00080425	**0.00293503**
0.069	0.00373928	**0.033**	0.0008553	**0.00288398**
0.069	0.00373928	**0.034**	0.00090792	**0.00283136**
0.069	0.00373928	**0.035**	0.00096211	**0.00277717**
0.069	0.00373928	**0.036**	0.00101788	**0.0027214**
0.069	0.00373928	**0.037**	0.00107521	**0.00266407**
0.069	0.00373928	**0.038**	0.00113411	**0.00260517**
0.069	0.00373928	**0.039**	0.00119459	**0.00254469**
0.069	0.00373928	**0.040**	0.00125664	**0.00248264**
0.069	0.00373928	**0.041**	0.00132025	**0.00241903**
0.069	0.00373928	**0.042**	0.00138544	**0.00235384**
0.069	0.00373928	**0.043**	0.0014522	**0.00228708**
0.069	0.00373928	**0.044**	0.00152053	**0.00221875**
0.069	0.00373928	**0.045**	0.00159043	**0.00214885**
0.069	0.00373928	**0.046**	0.0016619	**0.00207738**
0.069	0.00373928	**0.047**	0.00173494	**0.00200434**
0.069	0.00373928	**0.048**	0.00180956	**0.00192972**
0.069	0.00373928	**0.049**	0.00188574	**0.00185354**
0.069	0.00373928	**0.050**	0.0019635	**0.00177579**
0.070	0.00384845	**0.026**	0.00053093	**0.00331752**
0.070	0.00384845	**0.030**	0.00070686	**0.00314159**
0.070	0.00384845	**0.031**	0.00075477	**0.00309368**
0.070	0.00384845	**0.032**	0.00080425	**0.0030442**
0.070	0.00384845	**0.033**	0.0008553	**0.00299315**
0.070	0.00384845	**0.034**	0.00090792	**0.00294053**
0.070	0.00384845	**0.035**	0.00096211	**0.00288634**
0.070	0.00384845	**0.036**	0.00101788	**0.00283057**
0.070	0.00384845	**0.037**	0.00107521	**0.00277324**
0.070	0.00384845	**0.038**	0.00113411	**0.00271434**
0.070	0.00384845	**0.039**	0.00119459	**0.00265386**
0.070	0.00384845	**0.040**	0.00125664	**0.00259181**
0.070	0.00384845	**0.041**	0.00132025	**0.0025282**
0.070	0.00384845	**0.042**	0.00138544	**0.00246301**
0.070	0.00384845	**0.043**	0.0014522	**0.00239625**
0.070	0.00384845	**0.044**	0.00152053	**0.00232792**
0.070	0.00384845	**0.045**	0.00159043	**0.00225802**
0.070	0.00384845	**0.046**	0.0016619	**0.00218655**
0.070	0.00384845	**0.047**	0.00173494	**0.00211351**
0.070	0.00384845	**0.048**	0.00180956	**0.00203889**

0.070	0.00384845	**0.049**	0.00188574	**0.00196271**
0.070	0.00384845	**0.050**	0.0019635	**0.00188496**
0.071	0.00395919	**0.026**	0.00053093	**0.00342826**
0.071	0.00395919	**0.030**	0.00070686	**0.00325233**
0.071	0.00395919	**0.031**	0.00075477	**0.00320442**
0.071	0.00395919	**0.032**	0.00080425	**0.00315494**
0.071	0.00395919	**0.033**	0.0008553	**0.00310389**
0.071	0.00395919	**0.034**	0.00090792	**0.00305127**
0.071	0.00395919	**0.035**	0.00096211	**0.00299708**
0.071	0.00395919	**0.036**	0.00101788	**0.00294132**
0.071	0.00395919	**0.037**	0.00107521	**0.00288398**
0.071	0.00395919	**0.038**	0.00113411	**0.00282508**
0.071	0.00395919	**0.039**	0.00119459	**0.0027646**
0.071	0.00395919	**0.040**	0.00125664	**0.00270256**
0.071	0.00395919	**0.041**	0.00132025	**0.00263894**
0.071	0.00395919	**0.042**	0.00138544	**0.00257375**
0.071	0.00395919	**0.043**	0.0014522	**0.00250699**
0.071	0.00395919	**0.044**	0.00152053	**0.00243866**
0.071	0.00395919	**0.045**	0.00159043	**0.00236876**
0.071	0.00395919	**0.046**	0.0016619	**0.00229729**
0.071	0.00395919	**0.047**	0.00173494	**0.00222425**
0.071	0.00395919	**0.048**	0.00180956	**0.00214963**
0.071	0.00395919	**0.049**	0.00188574	**0.00207345**
0.071	0.00395919	**0.050**	0.0019635	**0.0019957**
0.072	0.0040715	**0.026**	0.00053093	**0.00354057**
0.072	0.0040715	**0.030**	0.00070686	**0.00336465**
0.072	0.0040715	**0.031**	0.00075477	**0.00331674**
0.072	0.0040715	**0.032**	0.00080425	**0.00326726**
0.072	0.0040715	**0.033**	0.0008553	**0.00321621**
0.072	0.0040715	**0.034**	0.00090792	**0.00316358**
0.072	0.0040715	**0.035**	0.00096211	**0.00310939**
0.072	0.0040715	**0.036**	0.00101788	**0.00305363**
0.072	0.0040715	**0.037**	0.00107521	**0.00299629**
0.072	0.0040715	**0.038**	0.00113411	**0.00293739**
0.072	0.0040715	**0.039**	0.00119459	**0.00287691**
0.072	0.0040715	**0.040**	0.00125664	**0.00281487**
0.072	0.0040715	**0.041**	0.00132025	**0.00275125**
0.072	0.0040715	**0.042**	0.00138544	**0.00268606**
0.072	0.0040715	**0.043**	0.0014522	**0.0026193**
0.072	0.0040715	**0.044**	0.00152053	**0.00255097**
0.072	0.0040715	**0.045**	0.00159043	**0.00248107**
0.072	0.0040715	**0.046**	0.0016619	**0.0024096**
0.072	0.0040715	**0.047**	0.00173494	**0.00233656**
0.072	0.0040715	**0.048**	0.00180956	**0.00226195**
0.072	0.0040715	**0.049**	0.00188574	**0.00218576**
0.072	0.0040715	**0.050**	0.0019635	**0.00210801**
0.073	0.00418539	**0.026**	0.00053093	**0.00365446**
0.073	0.00418539	**0.030**	0.00070686	**0.00347853**

0.073	0.00418539	**0.031**	0.00075477	**0.00343062**
0.073	0.00418539	**0.032**	0.00080425	**0.00338114**
0.073	0.00418539	**0.033**	0.0008553	**0.00333009**
0.073	0.00418539	**0.034**	0.00090792	**0.00327747**
0.073	0.00418539	**0.035**	0.00096211	**0.00322327**
0.073	0.00418539	**0.036**	0.00101788	**0.00316751**
0.073	0.00418539	**0.037**	0.00107521	**0.00311018**
0.073	0.00418539	**0.038**	0.00113411	**0.00305127**
0.073	0.00418539	**0.039**	0.00119459	**0.0029908**
0.073	0.00418539	**0.040**	0.00125664	**0.00292875**
0.073	0.00418539	**0.041**	0.00132025	**0.00286513**
0.073	0.00418539	**0.042**	0.00138544	**0.00279994**
0.073	0.00418539	**0.043**	0.0014522	**0.00273319**
0.073	0.00418539	**0.044**	0.00152053	**0.00266486**
0.073	0.00418539	**0.045**	0.00159043	**0.00259496**
0.073	0.00418539	**0.046**	0.0016619	**0.00252348**
0.073	0.00418539	**0.047**	0.00173494	**0.00245044**
0.073	0.00418539	**0.048**	0.00180956	**0.00237583**
0.073	0.00418539	**0.049**	0.00188574	**0.00229965**
0.073	0.00418539	**0.050**	0.0019635	**0.00222189**
0.074	0.00430084	**0.026**	0.00053093	**0.00376991**
0.074	0.00430084	**0.030**	0.00070686	**0.00359398**
0.074	0.00430084	**0.031**	0.00075477	**0.00354607**
0.074	0.00430084	**0.032**	0.00080425	**0.00349659**
0.074	0.00430084	**0.033**	0.0008553	**0.00344554**
0.074	0.00430084	**0.034**	0.00090792	**0.00339292**
0.074	0.00430084	**0.035**	0.00096211	**0.00333873**
0.074	0.00430084	**0.036**	0.00101788	**0.00328296**
0.074	0.00430084	**0.037**	0.00107521	**0.00322563**
0.074	0.00430084	**0.038**	0.00113411	**0.00316673**
0.074	0.00430084	**0.039**	0.00119459	**0.00310625**
0.074	0.00430084	**0.040**	0.00125664	**0.0030442**
0.074	0.00430084	**0.041**	0.00132025	**0.00298059**
0.074	0.00430084	**0.042**	0.00138544	**0.0029154**
0.074	0.00430084	**0.043**	0.0014522	**0.00284864**
0.074	0.00430084	**0.044**	0.00152053	**0.00278031**
0.074	0.00430084	**0.045**	0.00159043	**0.00271041**
0.074	0.00430084	**0.046**	0.0016619	**0.00263894**
0.074	0.00430084	**0.047**	0.00173494	**0.0025659**
0.074	0.00430084	**0.048**	0.00180956	**0.00249128**
0.074	0.00430084	**0.049**	0.00188574	**0.0024151**
0.074	0.00430084	**0.050**	0.0019635	**0.00233734**
0.075	0.00441786	**0.026**	0.00053093	**0.00388694**
0.075	0.00441786	**0.030**	0.00070686	**0.00371101**
0.075	0.00441786	**0.031**	0.00075477	**0.0036631**
0.075	0.00441786	**0.032**	0.00080425	**0.00361362**
0.075	0.00441786	**0.033**	0.0008553	**0.00356257**
0.075	0.00441786	**0.034**	0.00090792	**0.00350994**
0.075	0.00441786	**0.035**	0.00096211	**0.00345575**

0.075	0.00441786	**0.036**	0.00101788	**0.00339999**
0.075	0.00441786	**0.037**	0.00107521	**0.00334265**
0.075	0.00441786	**0.038**	0.00113411	**0.00328375**
0.075	0.00441786	**0.039**	0.00119459	**0.00322327**
0.075	0.00441786	**0.040**	0.00125664	**0.00316123**
0.075	0.00441786	**0.041**	0.00132025	**0.00309761**
0.075	0.00441786	**0.042**	0.00138544	**0.00303242**
0.075	0.00441786	**0.043**	0.0014522	**0.00296566**
0.075	0.00441786	**0.044**	0.00152053	**0.00289733**
0.075	0.00441786	**0.045**	0.00159043	**0.00282743**
0.075	0.00441786	**0.046**	0.0016619	**0.00275596**
0.075	0.00441786	**0.047**	0.00173494	**0.00268292**
0.075	0.00441786	**0.048**	0.00180956	**0.00260831**
0.075	0.00441786	**0.049**	0.00188574	**0.00253212**
0.075	0.00441786	**0.050**	0.0019635	**0.00245437**
0.075	0.00441786	**0.051**	0.00204282	**0.00237504**
0.075	0.00441786	**0.052**	0.00212372	**0.00229415**
0.075	0.00441786	**0.053**	0.00220618	**0.00221168**
0.076	0.00453646	**0.026**	0.00053093	**0.00400553**
0.076	0.00453646	**0.030**	0.00070686	**0.0038296**
0.076	0.00453646	**0.031**	0.00075477	**0.00378169**
0.076	0.00453646	**0.032**	0.00080425	**0.00373221**
0.076	0.00453646	**0.033**	0.0008553	**0.00368116**
0.076	0.00453646	**0.034**	0.00090792	**0.00362854**
0.076	0.00453646	**0.035**	0.00096211	**0.00357435**
0.076	0.00453646	**0.036**	0.00101788	**0.00351858**
0.076	0.00453646	**0.037**	0.00107521	**0.00346125**
0.076	0.00453646	**0.038**	0.00113411	**0.00340234**
0.076	0.00453646	**0.039**	0.00119459	**0.00334187**
0.076	0.00453646	**0.040**	0.00125664	**0.00327982**
0.076	0.00453646	**0.041**	0.00132025	**0.00321621**
0.076	0.00453646	**0.042**	0.00138544	**0.00315102**
0.076	0.00453646	**0.043**	0.0014522	**0.00308426**
0.076	0.00453646	**0.044**	0.00152053	**0.00301593**
0.076	0.00453646	**0.045**	0.00159043	**0.00294603**
0.076	0.00453646	**0.046**	0.0016619	**0.00287456**
0.076	0.00453646	**0.047**	0.00173494	**0.00280152**
0.076	0.00453646	**0.048**	0.00180956	**0.0027269**
0.076	0.00453646	**0.049**	0.00188574	**0.00265072**
0.076	0.00453646	**0.050**	0.0019635	**0.00257296**
0.076	0.00453646	**0.051**	0.00204282	**0.00249364**
0.076	0.00453646	**0.052**	0.00212372	**0.00241274**
0.076	0.00453646	**0.053**	0.00220618	**0.00233028**
0.077	0.00465663	**0.026**	0.00053093	**0.0041257**
0.077	0.00465663	**0.030**	0.00070686	**0.00394977**
0.077	0.00465663	**0.031**	0.00075477	**0.00390186**
0.077	0.00465663	**0.032**	0.00080425	**0.00385238**
0.077	0.00465663	**0.033**	0.0008553	**0.00380133**
0.077	0.00465663	**0.034**	0.00090792	**0.00374871**

0.077	0.00465663	**0.035**	0.00096211	**0.00369451**
0.077	0.00465663	**0.036**	0.00101788	**0.00363875**
0.077	0.00465663	**0.037**	0.00107521	**0.00358142**
0.077	0.00465663	**0.038**	0.00113411	**0.00352251**
0.077	0.00465663	**0.039**	0.00119459	**0.00346204**
0.077	0.00465663	**0.040**	0.00125664	**0.00339999**
0.077	0.00465663	**0.041**	0.00132025	**0.00333637**
0.077	0.00465663	**0.042**	0.00138544	**0.00327118**
0.077	0.00465663	**0.043**	0.0014522	**0.00320442**
0.077	0.00465663	**0.044**	0.00152053	**0.00313609**
0.077	0.00465663	**0.045**	0.00159043	**0.00306619**
0.077	0.00465663	**0.046**	0.0016619	**0.00299472**
0.077	0.00465663	**0.047**	0.00173494	**0.00292168**
0.077	0.00465663	**0.048**	0.00180956	**0.00284707**
0.077	0.00465663	**0.049**	0.00188574	**0.00277088**
0.077	0.00465663	**0.050**	0.0019635	**0.00269313**
0.077	0.00465663	**0.051**	0.00204282	**0.00261381**
0.077	0.00465663	**0.052**	0.00212372	**0.00253291**
0.077	0.00465663	**0.053**	0.00220618	**0.00245044**
0.077	0.00465663	**0.054**	0.00229022	**0.0023664**
0.077	0.00465663	**0.055**	0.00237583	**0.0022808**
0.078	0.00477836	**0.026**	0.00053093	**0.00424743**
0.078	0.00477836	**0.030**	0.00070686	**0.0040715**
0.078	0.00477836	**0.031**	0.00075477	**0.00402359**
0.078	0.00477836	**0.032**	0.00080425	**0.00397411**
0.078	0.00477836	**0.033**	0.0008553	**0.00392306**
0.078	0.00477836	**0.034**	0.00090792	**0.00387044**
0.078	0.00477836	**0.035**	0.00096211	**0.00381625**
0.078	0.00477836	**0.036**	0.00101788	**0.00376049**
0.078	0.00477836	**0.037**	0.00107521	**0.00370315**
0.078	0.00477836	**0.038**	0.00113411	**0.00364425**
0.078	0.00477836	**0.039**	0.00119459	**0.00358377**
0.078	0.00477836	**0.040**	0.00125664	**0.00352173**
0.078	0.00477836	**0.041**	0.00132025	**0.00345811**
0.078	0.00477836	**0.042**	0.00138544	**0.00339292**
0.078	0.00477836	**0.043**	0.0014522	**0.00332616**
0.078	0.00477836	**0.044**	0.00152053	**0.00325783**
0.078	0.00477836	**0.045**	0.00159043	**0.00318793**
0.078	0.00477836	**0.046**	0.0016619	**0.00311646**
0.078	0.00477836	**0.047**	0.00173494	**0.00304342**
0.078	0.00477836	**0.048**	0.00180956	**0.00296881**
0.078	0.00477836	**0.049**	0.00188574	**0.00289262**
0.078	0.00477836	**0.050**	0.0019635	**0.00281487**
0.078	0.00477836	**0.051**	0.00204282	**0.00273554**
0.078	0.00477836	**0.052**	0.00212372	**0.00265465**
0.078	0.00477836	**0.053**	0.00220618	**0.00257218**
0.078	0.00477836	**0.054**	0.00229022	**0.00248814**
0.078	0.00477836	**0.055**	0.00237583	**0.00240253**
0.079	0.00490167	**0.026**	0.00053093	**0.00437074**

0.079	0.00490167	**0.030**	0.00070686	**0.00419481**
0.079	0.00490167	**0.031**	0.00075477	**0.0041469**
0.079	0.00490167	**0.032**	0.00080425	**0.00409742**
0.079	0.00490167	**0.033**	0.0008553	**0.00404637**
0.079	0.00490167	**0.034**	0.00090792	**0.00399375**
0.079	0.00490167	**0.035**	0.00096211	**0.00393956**
0.079	0.00490167	**0.036**	0.00101788	**0.00388379**
0.079	0.00490167	**0.037**	0.00107521	**0.00382646**
0.079	0.00490167	**0.038**	0.00113411	**0.00376755**
0.079	0.00490167	**0.039**	0.00119459	**0.00370708**
0.079	0.00490167	**0.040**	0.00125664	**0.00364503**
0.079	0.00490167	**0.041**	0.00132025	**0.00358142**
0.079	0.00490167	**0.042**	0.00138544	**0.00351623**
0.079	0.00490167	**0.043**	0.0014522	**0.00344947**
0.079	0.00490167	**0.044**	0.00152053	**0.00338114**
0.079	0.00490167	**0.045**	0.00159043	**0.00331124**
0.079	0.00490167	**0.046**	0.0016619	**0.00323977**
0.079	0.00490167	**0.047**	0.00173494	**0.00316673**
0.079	0.00490167	**0.048**	0.00180956	**0.00309211**
0.079	0.00490167	**0.049**	0.00188574	**0.00301593**
0.079	0.00490167	**0.050**	0.0019635	**0.00293817**
0.079	0.00490167	**0.051**	0.00204282	**0.00285885**
0.079	0.00490167	**0.052**	0.00212372	**0.00277795**
0.079	0.00490167	**0.053**	0.00220618	**0.00269549**
0.079	0.00490167	**0.054**	0.00229022	**0.00261145**
0.079	0.00490167	**0.055**	0.00237583	**0.00252584**

0.080	0.00502655	**0.026**	0.00053093	**0.00449562**
0.080	0.00502655	**0.030**	0.00070686	**0.00431969**
0.080	0.00502655	**0.031**	0.00075477	**0.00427178**
0.080	0.00502655	**0.032**	0.00080425	**0.0042223**
0.080	0.00502655	**0.033**	0.0008553	**0.00417125**
0.080	0.00502655	**0.034**	0.00090792	**0.00411863**
0.080	0.00502655	**0.035**	0.00096211	**0.00406444**
0.080	0.00502655	**0.036**	0.00101788	**0.00400867**
0.080	0.00502655	**0.037**	0.00107521	**0.00395134**
0.080	0.00502655	**0.038**	0.00113411	**0.00389243**
0.080	0.00502655	**0.039**	0.00119459	**0.00383196**
0.080	0.00502655	**0.040**	0.00125664	**0.00376991**
0.080	0.00502655	**0.041**	0.00132025	**0.00370629**
0.080	0.00502655	**0.042**	0.00138544	**0.00364111**
0.080	0.00502655	**0.043**	0.0014522	**0.00357435**
0.080	0.00502655	**0.044**	0.00152053	**0.00350602**
0.080	0.00502655	**0.045**	0.00159043	**0.00343612**
0.080	0.00502655	**0.046**	0.0016619	**0.00336465**
0.080	0.00502655	**0.047**	0.00173494	**0.0032916**
0.080	0.00502655	**0.048**	0.00180956	**0.00321699**
0.080	0.00502655	**0.049**	0.00188574	**0.00314081**
0.080	0.00502655	**0.050**	0.0019635	**0.00306305**
0.080	0.00502655	**0.051**	0.00204282	**0.00298373**
0.080	0.00502655	**0.052**	0.00212372	**0.00290283**

0.080	0.00502655	**0.053**	0.00220618	**0.00282036**
0.080	0.00502655	**0.054**	0.00229022	**0.00273633**
0.080	0.00502655	**0.055**	0.00237583	**0.00265072**

Figure 3: Secondary Metering Rods Listed Rich to Lean

Code	P/N	Dia of Tip	Tip Length
BV	7040724	0.0300	S
CB	7042335	0.0300	S
CC	7042356	0.0303	M
DC	7047816	0.0303	M
BY	7040856	0.0320	M
CF	7044775	0.0340	M
DG	7048890	0.0340	M
DF	7048512	0.0340	M
AX	7033549	0.0400	S
BB	7034335	0.0400	S
BF	7034400	0.0400	S
BG	7034822	0.0400	M
BH	7035916	0.0400	M
BJ	7036077	0.0400	S
BK	7037295	0.0400	S
BM	7037744	0.0400	M
BP	7038034	0.0400	S
BW	7040767	0.0400	M
CA	7042304	0.0400	M
CJ	7045780	0.0400	S
CM	7045840	0.0400	M
CS	7045924	0.0400	S
BE	7034377	0.0413	S
BL	7037733	0.0413	S
BN	7036671	0.0413	S
CE	7043771	0.0413	L
CY	7046004	0.0443	M
DA	7046010	0.0443	M
AD	7033772	0.0450	S
AH	7033812	0.0530	M
AU	7033655	0.0530	L
CK	7045781	0.0530	L
CV	7045984	0.0530	L
BU	7040725	0.0550	S
CR	7045923	0.0550	S
AJ	7033628	0.0570	M
AK	7033104	0.0570	S
AL	7033680	0.0570	S
AP	7033981	0.0570	M
AR	7033171	0.0570	S
AV	7033182	0.0570	M
AY	7033830	0.0570	L
AZ	7033889	0.0570	L
BA	7034337	0.0570	S
BZ	7042300	0.0570	L
CD	7042719	0.0570	L
CH	7045779	0.0570	S

CN	7045841	0.0570	S
CP	7045842	0.0570	S
CX	7045985	0.0570	L
DR	17053659	0.0570	S
BD	7034365	0.0580	M
DH	7048992	0.0580	M
BC	7034300	0.0584	S
BT	7040601	0.0600	M
AT	7033658	0.0670	L
CL	7045782	0.0670	L
DL	7048892	0.0690	S
DP	17053531	0.0690	S
AN	7034320	0.0700	S
BX	7040797	0.0700	S
DB	7047806	0.0700	S
AS	7045778	0.0777	M
CG	7045778	0.0777	M
CT	7045983	0.0777	M
DE	7048092	0.0877	M
BR	7038910	0.0900	L
AW	7033194	0.0908	M
BS	7038911	0.0950	L
CZ	7045986	0.0950	L
DD	7048091	0.1050	L
DK	7048919		
DM	17050221		
DN	17053703		
DS	17056618		
DU	17059952		

Technical Procedure #1: How to remove the Airhorn (the “Top”) off of a Q-Jet

To pop the top off a Q-Jet, proceed as follows:

1. Remove the air cleaner stud.
2. Using a hammer and a small pin punch or a small finish nail, tap the roll pin holding the accelerator pump lever to the top of the carb in towards the choke horn wall. Don't tap the roll pin all the way up against the wall - leave just a slight gap so you can later get a screwdriver blade in behind it to pry it back again. Remove the accel pump lever.
3. Remove the single screw holding the secondary rod hanger to the top of the carb and remove the hanger with the secondary rods.
4. Remove the choke connecting rod. There are 2 types: One type has a clip holding it to the choke lever. Remove the clip, disengage the rod from the upper lever, then twist/rotate the rod to disengage it from the lower lever inside the carb. Later model carbs have a single screw holding the upper lever to the choke shaft. On this type, remove the screw, remove the lever, and remove the choke rod by twisting/rotating it to release it from the lower lever inside the carb.
5. Remove the (2) 1/2" head bolts at the front of the carb.
6. Remove the 9 top attach screws: Two long screws in the very back; a screw on either side of the secondary airvalves; two screws just forward of the secondary airvalves; two screws just inside the choke air horn right at each primary discharge nozzle, and a single screw center front. If the carb has the stock screws in it, the two screws inside the air horn are designed to be too big to drop down into the intake manifold. But many aftermerket screws can, in fact, drop through the carb and go into the intake. Once you have loosned these two screws, use a pair of needle nosed pliers to carefully lift them out and make sure they don't drop.
7. Lift the top of the carb straight up until it clears the accelerator pump and until the air bleed tubes clear the gasket. If you have a pre-’75 Q-Jet with a choke-pulloff attached to the float bowl of the carb, cock the top over to the side to disengage the secondary airvalve rod.
8. Remove the gasket by carefully freeing it from the power piston/primary metering rod hanger.
9. Remove the accelerator pump.
10. Remove the power piston/primary metering rod hanger by pushing it down against its spring pressure and "flicking" it off your fingernail so it pops up. A couple of flicks will disengage the locking collar from the casting, and the assembly can be removed.
11. Remove the phenolic float bowl filler.
12. Remove the float and needle as an assembly.
13. Remove the main jets.

The rods and the jets are stamped with their sizes, but you may have to clean them and use a magnifying glass to see the stampings. Some commercially rebuild carbs use “generic” jets and rods with no size markings.

Only trick for re-assembly:

1. When installing the power piston, take care to fish around until the rods drop down into the jets and the power piston works smoothly. Gently push the piston nylon locking collar back into the carb casting. I've seen people not get the rods into the jets, and simply smash the top of the carb down onto the piston/rod assembly. Obviously, this will bend the rods.

Once you have the top back on, installing the choke linkage rod is considered the only "tricky" part. There is a short lever arm down inside the carb, and this arm has a hole in its end. This arm is very easy to see when you have the top off the carb, so I recommend that novices take a look at it and its orientation/function while they have the top off the carb. With the top off, take the choke rod and practice installing/engaging it in this lower lever until you get the knack of rotating the rod slightly to engage it in the hole in the lever.

Once you have the top back on (taking care not to overtighten screws and bolts), activate the choke linkage on the outside of the carb to move this lever arm to its furthest "up" position. You can just barely see it if you look down the carb. Now, insert the choke rod down into the carb, with the rod rotated slightly. Engage the hole in the lever arm at this angle, and once you've hooked the arm, rotate the rod to fully engage it.

Install the accelerator pump lever to the top of the carb. Insert a finish nail or a small pin punch through the roll pin hole to assure that it's aligned, and then use a small screwdriver to pry the roll pin back through the lever.

Install the secondary metering rods with the hanger.

NOTE: If you're going to be doing several jet changes, you do not need to attach the choke linkage rod to run the car. Leave the rod off until you're complete.

Technical Procedure #2: How to Adjust a Q-Jet Adjustable Power Piston

To adjust a Q-Jet with an adjustable Power Piston, proceed as follows:

The Q-Jet uses a power piston with metering rods to lean out the fuel mixture at cruise and at idle, and to richen up the mixture at wide open throttle (WOT). When engine vacuum is high, the power piston is pulled down into the carb against spring pressure, and this inserts the "fat" part of the primary metering rods into the jets for a lean, crisp, economical fuel mixture. When engine vacuum is lost, such as occurs under high power settings, the piston pops up from the spring pressure, and the "skinny" part of the primary rod is all that remains in the jet. This increases the metering area of the jet and richens up the fuel mixture for good power and performance.

Some Q-Jets have an adjustable feature on the power piston seated height – others do not. The factory set the adjustable feature on each carb specifically, and there is no "factory spec" for a starting point for the piston height – if someone has changed it, you can not get it back to the original spec. But you can get a very good setup as described here.

Before adjusting the height of the power piston (the height of the piston when fully seated in its bore – i.e. the "lean" position of the rods in the jets), it is important to understand a few facts about this system.

Early Chevy Q-Jets and some later Buick/Olds/Pontiac carbs do not have adjustable power piston heights: The power piston does not have a little "pin" sticking out the bottom of the piston, and the piston can be pushed deeply into the piston bore so that the "fat" part of the metering rod fully engages into the metering area of the jets. This produces the true jet/rod metering area we have been talking about in this article, and we use this relationship concept in our tuning and tweaking procedures.

After the first few years of production, Rochester slightly changed the Q-Jet power piston design. In order to get the Q-Jet to idle well on higher-performance engines, idle air bleed holes were added to the carb. These holes operate the same as the "racer's trick" of drilling holes in the throttle blades: They allow air to bypass the throttle blades so that the blades can be adjusted to a more "closed" position while maintaining good idle speed and idle quality. This produces very crisp off-idle transition. You can see these holes in the float bowl casting when you pop the airhorn off: In the forward outboard casting chambers, there will be a hole about 3/16" diameter in both sides of the carb. These holes connect to air bleed holes in the throttle plate primary throttle bores just below the throttle blades.

Obviously, if you allow more air to bleed into the engine, the mixture will lean out. To compensate for this, the carbs with the idle air bleed holes have adjustable power pistons to limit how "deep" the rods are inserted into the jets at idle and light cruise. By not allowing the rods to fully engage their "fat" parts into the jets, complete control of idle and light cruise mixture can be maintained. Further, by having an adjustment feature on the rod engagement depth, it is possible to actually fine-tune and adjust cruise mixture on a carb without the need to change carb components. This gives a carb tuner great opportunity to tune the Q-Jet… and great opportunity to really screw one up.

On pre-'75 Q-Jets, the power piston height is adjusted and set by changing the height of a little spring "tang" located between the primary throttle bores in the throttle plate. There is an adjustment screw in the forward face of the throttle plate, covered by a sheet metal plug. If you remove the plug, you will see the little screw. Screwing this adjustment "in" will raise the metal tang, which pushes the power piston up (rich). Problem is, this screw is almost always seized and rusted, and adjustment is impossible without twisting the head off the screw. So rather than messing with a screw that is likely inoperable, I find it much easier to adjust the piston height by simply bending the metal tang with a small screwdriver.

Note: A caution is appropriate here. Many carb builders (including some of the well-known commercial rebuilders) modify and eliminate this very cool adjustable system. They install lead plugs into the idle air bleed holes in the float bowl, and they cut the extension pin off the bottom of the power piston. This makes adjustment of the piston height impossible, and the piston will ride in the full-lean position like an early-model carb regardless of how you adjust the tang. This does not work well in a carb designed for the high-ride power piston. If you see that the extension pin in the bottom of your power piston has been snipped off with a pair of side-cutters, you must replace your power piston and knock the lead plugs out of the float bowl before trying to adjust the piston height.

An excellent starting point for power piston "ride height" is to set the piston so that its inner brass cylinder rides .020" - .030" above the top inner lip of the plastic retaining collar when the piston is fully seated. This will produce very good throttle response and idle mixture screw response on most carbs, and is a great starting point for your tuning. You can measure, with a pair of calipers, how much the piston height needs to change in order to hit this number. Pull the float bowl off the throttle plate and measure the height of the tang above the throttle plate surface. Bend the tang the amount needed to make the change. Put the bowl back onto the throttle plate and re-check the piston height when seated.

Later model Q-Jets (1975+) most often have an “APT” adjustment screw (Adjustable Part Throttle) located in a bore just forward of the power piston. The piston has a tang sticking out the forward side that hits this APT adjuster to limit the seated depth of the piston. Adjust this APT screw to achieve the .020” - .030” spec. You can make a tool using a piece of “model railroad tubing” that you flatten just a little to fit the adjuster screw. This tool will allow you to adjust the APT from outside the carb if you knock the little aluminum plug out of the airhorn above the APT screw: You can actually fine-tune your cruise mixture by simply turning this screw once your carb is assembled and on the car.

Some 1975+ Q-Jets do not have an APT adjustment screw to limit the piston height. Rather, they were designed for an “aneroid bellows” located in the forward passenger side corner of the carb. This bellows was intended as an altitude compensator to lean the carb at lower atmospheric pressures and to richen it at lower elevations. Few, if any, bellows were actually installed, and most “aneroid” carbs have a solid phenolic block installed in this location rather than the bellows. This solid block has an adjustable metering rod and a jet in the bottom of the aneroid bore. By adjusting the depth of the rod into the jet, you are adjusting the APT the same as on the other carbs. Again, you can knock the sheet metal plug out of the airhorn above the aneroid adjustment screw to access this in your running car. A nominal starting position for the adjustment is to run the screw down until it seats against the snap ring. Then turn it “up” 2 full turns. The more you turn it “up,” the richer the carb will run at idle and cruise.

Technical Procedure #3: How to Set Up a Q-Jet Choke

The procedure outlined here differs from other I have seen, and is based on my years of experience doing this work in the quickest, least painful, most economical way. It is recognized that other people will have different methods of doing things, and may disagree with specific methods and procedures that I use.

Overview

The Rochester QuadraJet uses an automatic choke system that is actually very good, if properly set up and adjusted. But before starting on the choke setup, it's important to remember a few other tuning parameters.

The Q-Jet choke setup assumes that other engine parameters are correctly set up and tuned. Most importantly is proper ignition timing. Before doing any carb tuning, it is imperative that the initial timing, total timing, timing curve, and vacuum advance systems be correctly set up and functioning. You cannot correct tuning issues related to timing by tweaking the carb. See my papers on setting up timing and vacuum advance before you start playing with carb adjustments.

Also, the choke setup assumes that your carb is correctly jetted and set up. If your carb is running either rich or lean, the choke will not function properly, even when adjusted to specification. Make sure your carb has the correct jets, rods and float level adjustment before trying to set up the choke. These carbs are old, and most of them have seen some "creative" jetting over the years. See my paper on Q-Jet setup for a listing of carb numbers and correct jetting.

Procedure

There are two styles of Q-Jets, and the setup procedure differs between the two.

The early style carbs utilize a "divorced choke" system. These carbs, used from 1967–1974, rely on a choke coil bolted down to the intake manifold inside a little metal box. There is a rod that connects the carb choke linkage to the coil on the manifold. As the manifold crossover gets hot, the coil expands, and pushes the rod up to open the choke.

The second style uses an "integral choke," and was used from 1975–1981 (except truck – Heavy Duty truck carbs used after 1975 still used divorced choke systems). 1975–1979 uses a "hot air" choke whereby clean air is pulled from a nipple at the back of the carb airhorn, through a steel tube, through a heat exchanger in the manifold crossover, and back up a steel tube into the front of the choke housing on the carb. There is a vacuum bleed hole between the carb choke housing and manifold vacuum, causing the air to be pulled through the tube from the airhorn. As the engine gets hot, the air in the tube gets hot, and the coil expands to open the choke. This choke will not function at all if the entire hot air tube system is not hooked up and functional. From 1980-1981 an integral electric choke was used in place of the hot air system. There is a single wire that connects to the choke housing cover. The cover contains an electrical heating element that heats up the coil and opens the choke.

As a note, the 1980 electric choke cover can be used to convert a 1975-1979 hot air choke to an electric choke. The only thing to remember is to remove the hot air choke gasket: If you do not remove the cover gasket when using the electric choke cover, the electric choke will not have a ground, and it will not function. I also recommend that you install a rubber cap on the hot air inlet port on the choke housing to avoid sucking dirty air into the housing. There is no need to plug the vacuum bleed hole in the housing since this vacuum bleed is insignificant to engine operation.

Here is my recommended sequence and procedure for doing a basic Q-Jet choke set-up:

1. Divorced Choke Systems (1967-1974)

- Disconnect the divorced choke rod from the lever on the passenger side of the carb. Leave it attached to the choke coil box on the manifold.
- Open the throttle slightly and fully close the choke by pushing on the lever arm that the disconnected rod normally attaches to.
- Push the choke rod all the way down into the choke coil until it hits the stop. If the engine is dead cold, it may already be bottomed out.
- At this position, the top of the choke rod should be level with the bottom edge of the choke rod hole in the lever on the carb.
- Bend the rod to obtain this relationship.
- Once complete, hook the rod back up to the lever.
- With the rod hooked up, push the choke rod back down to the seated position once again. This should fully close the choke blade. If the choke blade is not fully closed in this position, bend the choke intermediate rod that comes up through the body of the carb and attaches to the choke blade lever. Bend the rod so that the choke blade is fully closed.
- Remove the short piece of vacuum hose attaching the choke pulloff to the vacuum nipple on the carb. Attach a long (about 2') vacuum hose to the pulloff.

- Crack the throttle slightly and push down on the divorced choke rod to close the choke fully. Release the throttle. Keep light finger pressure on the choke rod to maintain light closing pressure on the choke.
- Suck on the vacuum hose to retract the choke pulloff. If the pulloff does not retract, it must be replaced.
- With the pulloff fully retracted and light finger pressure on the choke rod, use your other hand to lightly push down on the forward lower edge of the choke blade to simulate to force of the air across the blade. This will open the choke slightly. At this point, measure the distance between the forward lower edge of the choke blade and the forward wall of the airhorn. This distance should be ¼". You can use a ¼" drill bit as a simple gauge to check it. To adjust, bend the tang on the choke linkage where it contacts the choke pulloff rod.
- Re-attach the vacuum hose to the pulloff and the carb.

This completes choke adjustment for a divorced choke carb.

2. Integral Choke Systems (1975-1981)

- Remove the three screws holding the black choke cover to the choke housing and remove the cover. If rivets are used, drill out the rivets.
- Crack the throttle slightly open and push up on the choke coil lever inside the choke housing until the choke is closed.
- Notice that there is a small 1/8" hole recess inside the choke housing which will appear right below the lower edge of the choke coil lever when you push the lever up. Insert a 1/8" drill bit in this recess and allow the lever to rest on the drill bit.
- In this position, your choke blade should be fully closed. If not, bend the choke intermediate rod that comes up through the body of the carb and attaches to the choke blade lever. Bend the rod so that the choke blade is fully closed.
- Now, remove the drill bit, crack the throttle slightly and rotate the fast idle cam (the steel counterweight that rotates on the choke housing shaft between the choke housing and the carb body) so that the fast idle cam follower is positioned on the second step of the cam, right up against the edge of the highest step.
- In this position, apply light finger pressure on the choke coil lever inside the choke housing to close the choke (lift up on the lever).
- The choke should be cracked open 5/16" as measured between the rear upper edge of the choke blade and the rear airhorn wall. Use a drill bit to check this.
- To adjust, notice that there is a small sheet metal tang attached to the lower side of the fast idle cam. This tang determines the travel range of the choke. Bend the tang to adjust.
- Now, install the choke housing cover to the choke housing. If you're using an electric choke, DO NOT use a gasket between the cover and the housing. Be sure that the choke coil tang in the cover correctly mates with and engages to the choke coil lever inside the housing.
- With the cover attach screws loose, rotate the cover so that the indicator scribe line points straight up. This should fully close the choke. If there is no scribe line (electric chokes do not have lines), rotate the cover counter clockwise until the choke blade is fully closed. Lightly snug the cover attach screws to keep the cover in this position. You may need to crack the throttle open to get the choke to snap closed.
- Remove the short piece of vacuum hose attaching the choke pulloff to the vacuum nipple on the carb. Attach a long (about 2') vacuum hose to the pulloff.
- Suck on the vacuum hose to retract the choke pulloff. If the pulloff does not retract, it must be replaced.
- With the pulloff fully retracted, use your other hand to lightly push down on the forward lower edge of the choke blade to simulate to force of the air across the blade. This will open the choke slightly. At this point, measure the distance between the forward lower edge of the choke blade and the forward wall of the airhorn. This distance should be ¼". You can use a ¼" drill bit as a simple gauge to check it. To adjust, turn the screw on the end of the choke pulloff lever. After each adjustment, you must release the vacuum on the hose and suck on it again to re-seat the pulloff, each time apply the light finger pressure to the forward lower edge of the choke blade.
- Once completed, loosen the choke coil cover attach screws and rotate the cover clockwise. On hot air choke systems, the cover scribe mark should be aligned with the second dot clockwise of the center dot on the choke housing marks. On electric chokes, the indentation in the outer edge of the cover should be aligned with the screw & clip location towards the forward side of the choke housing. Snug the screws down or re-install new rivets. (NOTE: On riveted applications, the rivet holes can be tapped for #10 screws.)
- Re-attach the vacuum hose to the pulloff and the carb.

This completes choke adjustment for an integral choke carb.

Tuning note on Intergral Choke Carbs:

When doing custom tuning adjustments on the integral choke carbs, keep the adjustments limited to 2 parameters: Setting the position of the choke cover (rotating the cover) and adjusting the choke pulloff screw. When doing these adjustments, keep the following relationship in mind:

- The cover adjustment (rotating the cover) determines how LONG (duration) the choke is applied before fully opening. Turning the cover clockwise shortens the duration. Turning the cover counter clockwise increases choke duration. It only takes a very small rotational adjustment to change this (1 or 2 mark lines on the cover). Contrary to popular misunderstanding, turning the cover does **NOT** change how rich or lean the carb runs with the choke applied.
- The choke pulloff screw determines how RICH or LEAN the carb will initially run when started cold. If your carb runs rich when initially started, turn the screw to open the choke a little more. Likewise, if your car starts lean and wants to die, turn the screw to open the choke blade a little less.

In summary:
Rotate the cover to change the amount of **TIME** the choke is applied.
Adjust the screw to change how ***rich/lean*** the choke is upon initial startup.

3. Fast Idle Bench Setup
The fast idle screw is located on the passenger side of the carb, on the primary throttle shaft just below the choke linkage. An initial fast idle setting can be done as follows:

- Back out the idle speed screw on the driver's side of the carb 3 full turns.
- Crack the throttle open and rotate the fast idle cam so that the cam follower is on the top (fastest) part of the cam (simply lift the cam all the way up).
- Hold the throttle blades firmly closed and back the fast idle screw out until the cam follower just barely looses contact with the fast idle cam. Find the adjustment point where the follower just barely touches the cam with the throttles fully closed. From this point, turn the fast idle screw in 2-1/2 turns.
- Re-establish your driver's side idle speed screw by turning it back in 3 turns to the original setting.
- Start the engine cold and fine-adjust your fast idle screw to the fast idle speed of your preference.

Technical Explanation: The Q-Jet Airvalve and Secondary Operating System

Lots of misunderstandings on the operation of the secondaries on a Q-Jet carb.

To understand the operation of the Q-Jet, first you have to understand what a "vacuum secondary" carb is and how it functions.

A "vacuum secondary" carb is a carb whose secondary throttle blades are opened by the force created by venturi vacuum in the primary side of the carb. The vacuum created in the venturi of a carb is directly proportional to the mass flow of air passing through the venturi. This venturi vacuum is completely independent of manifold vacuum, which is non-existent at wide open throttle (WOT). A vacuum secondary carb has a little hole drilled right into the venturi on the primary side, and this venturi vacuum is fed to a spring loaded diaphragm attached to the secondary throttle shaft. Once airflow on the primary side approaches the maximum flow capability of the primary venturi, the vacuum will be high enough to overcome the diaphragm's spring pressure, and the secondary throttle is opened by the primary venturi vacuum. This is a vacuum secondary carb.

The Q-Jet does not have any vacuum holes drilled in the primary venturi, and there is no vacuum diaphragm attached to the secondary throttle shaft. The Q-Jet is not a vacuum secondary carb – it is mechanical carb with a secondary airvalve control.

But vacuum sucks the airvalve open, and the airvalve is connected to a vacuum diaphragm, so it's vacuum operated, right?

Not really. Imagine this: Take a spring-loaded screen door and set it up right out in your front yard. As the wind starts blowing, the door gets pushed open. The harder the wind blows, the more the door gets pushed open. Do you have a vacuum on one side of your front yard sucking the door open..? Of course not – the pressure is the same all over your yard. The force opening the door is the mass flow of air pushing the door open. There may be a low pressure area in Texas that is causing the air to move, but Texas is not "sucking" the door open – mass air flow is pushing it open, and the door is responding to the actual total mass air flow being pushed through it. The Q-Jet operates the same way: At WOT, there is no vacuum in the manifold – the manifold is very close to atmospheric pressure (a correctly-sized carb will cause the manifold vacuum at WOT to be at about 0.5" Hg, which is nothing). So the force opening the airvalve is the same as the wind pushing your yard-mounted screen door open: It's mass flow pushing it open. This is not a vacuum operated carb. There is no vacuum in the manifold at WOT, but there is plenty of mass airflow.

The diaphragm on the side of the Q-Jet "controlling" the secondary airvalve is actually the choke pulloff. It is also connected to the airvalve to hold it firmly closed when manifold vacuum is high. When the engine is placed in a power condition (WOT or low manifold vacuum), the diaphragm relaxes at a controlled rate to prevent excessively sudden opening of the airvalve: The longer the

airvalve is delayed in its opening, the bigger "fuel shot" the secondaries get upon opening, thus preventing a secondary tip-in stumble. The pulloff merely allows a controlled opening rate of the valve, and is not a vacuum-operated control of the secondary throttle in any way. Think of the pulloff as the damper cylinder on the screen door: The damper cylinder does not open the screen door – it merely controls and dampens its opening rate.

Thus the Q-Jet is not a vacuum secondary carb. It is an airvalve-controlled mechanical secondary carb with a damper. The airvalve is not operated by vacuum – it is operated by mass flow. The airvalve's opening rate is controlled and dampened by the loss of vacuum signal – not by the creation of any vacuum.

For some interesting reading on the 3 different types of engine vacuum, feel free to drop me an e-mail request for my "Engine Vacuum Explained" tech paper.

Questions, Comments & Technical Assistance

If you have questions or comments regarding this article, or if you notice any errors that need to be corrected (which is quite possible since I'm writing this from memory…), please feel free to drop me an e-mail. Also, if you need any technical assistance or advice regarding this process, or other maintenance issues, feel free to contact me:

V8FastCars@msn.com