How to get started in Vintage Racing REV. 05-2014

With all the interest currently being shown in vintage racing, I decided it was time to write some notes on how to get started with a 356. If money is no obstacle, one can buy a fully-prepared, vintage legal, competitive 356 for $60,000 to $100,000. The Speedsters and Roadsters are more. The key words here are “fully-prepared.” There are not that many top-of-the line cars for sale. A rollbar, plastic windows, and numbers do not constitute a “race-ready” car. There are always “turnkey” race cars available for $ 30,000 to $45,000, but unfortunately most of them are more “turkey” than “turnkey.” There can be some good cars for sale for less than the cost of building one from the ground up, but they are rare and you really have to be sure of what you’re buying. It can easily cost$50,000 + to build a full-spec car, not including rust repair, body and paint work. It doesn’t make sense to pay a premium for a “race” car, then tear it apart to completely re-do everything. We have seen it done time after time. There’s some real junk out there!

I will try to describe step-by-step how one can get into vintage racing slowly and “reasonably,” building the car up in stages. If you can do most of the work yourself, great. And you can do much of the work yourself assuming some mechanical experience. Some things will need to be trusted to experts.

Where to Start

One of the first things to do is get a copy of the rules from the organizations sanctioning races in your area. It’s no fun to bring an illegal car to the track and face the ridicule of your peers. If you go fast enough there will be plenty of people who will assume you’re cheating. Many of these accusers don’t have their cars assembled right and assume those who are faster are cheaters.

First, you need a car. Everyone wants a Speedster; that’s why rusted-out examples start at $80,000.+ If you already own a 356, you could convert that, depending on the car. Don’t take a nice street-ready 356 and start gutting it. If you have a $80,000 almost-show 356 SC, don’t use it. You need a solid, semi-rust-free body shell. Don’t use a 1950-55, unless you want to do some serious shock absorber relocation and transmission mount additions. 1956-59 A’s are good, but you may not want to put up with the old style gearshift linkage. This can be changed, but will require some modifications. If using a ‘56-57 you have to change the steering box to the 1958-65 ZF box. You will also need the adjustable left tie-rod.

If using drum brakes, do not use the pre-1959 VW-size skinny spindles. They can break at the base and shed the complete wheel and brake drum. The 1959-63 brake spindle is the one with the clamping collar for wheel bearing retention instead of double jam-nuts.

1960-61 T-5 coupes are usually more reasonably priced than 1962-63 and have all the mechanical attachment points that you need.

1964-65 C's of course have the desired disc brakes as well as the best core engine for building up to race specs.

Disc brakes can be bolted onto any 356 and are the preferred choice. The drum brakes just do not hold up. Fade occurs constantly, drums crack, and nobody has a good racing wheel for that large bolt pattern. But first, check your rules. Some groups do not permit up-dates!

Okay, you've found a solid car, or repaired one, or you have your old street driver. You've read the rules and understand them. Most of my preparation is for SVRA and HSR, so I will lean toward the modifications pertaining to those groups.

Preparation

The days of removing your hubcaps and taping on some numbers are OVER. To get on the track, you will of course need a five-point racing seatbelt set-up as well as a rollbar. Also required is a fuel cell instead of the stock gas tank, as well as a dual-circuit brake system.

The rollbar can be a simple bolt-in or a little more complex custom welded installation with forward reaching bars for "safety" as well as chassis stiffness. Any strictly bolt-in rollbar can only be attached to a single layer of sheet metal due to the necessary access to the bottom hardware. Because of this, I don't recommend a bolt-in bar for an open car. It should be strong enough for a coupe, but I wouldn't trust it to support an upside-down open car. The fuel cell is a bit more complex and the installation will depend on whether you're using a 1956-61 or a T-6 body (which has an outside gas-filler). Give me a call for further details.

Brakes

The dual-circuit master cylinder is pretty easy. With drum brakes, use a VW 19mm; 1967 Type I, #113.611.015 BD.

For disc brakes, the 911 #911.355.012.02, reservoir #911.355.013.13.

Use the proper reservoir to master cylinder blue hose, #999.181.021.50. It's almost $18.00 per meter, but that's all you'll need, and no other material will last with brake fluid. Don't use fuel line or clear plastic hardware store hose. The reservoir will require a small vent line. Run it upward and then back down. No brake fluid should really get in there and stay, so clear plastic hardware hose is fine for this application.

Plumbing the 911 master cylinder is a little different than the 356 m/c. The 911 cylinder has only one outlet line for the front brakes. Simply run a metal brake line to a 'T' fitting and then to the front brakes. You will also need a 'T' fitting for the rear brake line so you can install a brake light switch because the 911 master cylinder does not contain a brake light switch like the 356 or VW does. The switch on the side of the 911 master cylinder is a warning light switch for brake failure. Since the 911 master cylinder extends into the car more than the 356 cylinder, the brake actuating pushrod from the pedal will need to be shortened accordingly.

Don't use silicone fluid for disc-brake cars! It does not work for racing. I

don't know why, just trust me. It does seem to work with the drum brakes. Just use a standard brake fluid such as Castrol LMA, or ATE is now Gold. Don't waste your money on the expensive "trick" fluids; you have to bleed the brakes every weekend anyway.

Tires

Wheels for disc-braked cars are plentiful in the 5-1/2" or 6" x 15" sizes permitted. Tires are in a major change period. Check with racers in your area. Tire pressures should be set cold such that when hot they are around 28 psi. That's checked in pit lane immediately after several hot laps. A too-slow cool off lap will drop the reading, not to mention checking the pressures after parking in your paddock spot. For the radial tires, most people set way too high. It seems the autocrossers are setting their tires in the 35-40 psi range cold! Not for the track! Try for the 28-30 psi range hot and adjust up or down according to personal preference. The rear of the car carries more weight and works the tires harder, so set it lower than the front to achieve equal pressure when hot. I set my pressures at Mid-Ohio cold to: LR 20, RR 21, LF 22, RF 23. The above numbers are good for most tires. The Hoosier "Speedster" spec tires for SVRA like a little higher pressure we shoot for 32 psi HOT. We run 185x65x15 on the front and 205x60x15 on the rear.

Now you can get on the track, but you haven't done anything to make the car faster. You will have to make a decision about street-or-track compromises. There is only so far you can take your vintage racer before it becomes impractical for street use.

Suspension

Two no-cost items (if you do your own work) are; lowering the front end and de-cambering the rear. Lowering the front consists of loosening the torsion bar center anchors, backing off the adjusters until you run out of adjustment slot, pushing the front end of the car down while the suspension is on jack stands (that raises the suspension) and then tightening the center anchors. You can also take everything apart to grind out the slots for even more lowering, but be careful. Too low, and the sway-bar bracket on the lower trailing arm will hit the shock absorber. After lowering the front end, don't worry about "bump-steer." The 356 steering geometry works just fine at stock height or lowered. Don't lengthen the steering arm to quicken the steering ratio! This *will* screw up your bump steer! Also, I have never found a need for a steering damper on a race car. Go ahead and cut off the front suspension bump stops.

Obviously your king and link pins should be in good condition. If not, rebuild the front end. Under track stress the link pin carrier will eventually crack and break. This should be reinforced by welding a piece of 3/16" steel on the front to help stiffen it. The carrier can still eventually break, but it should be looked at after every event anyway, and this will give you that much more safety margin. The cracking is always progressive and takes place over several events. A visual inspection when greasing the front end is all that's required.

You might eventually want to re-machine the front end for negative camber. It's expensive but does improve the handling. Check your rules! For disc brake cars we supply a heavy-duty spindle assembly (see the suspension section on the web site) for the ultimate in front suspension and safety.

Actual de-cambering procedures for the rear are covered in many other publications such as Elfrink's Porsche Technical Manual. For a compromise car you need 1-1/2 degrees to 2 degrees negative camber. For a full track car, 2-1/2 to 3-1/2 degrees is optimum. You also need to adjust rear toe-in to 3-1/16" total and be sure it's equal side to side!

This would be the time to install solid plastic bushings for the rear trailing arms. This will help locate the rear axles for better handling. You also need good transmission mounts, because with a swing axle, the transmission is also a suspension point. New rear mounts are almost always needed. The front mounts seem to last forever.

One of the first items you should add is my camber regulator for the rear suspension. I realize this is a blatant plug, but it works! I have received enough un-solicited testimonials from those who have tried it that I even offer a money back guarantee. One caveat: with the regulator installed, drum-brake cars will have difficulty getting the wheels on and off because the axles will not droop.

The products that I supply I have produced or procured because they are required for speed or reliability. I don't manufacture anything that isn't needed.

If your shock absorbers are in good shape, new ones probably won't help much. If you do need shocks, a set of Konis all the way around would be your best bet. Set them to medium to start with. Some people recommend setting the fronts firm and the rears soft. Do whatever feels good for you.

After getting the rear suspension to work, if you feel there is still too much oversteer, install an adjustable 19mm front sway bar. The Automotion bar is readily available, although you should reinforce the mounting location on the lower trailing arm. The manner in which the adjustable links attach puts a twisting load into the mounting arm and will eventually bend it. A simple additional piece of steel welded in will take care of the problem.

A good racing seat will do wonders for lap times, and a smaller-diameter racing steering wheel just looks so neat! You can get a perfectly useable wheel for $150 to $175; you don't need a "Super-Hero" autograph model for $300 plus.

Your Engine

You can run around with a stock engine and have a perfectly good time. You better be sure, however, that it will survive the track. Low oil level will destroy an engine quicker than high rpm and heat. Always run the oil level to the top mark on the dipstick, checked with the engine running. One of the first improvements

to hang on the engine is a deep oil sump. There are small extended sumps available, but I don't believe they're adequate. A Super 90 oil pick-up is better than nothing, but still not the answer. An Accusump oil accumulator in your oil line will help, but it doesn't work as well as advertised either. Besides, if you haven't installed external oil lines yet, you can't very well put in the Accusump.

When installing the deep sump be sure to extend the oil pick-up tube properly. Don't use plastic hose! I use a piece of metal-braided oil line and two hose clamps to connect an extension piece to the oil tube. Also, before assembling the engine case, install the oil drain plug from the inside, or it will interfere with the sump. Here's a trick for installing the drain plug if the case is already together: cut a slot in the round end of the plug, put the plug inside the case, and use a screwdriver to "unscrew" the plug into the hole. You just can't get a wrench inside an assembled case. With a deep sump, run the oil level about 1/4" below the top mark, at idle. The deep sump does hang down and decreases your ground clearance, so you should install a skid plate to protect it. We have a very nice bolt-on unit we sell. See new photo on the web site.

Don't go any earlier than the large-oil-pump1960 engine case. The best engines for cores are 1964-69 C, SC, and 912. I will concentrate on the modifications to these.

Zenith carburetors are good, but you can't beat a pair of Solex 40 P-IIs. Rebuild, put in 36mm venturis, 160 main jets, 160 air correction jets and a set of velocity stacks and you're in business. When setting the accelerator pumps for the track, ignore the stock specifications. The stock pump delivery is too much for track use. Don't bother measuring the amount, just cut it back to a light dribble. You only need enough to start the engine. If you can't get it low enough with the adjusting nuts at the end of the rod, just reverse the position of the nuts so that the long one protrudes past the end of the rod.

Bottom End

Rebuilding the engine with a slightly hotter camshaft and good racing pistons is definately worthwhile. The crankshaft should be checked for cracks, then shotpeened for increased reliability. If the crank needs grinding, do so, and don't worry about re-hardening the journal surfaces. Don't do anything to that crank that can upset the metallurgy; especially don't weld it to rebuild a journal to size! Don't cut a groove in the cam gear for more power; that's an old wives' tale! Once you convert to heavy valve springs and high rpm, you will have to switch to steel, straight-cut cam gears. We only run new Scat Superlite Cranks in our cars. Good C and SC cranks of standard size are NOA and are saved for street rebuilds. The stock 1964-69 connecting rods are very good even for racing. Don't use the early 912 rods with the wrist pin oil hole in the beam. These will break in racing usage. I also side-clearance the big end of the rod for easier oil flow out of the bearing. Shot-peening is not needed on the stock rods; they are reliable even in a 7600 rpm engine. Beyond that, get the Carrillos. There are two styles available; expensive with the large bolts, and even more expensive with the tiny 1/4" aircraft bolts. The large-bolt rods will not clear #2

& #4 cam lobes! You can only use the 1/4" bolt version, and you must use a bolt-stretch gauge to install them.

Head Work
The late heads can be left fairly stock, or they can be improved by some light combustion chamber unshrouding. Don't touch the ports unless you have a flow bench! Hogging the port out will not make these heads better; it's already big enough. Simply going bigger will only decrease flow velocity and gain nothing. The port needs to be re-shaped with minimum enlargement in order to get the most improvement and maintain mid-range torque.

Racing valve springs and titanium valve spring retainers should be used once the redline is moved past 6500 rpm. Heavy duty chrome-moly pushrods will eventually be needed. No carbon fiber pushrods! Wrong expansion rate. The #1 and #4 exhaust rocker arms have bad stress risers because of their shortness and the manner in which they are machined. When the exhaust valve spring pressures exceed 260 pounds at maximum lift, these rocker arms will eventually break. The solution is to grind the critical area smooth and have it shot-peened. The long rocker arms on #2 and #3 do not have this problem.

Flywheel
The flywheel should be lightened, but don't go crazy milling and drilling down to seven pounds. It will just break eventually and you'll need another flywheel. A simple lightening job to ten or eleven pounds is just fine. Of course everything should be balanced.

You don't have to use a 200mm flywheel. The 180mm is completely adequate for any of our engines. Don't use the 180mm Fichtel & Sachs pressure plate. One or more of the three flat locating springs will break in one or two race weekends. The symptom will be a dragging, non fully releasing clutch. The ideal pressure plate is a Kennedy, available in 180 and 200 mm sizes. Include the metallic 4-puck clutch disc and you're all set. Note: the metallic disc is NOT streetable.

Exhaust System
The only exhaust system to consider is the Bursch race system. You can use the stock 1-1/2" diameter for a mild engine, but you will have to move up to the 1-5/8" and 1-3/4" systems as the power output goes up. We now have a stepped 1-5/8" up to 1-3/4" system that gives good torque and top end power.

Fuel System
The stock fuel pump is adequate, but you can't beat an electric fuel pump for filling dry carburetors with the engine off. You can also install a fuel pressure regulator for better control of that function. The fuel pump should be controlled by a separate switch so it can be turned off with the engine still running. That way you can lower the fuel level in the carbs and not get as much hot "boil-over" after the engine is shut off. For the fuel pressure we run, 4-5 psi max, you don't need metal-braided fuel line. It's heavier and

much more expensive than ordinary rubber fuel hose, but looks nicer. I do use the metal-braided hose when routing the fuel line inside the car, for safety. I install a manual fuel shut-off valve within easy reach of the driver. With the high location of the fuel tank on a 356, the gas can self-siphon into the carbs when parked. This is especially bothersome when disconnecting fuel lines with a relatively full fuel cell. The above reference to a shut-off valve is only important for a "bottom feed" fuel tank.

Engine Breathing

You will need to use the 1964-69 non-vented valve covers. The ball-check covers are useless. It's oil vapor that comes out of the vent, and the ball can't stop that. The engine does need to "exhale" its crankcase pressures. The 1964-69 oil filler-breather is what you need. Vent the large outlet into a catch-bottle in the engine compartment. Also vent both heads into the catch bottle. The 912 heads already have vent holes; use them. If your heads aren't vented, drill them out and resist the temptation to vent the valve covers instead. Remember, you need to remove these valve covers quite often. Vent lines get in the way when doing so. The 1964-69 oil filler will interfere with the engine lid of an open 356 with the single grill. Either section the oil filler, or notch the interfering drip pan in the lid. Keeping valve cover gaskets from leaking has always been a problem. We now have a steel core laminated gasket made for us by Fel-Pro. They can be installed without adhesive and will not "suck in" like the standard gasket.

Engine instrumentation

You will need a decent tachometer. The stock 6000 rpm cable-driven tach is not the way to go. You will need an electric, but you're changing all the instruments anyway. The windshield wiper can be slowed down with a resistor. You don't need a 10,000 rpm super-duper drag tach with shift light and memory recall for $250. A simple Autometer $120. 8000 rpm tach is just right. Oil pressure and temperature should be monitored; I use VDO gauges here, a 0-80 lb. oil pressure and 0-300 degree oil temperature. To insure an accurate oil temperature reading, I also use a standard oil filter inlet line and loop it back to the oil filter outlet line fitting on the case. This gives you oil flow in that area and produces a more reliable oil temperature indication.

Cylinder head temperature should be monitored to ensure enough air flow for cooling. VDO gauge here also. For proper cooling, a 4" crankshaft pulley driving the earlier 16-blade cooling fan is the set-up you want. With a stock pulley, at 7000 engine rpm, the fan would be turning over 10,000 rpm! That's too fast. Also, the 28-blade late fan also does not seem to remain efficient at high revs.

Eventually you will need exhaust temperature gauges. This is the only way to accurately jet the engine. When using senders in all four pipes, it also tells you which cylinder is at fault when you get one of those track gremlins that often occur. You can use dual gauges, or one single gauge and a 4-way switch. Less clutter, but you do have to switch around when one cylinder drops out.

Ignition
The stock ignition system is quite adequate. You can install an MSD or some capacitive discharge system, but I don't believe you'll see much benefit. Crankfire ignitions are currently not allowed. Full ignition timing should be 36 degrees. For racing, you need a distributor that puts out less advance than the stock 15 degrees; that's 30 degrees at the crank. You want plenty of static advance, like 16 degrees, for easy starting, so you want to limit the distributor to about 10 degrees, that's 20 degrees at the crank. The Bosch 009 only has 10 degrees of advance, so it's a pretty good set-up. The points can sometimes be weak at higher rpm, so a set of 050 points can be installed.

A new product available is an electronic module that fits inside the Bosch 009 distributor and replaces the points and condenser. The resulting crispness of the timing is as good as a crank-fire! I have tested this unit to 7800 rpm and highly recommend it.

Spark plugs will have to be changed to a short-tip cold plug such as the Bosch W3AS Silver-tip. An extended tip street plug will have its nose slammed shut by the piston! Even a short-tip plug may need extra shims.

Oil Cooling
The stock oil cooler won't handle much heat from even a mild engine being put through its paces. Besides, that heavy lump of metal can cause the engine case to crack. As engine power output increases, so does the amount of heat produced. You will eventually need better oil cooling. Don't use the cheap cooler over the fan shroud air intake! Install one or two decent-size coolers up front behind the grill openings. This is where the 'B's and 'C's have an advantage over the 'A's.

There are no ready-made oil cooling kits for a 356. You will have to engineer everything yourself. You can plumb off the top of the engine with an adapter that bolts in place of the stock oil cooler. I hate this system. You have to cut the fan shroud, route the lines all over the place, interfering with the throttle linkage, and top engine mounting nuts. I prefer to come out of the oil pump cover, and then eventually back into the side of the timing cover. You will need an oil cooler by-pass plate which we sell (Blatant Plug). You will have to be careful with lines passing right by the exhaust pipes. The modern thermal exhaust wraps do wonders for the reliability of this application.

After the oil line leaves the pump cover, its first stop should be a full-flow filter. I prefer the Oberg, now sold as Racor cleanable screen set-up. It lets you monitor the health of your engine, and you don't ever have to buy another filter! If you feel the need for a thermostat, install it after the filter. I don't use a thermostat. A race engine should be warmed up gradually anyway.

Be sure and use AN-10 oil lines. The AN-8 are too small to run all the way to the front of the car and back again; too much restriction. After the filter, go to the cooler(s) and then back to the engine.

One detail about an external oil cooler set-up; the oil pressure relief valve is at the end of this long system of oil. This means that on a cold start-up, the oil pump can put out over 700 psi! That's right, I said 700 psi! This pressure is not relieved until the oil gets back to the case. 700 psi will blow off spin-on filters, break the top off a Mecca aluminum oil filter, bulge oil coolers, and even make an Oberg flex and drip. Careful start-up and warm-up with minimum rpms is essential. The other solution is our oil pump cover with built-in pressure relief valve.

Use proper oil lines for all of the above. No slip-on rubber hoses with hose clamps! Use proper metal-braided oil lines. Besides, they look so nice!
Remember, "Aeroquip" is a brand name, there are also "Earl's" and "Russell."

Transmissions
Before you develop much more power, you will need to change gears. The stock gear ratios are fine for the street, but useless on the track. Even the Speedster 3-A & 4-B won't be adequate for serious track use. As an engine produces more power, the torque band gets narrower. Coupling a full 160 +hp engine to a stock gearbox will result in lap times slower than a 120 hp engine hooked up to more useable gear ratios. For slow to medium speed tracks a 1-B, 2-B, 3-E, 3-C would work very well. A 4-A gear would give more top end if the straight was long enough and the engine had enough power. Having the 3-E and 4-A gears would also mean not having to buy new ratios when going to the ultimate track gearbox. Machine first gear off the input shaft and install a 2-B for first, 3-E for second, your old 3-B for third, and the 4-A for fourth. One glance at a gear chart shows how ideal the spacing is with these ratios. These gears are available from 356 Enterprises. We started making gears in 1983, when new-old stock or even used gears were almost impossible to find. If we were to continue racing, something had to be done; so we did it.

You will eventually need a limited-slip differential to get the power to the road in tighter corners. Either an old, original ZF unit, or one of the Guard Torque Biasing differentials. The fulcrum plates and axle shafts take some serious punishment in racing conditions. The severe negative camber combined with high power output causes the steel material to actually weld together. For this reason a dissimilar metal is required. We have been nickel-plating the stock fulcrums, grinding some grooves on the face of the fulcrum for better oil flow. Be sure to use a good synthetic trans oil to help the fulcrums as much as possible. I also do an additional transmission side-cover modification to improve oil flow to the fulcrum plates. We stock for sale Swepco 212 with Moly.

Back to the Engine
Once you've decided your car is ready for 160+ hp, you will install a hotter cam and concentrate on full cylinder head modifications as well as a compression ratio well over 11:1. You will already be using racing gasoline, minimum of 110 octane in any engine over 10:1. Don't play games trying to mix cheap unleaded, aviation gas, octane booster, etc. You will waste your time and money, and eventually cook some pistons. It's not worth it! You will spend $450. to $600. on 110 octane race gas at approximately $9.00

++ per Gal. Compare that to the cost of one piston. If you already built a milder engine properly, you'll notice I didn't mention requiring any other parts to be changed.

Hopefully, this will give you some idea of what's required to get into racing.
Map out your budget and time, then decide what steps to follow. I started racing in 1965 with a car I drove to the track, developing it over time as my finances permitted.

If, after reading this you have second thoughts, better now than after spending much time and money and then deciding maybe you're not that interested.
Racing at any level requires serious commitment, but this commitment will be rewarded by some of the most fun you've ever had, and some of the best friends you've ever made! OR you can always rent one of our prepared race cars. Call for details.

Vic Skirmants