



## WEIAND SUPERCHARGER INSTALLATION INSTRUCTIONS

**CAUTION:** All superchargers and turbochargers increase the combustion pressure and temperature within an engine. This puts additional loads on pistons, rings, bearings, crank, rods, and cylinder walls. All of these components are capable of withstanding substantial increases in combustion pressure under proper conditions.

In order to avoid potentially severe engine damage, it is critical that the timing and fuel mixture are correct. Detonation (spark knock) caused by excessive ignition timing, or too high of a compression ratio and/or a lean condition in the carburetor can destroy pistons, rings, and bearings in a short period of time. These conditions coupled with high engine rpm can literally destroy an engine. Engine speeds in excess of 6,000 rpm are totally unnecessary with a blower, and can be extremely detrimental. A roots supercharged engine will make maximum torque at a relatively low engine speed.

This supercharger is intended for use on engines with compression ratios of up to 9.50:1 with a maximum blower pressure of 5-6 psi. Higher boost pressures will require lower compression ratios or a boost retard.

See the operation section of these instructions for details of distributor timing and carburetor modifications.

The supercharger, when installed correctly, will not cause any damage to an engine in good operating condition, as long as engine knock, or ping, is controlled. The supercharger should not be used on any engine that is not in good operating condition, or that does not have adequate oil pressure.

**Precautions before beginning installation:** One of the most important aspects of an engine that is to utilize a supercharger is its overall condition. This supercharger is not a cure all for an ailing engine, and may cause an engine already in poor shape to fail. The chosen engine should first be double-checked on the following points:

**1. OIL PRESSURE.** A supercharger increases cylinder pressure, which increases the loading on the connecting rod and main bearings. As long as there is adequate oil pressure, no difference in bearing life should be expected. DO NOT ASSUME that because the engine oil light does not come on that there is adequate engine oil pressure. We strongly recommend that your engine be able to maintain a MINIMUM OF 20 PSI OIL PRESSURE AT IDLE, and more as engine RPM increases. THIS SHOULD BE CHECKED WITH A GAUGE. Use of a slightly higher viscosity oil may be required. Do not resort to an "oil thickening" additive to achieve the recommended oil pressure. Repair the problem before installing the supercharger.

**2. COMPRESSION RATIO, RING CONDITION, AND COMPRESSION PRESSURE.** An engine being considered for a supercharger should not exceed 9.5:1 compression ratio. Exceeding this limit requires a reduction in the amount of boost, water injection, race fuel, or excessive spark retarding to prevent detonation (engine knock) and its destructive results on the engine.

Performing a compression or leak down test before installation is also a good idea. This will help determine ring condition and valve seating. An engine with one or more cylinders reading 10-15% lower than the rest should have this condition checked and repaired before supercharger installation. Check the factory service manual for proper procedures and readings.

<b>EFFECTIVE COMPRESSION RATIO CHART</b>												
<b>Comp. Ratio</b>	<b>Blower Boost Pressure (lbs. per square inch)</b>											
	<b>2</b>	<b>4</b>	<b>6</b>	<b>8</b>	<b>10</b>	<b>12</b>	<b>14</b>	<b>16</b>	<b>18</b>	<b>20</b>	<b>22</b>	<b>24</b>
<b>7.0</b>	8.0	8.9	9.9	10.8	11.8	12.7	13.6	14.5	15.3	16.2	17.0	17.9
<b>7.5</b>	8.5	9.5	10.6	11.6	12.6	13.6	14.6	15.7	16.7	17.8	18.6	19.5
<b>8.0</b>	9.1	10.2	11.3	12.4	13.4	14.5	15.6	16.7	17.8	18.9	19.8	20.9
<b>8.5</b>	9.7	10.8	12.0	13.1	14.3	15.4	16.6	17.8	18.9	19.8	20.9	21.9
<b>9.0</b>	10.2	11.4	12.7	13.9	15.1	16.3	17.6	18.8	20.0	21.2	22.4	23.6
<b>9.5</b>	10.8	12.1	13.4	14.7	16.0	17.3	18.5	19.8	21.1	22.4	23.6	24.8
<b>10.0</b>	11.4	12.7	14.1	15.4	16.8	18.2	19.5	20.9	22.2	23.6	24.8	26.0
<b>10.5</b>	11.9	13.4	14.8	16.2	17.6	19.1	20.5	21.9	23.4	24.8	26.2	27.6
<b>11.0</b>	12.5	14.0	15.5	17.0	18.5	20.0	21.5	22.9	24.5	26.0	27.5	28.9

The above chart shows the **effective** compression ratio of your engine, which combines the static compression ratio with the amount of supercharger boost. Note that for most street applications with 92 octane pump gas, you should keep your effective compression ratio below about 12:1. On marine engines, you should keep the effective compression ratio below about 11.5:1. For added protection against possible engine detonation (knock), we strongly recommend using a boost retard system.

**3. RADIATOR CAPACITY.** This supercharger, under boost conditions, permits your engine to convert air/fuel mixture into heat at a greater rate than stock, which produces more heat and, therefore, more power. Sustained periods of wide open throttle driving will raise the temperature of your engine. If your radiator is sized correctly for your stock engine, it should pose no problem with the supercharger. Where radiator cooling capacity may be marginal, we recommend that, prior to the installation of your Holley supercharger, you increase the cooling capacity, either through enlarging the radiator or adding auxiliary fans.

**4. IGNITION QUALITY.** Any engine being considered for use with a supercharger should undergo a general tune-up prior to the installation. Any ignition component in questionable condition should be replaced before supercharger installation. Missing, cross-firing, or electrical leaks should be carefully checked and repaired. Modification to the spark advance curve may also be necessary as discussed in the operation section of these instructions. We do not recommend a point type distributor on a blower motor, use only an electronic distributor.

## DISASSEMBLY

**STEP 1.** Drain the cooling system. Remove the upper radiator hose and put it aside. Remove the thermostat housing and the thermostat. Disconnect the heater hoses that are attached to the intake manifold. Scrape any gasket material from the thermostat housing. Disconnect the battery.

**STEP 2.** Loosen and remove all accessory drive belts from the engine. Remove the alternator or alternator brackets if any of the brackets are attached to the intake manifold. Remove any other accessory or accessory brackets that are attached to the intake manifold. Remove the fan from the water pump.

**STEP 3.** In many cases it will be easier to install the lower pulley to the crankshaft if the radiator and/or the fan shroud is removed from the vehicle.

**STEP 4.** Remove the distributor and spark plug wires from the engine, noting the position of the distributor and rotor before removal to permit easy reinstallation of the distributor. If the distributor uses a separate coil mounted on the intake manifold, remove the coil and its mounting bracket.

**STEP 5.** Disconnect the throttle linkage or cable from the carburetor. Disconnect the transmission linkage, if any, from the carburetor. Disconnect the fuel line from the carburetor. Temporarily plug the fuel line. Disconnect any other linkage or wiring that is connected to the carburetor or intake manifold.

**STEP 6.** Remove the bolts holding the intake manifold to the cylinder heads and remove the intake manifold. Remove all traces of the old gaskets and sealer from the cylinder heads and cylinder block. If the same carburetor is to be used with the supercharger, remove it from the intake manifold and set it aside.

## INSTALLATION

**WARNING:** Be very careful that no foreign objects are allowed to enter the supercharger. Anything that comes between the rotors and the housing or between the two rotors can cause serious damage to the supercharger. Do not remove the covering from the outlet port of the supercharger until just before it is bolted to the intake manifold. Do not remove the covering from the intake port until the carburetor is ready to be bolted on.

**STEP 1.** Remove the bolts that secure the crankshaft pulley to the damper. The center bolt from the damper must also be removed on small block Chevrolet V8s. Install the supplied supercharger drive pulley together with any spacers that are supplied with the kit inside of the stock stamped steel crankshaft pulley. Fit the pilot on the pulley or spacer into the center of the stock steel pulley, and the pilot of the drive pulley into the spacer, if there is one, and align the bolt holes. Put the supplied bolts through the pulley and spacer (if there is one) into the crankshaft. Use thread sealer on these bolts. Tighten the bolts. The small block Chevrolet kits require the removal of the center bolt that secures the harmonic balancer to the engine, but on other engines the center bolt is not removed. On small block Chevrolet kits install the supplied center bolt and tighten it to 75 ft./lbs. See Figure 1.

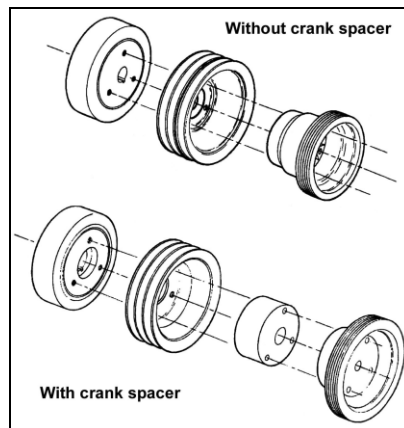


Figure 1

**STEP 2.** Prepare the intake manifold for installation. Install the thermostat into the manifold, and bolt on the thermostat housing. Use a new thermostat gasket when installing the thermostat housing and always use a thermostat or a water restrictor.

Remove the heater hose fitting(s), water pump bypass fittings and the temperature gauge sender from the old intake manifold and install in the similar location in the Holley intake manifold. Install pipe plugs in the unused water opening(s) in the manifold. The 1/8" pipe threaded hole on the manifold is for a manifold pressure gauge and the distributor vacuum advance/boost retard. If a gauge is not being used, this hole should be plugged with a 1/8 NPT pipe plug.

**STEP 3.** Install the supplied new intake manifold gaskets. Use the original intake manifold hold down bolts. If the distributor goes through the intake manifold, check that it fits correctly before tightening the manifold bolts. Leave the distributor in place while the bolts are being tightened. Tighten the intake manifold hold down bolts in the sequence specified by the manufacturer and to their specified torque. It is important to follow the tightening sequence and torque readings accurately to ensure that the manifold is not distorted. In some cases where there is a tight clearance next to a manifold bolt, 12 point or socket head screws may need to be used.

## **TOOLS REQUIRED:**

Ratchet or Speed Handle  
Torque Wrench (100 lb./ft.)  
Sockets 7/16", 1/2", 9/16", & 5/8"  
Extensions 3" or 4"  
Open End/Box Wrench 3/8", 7/16", 1/2", 9/16", & 5/8"  
Allen Wrench 3/8"  
Gasket Scraper

Small block Chevrolet and Ford blower kits with the 144 cid blower have provision for an exhaust crossover for manifold heat and exhaust gas recirculation (EGR). There is a mounting pad on the Holley intake manifold for the EGR valve. A block off plate is installed on the pad that can be removed to mount the EGR valve if it is being used. The exhaust gas for the EGR valve comes from the exhaust heat crossover in the intake manifold. If you are not using the EGR valve and if you do not use the vehicle in extremely cold conditions, the exhaust crossover passage can be blocked with steel shims at both cylinder heads. The driveability of the supercharger is very good without exhaust heat under all but the very coldest conditions. If you block the exhaust heat crossover, also secure the exhaust heat valve in one of the exhaust manifolds in the open position. Blocking the exhaust heat will provide approximately 10-15 HP gain on an average V8.

**STEP 4.** Reinstall radiator if removed. Connect upper radiator hose to the thermostat housing and connect the heater hose(s). You may need to use a different upper radiator hose to clear the supercharger drive housing. Fill the cooling system and check for leaks.

To check the oil level, first tilt the supercharger forward to be sure that oil flows around the front bearing. Then set the supercharger flat on a bench. Use the oil level sight plug window to check the level (Figure 2). The oil level should be up to the bottom of the hole. If the oil level is low, fill with SAE 80-90 gear lube. Because of the internal baffles inside of the gear case, the oil that is poured into the blower will go in very slowly. After pouring more oil into the fill hole wait two minutes before checking the fill level.

**STEP 6 (Poly-V belt).** A bracket for the idler is attached to the drive housing of the supercharger. There are two basic idler assemblies that are used on almost all kits. The idler for blowers with an offset input (used on Ford V8 engines to clear the distributor) have a fixed idler and a spring loaded idler. The spring-loaded idler is bolted to the cast mounting bracket (Figure 4). Both types of mounting brackets have a number of holes in them for locating. Only two of the holes are used for the mounting bolts for the spring loaded idler/tensioner. These holes allow for several different locations for the idler assembly, and are used for different sizes of driven (upper) pulleys.

The idler assembly should be bolted to the support bracket with the two Allen head screws supplied with the kit. The preliminary location for the spring loaded idler is shown on the supplemental instructions for the particular blower kit. The two screws that hold the spring loaded idler in place go through either two holes in the upper row or two holes in the lower row on the support bracket and then screw into either the upper or lower two tapped holes on the idler mounting pad. Mount the idler and tighten the screws, but do not use the thread sealer at this time. The supercharger should now look like Figure 2. Be sure that the bolts securing the support bracket to the drive housing are also tight. The nut on the threaded rod extending from the end of the idler assembly should be fully tightened to pull the idler all of the way in.

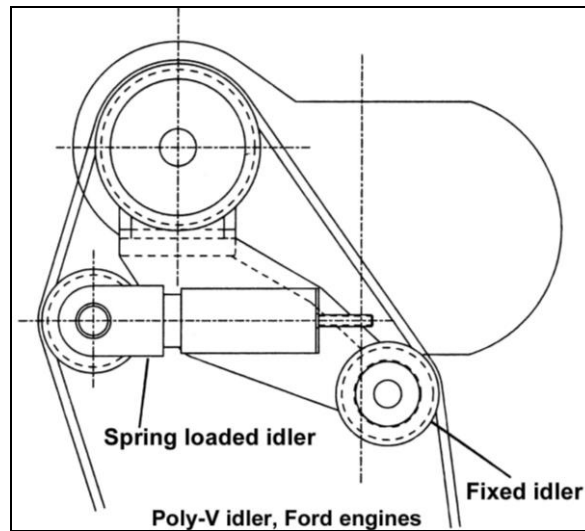


Figure 2

**STEP 7.** Remove cardboard cover from the bottom of the supercharger and clean the surface. Check the flatness of the intake manifold by placing the supercharger on the manifold and rocking it. If the manifold is flat, the supercharger will not rock. On older or rebuilt engines there may be some rocking. If there is more than .010" rocking, the supercharger housing may become distorted when it is bolted down. This can be checked by placing a feeler gauge between the bottom of the rotor housing and the intake manifold or by using a straightedge.

A gasket is used between the intake manifold and the blower on all blowers. This has been replaced with a gasket for better sealing. Some intake manifolds may have a machined groove for an O-Ring, but these will seal correctly with the supplied gasket.

Install the three 6-3/8" and one 8" studs through the mounting holes in the supercharger. Put the supplied flat washers under the heads of the bolts. Use thread sealer on these bolts. Tighten the bolts or nuts. Do not tighten the bolts or nuts to over 10 ft./lbs., or the threads in the intake manifold may strip, or the blower may lock up.

If the manifold is not completely flat, there will be an increase in the torque required to turn the blower, usually at ninety degree intervals in each complete revolution of the input shaft. If the torque to turn the input shaft is not over 25 in./lbs. at these tight spots, the PTFE seals will wear in during the first few miles of driving. If the turning torque is over 25 in./lbs., then loosen one hold down bolt at a time to see which one is causing the blower to bind up. Leave this one bolt at a lower torque level, but at least 5 ft./lbs. for the Powercharger, while the blower is being run in and tighten it later when the PTFE has seated.

**STEP 8.** Reinstall the stock brackets and accessories that attach to the intake manifold. The manifold is equipped with mounting bosses to accommodate most standard OEM parts from your stock manifold. Connect heater hoses and any other plumbing that connects to the manifold.

**STEP 9.** Install and tighten the accessory belts. Install the Poly-V belt over the lower drive pulley, driven pulley, and idler pulley(s). Loosen the nut on the threaded rod on the back of the idler to let the idler pulley tension the belt. When the nut is loose, measure the distance between the pulley support and the end of the fixed tube of the idler as shown in Figure 3. This dimension should be between .30" and .50" (5/16" and 1/2"). If the measured dimension is outside of this range, the idler will have to be moved in or out. Due to manufacturing tolerances on belts, the final position of the idler may be different than the preliminary location.

After the idler is correctly located and the dimension is between .30" and .50", tighten the nut on the threaded rod to remove tension from the idler. Then apply the supplied thread sealer to the two mounting screws and tighten securely. Remove the nut from the threaded rod and leave it off.

On some late model engines the idler may interfere with the alternator. If this happens you will need to use a slightly longer alternator belt.

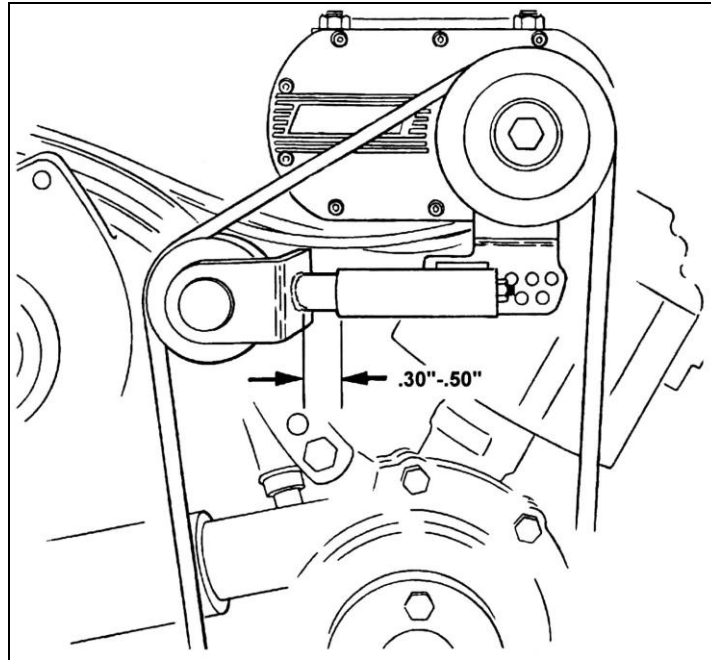


Figure 3

**STEP 10.** Install the fan if required. It may be necessary to put a fan spacer between the fan and the water pump so that the fan will not hit the supercharger drive belt. Allow at least 3/8" between the fan blades and the rear side of the radiator and fan shroud to avoid contact. You may need to modify an available fan spacer to achieve proper fan clearance. We do not recommend using a large viscous drive clutch fan with a blower. The addition of a fan spacer to the system together with the higher engine speeds frequently used with a supercharger seems to aggravate the possibility of breakage of the water pump. A lighter weight flex fan is recommended, particularly for truck usage. Also make sure that the pump pulley, spacer and fan assembly are concentric and balanced.

Some applications may not have enough room for a conventional fan with the supercharger installed. In this case electric cooling fan(s) can be used.

**STEP 11.** Remove the cardboard cover(s) from the top of the blower. Install the carburetor on the top of the supercharger. If a spreadbore is being used install a carburetor gasket at least 1/8" thick, preferably the stock GM carburetor spacer/insulator. This spacer/insulator assures a complete seal between the carburetor and the top of the blower. Some gaskets have a channel at the back that can cause a vacuum leak. Check the carburetor gasket and spacers that you are using to be sure that they fully seal to both the bottom of the carb and to the top of the blower. Holley spread bore carburetors will not always seal to the top of the Holley blower using standard gaskets. If there is an air leak between the carburetor and the blower, the engine will not run correctly and it will probably be lean. Be sure to use a cork or rubber gasket between the air cleaner and the carburetor, or excessive noise may result.

Check to see that the secondary throttle blade of the spreadbore carburetor can open fully without hitting the blower. The 1/8" gasket or spacer should be enough to avoid this problem, but it should be checked to be sure. If a Holley carburetor with the REO accelerator pump is used, it may be necessary to use two gaskets, so that the pump will not hit the supercharger housing. Check all carburetor secondary throttle plates in the full open position to make sure they don't hit the blower housing. If they do, space the carburetor up with the appropriate spacer or gaskets. If you have adequate hood clearance it's not a bad idea to utilize a non-metallic spacer between the carb and blower as a heat insulator. These are available from several manufacturers.

**STEP 12.** Connect the throttle linkage to the carburetor. Some cable throttle linkages and most rod-type linkages will require reworking to properly operate the throttle lever. Be sure that the carburetor is wide-open when the accelerator pedal is pushed to the floor, and that the throttle closes fully when the accelerator pedal is released.

Vehicles equipped with a TH200, TH200-R4, TH700-4R, C-3, AOD, or A4LD transmission have the shifts controlled by a mechanical linkage or cable between the carburetor and the transmission. This linkage or cable must be connected to the carburetor in exactly the same manner as the stock vehicle for the transmission to operate correctly. On GM transmissions the proper operation of the throttle cable is essential for correct operation and life of the transmission. Vehicles equipped with TH350, C-4, C-5 or C-6 transmission use a mechanical linkage or cable between the carburetor and transmission to control transmission kickdown. These cables and linkages must be adjusted for correct operation of the kickdown at wide-open throttle. The TH400 transmission uses an electric switch to control kickdown.

If your vehicle is equipped with a TH-350 or TH-400 automatic transmission, the shifts are controlled by a vacuum modulator that senses manifold vacuum, while kickdown is controlled by linkage, a cable or a switch. In most cases the vacuum modulator will work satisfactorily when hooked up to the carburetor.

**STEP 13.** Run a fuel line from the fuel pump to the carburetor. Be sure that the fuel line is away from the exhaust or any moving parts and that it is well secured. Use only approved fuel line. Install a new fuel filter between the fuel pump and the carburetor. See the Holley Supercharger Technical Manual for fuel line and pump sizes.

**STEP 14.** Recheck the distributor and install the spark plug wires. Be sure that the distributor is installed in the same position that it was in when it was removed. Use the distributor hold down clamp from the old manifold. A stud can be used to secure the hold down clamp. Incorrect ignition timing can cause backfiring, which may result in severe blower damage. See the Holley Supercharger Technical Manual for timing tips.

**STEP 15.** Connect power brake vacuum hose and other vacuum hoses to the vacuum fittings on the carburetor or to the port on the passenger's side of the rotor housing under the carburetor. (The pipe plug must be in this port if it is not connected to a vacuum line.) The power brakes must not be connected to the intake manifold. The crankcase vent hose (or the PCV valve) must have a separate vacuum connection to the carburetor or to the port on the rotor housing. The crankcase vent must not be connected to the same vacuum fitting used for the power brakes or for any other vacuum accessory. All other vacuum needs can be connected to one fitting, but the crankcase vent must be separate. The power brakes and other accessories will not work correctly if they are connected to the same fitting as the crankcase vent.

If a manifold pressure gauge (boost gauge) is used, it should be connected to the intake manifold. If a boost retard system is used, it also connects to this port. Use a T fitting if both a gauge and boost retard are connected in this location.

**STEP 16.** Install an air cleaner(s). The engine should not be run for any length of time or the vehicle should not be driven without an air cleaner. Otherwise dirt particles may damage the supercharger and will damage the engine.

**STEP 17.** Start the engine and let it idle. Look for gasoline, coolant, oil or vacuum leaks. There may be a noise similar to a misadjusted tappet coming from the supercharger, if there is rubbing between the PTFE seals and the housing. This noise may take a few thousand miles to go away as the PTFE seats. Check that the blower drive pulley on the crankshaft is running true and that the blower drive belt is also running true. Set the spark timing.

**STEP 18.** Let the engine idle for 5-10 minutes before driving the vehicle. (If the blower is being installed on a newly built engine, the engine should be broken in the normal manner. (See your cam instruction manual.) Do not use wide-open throttle, until you are sure the engine, transmission and BRAKES are working properly. Keep the engine speed down for the first 20 minutes of driving to allow the PTFE to properly seat. Once the engine is warm, and the PTFE is properly seated, give the vehicle a few full throttle bursts. The boost should come immediately, rising to its peak level above 4,000 engine rpm, if you've selected the proper size driven pulley for your engine displacement. If the boost reading is low, check the low boost section of the Technical Manual.

After a short test drive, check again for leaks, particularly for gasoline leaks.

## TECHNICAL MANUAL

The purpose of this section of the installation instructions is to provide the owner with an overview of mechanically driven superchargers - their operation, characteristics and advantages. This section points out what to expect from your blower and how to get the most from your blower in longevity and performance.

These superchargers have good efficiency at speeds and pressures normally used on the street. These Holley blowers are not designed as a full race blower, but rather a compact and lightweight system, which will install on your engine with little or no modification

## OPERATION

When driving a vehicle equipped with the Holley supercharger you will have more engine torque available at all engine speeds. It will be very responsive to accelerator pedal movement and will not have any of the lag associated with other types of superchargers.

If you have fitted a manifold vacuum/boost gauge, you will notice that under most driving conditions, the gauge will remain in the vacuum range. It will show a manifold boost from about half to wide-open throttle (WOT). The manifold boost at WOT will change with engine speed, being the greatest at high engine speeds. There will be enough boost in the low to mid speed range to greatly improve the acceleration of the vehicle.

There will be very little noise from the supercharger, except at WOT. Since the Poly-V belt is quiet, it does not add noise to the blower, as a Gilmer belt does. There may be some additional noise from a new blower, while the PTFE seals are seating in.

The supercharger kits are designed to use a single four-barrel carburetor. The original stock carburetor used on the engine can be used with the supercharger. The stock size carburetor will work well with the supercharger, although a higher flow capacity carburetor will usually increase top end power. Stock carburetors are usually more than adequate up to 4,500 to 5,000 rpm with 5-6 psi boost.

There may be a flat spot or hesitation when the throttle is opened quickly with the supercharger, particularly with larger displacement engines. This can be corrected by increasing the volume of the accelerator pump shot. On a Holley carburetor, the REO large accelerator pump kit can be installed.

## HOW IT WORKS

A roots type blower is an air pump. Air from the carburetor side is drawn into the housing by the rotors, pushed to the outlet side, and compressed in the manifold. Each complete revolution of the blower will produce four pressure pulses. These occur when the rotor tips pass the blower outlet port edge.

The quantity of air that the supercharger will move and the displacement of the supercharger is determined by the volume of air that is trapped between the rotor and the housing. Four of these volumes of air are moved every revolution of the blower. If the quantity of air that is pumped by the blower is more than the quantity of air that would normally be drawn in by the engine, the additional air will pressurize the intake manifold and produce boost.

The reason a large engine can produce more torque and power, all else being equal, is that it can convert more air/fuel mixture to energy per revolution than a small engine. A blower simply assists a small engine in "breathing" like a big one. The pressure ratio of the blower is roughly proportional to the ratio of power increase.

## DETONATION ELIMINATION

The increase in engine output with a Holley supercharger does have the potential of causing serious engine problems in one area—detonation, knock, or engine ping. The blower will increase the effective compression ratio of the engine. A 7 psi blower pressure will raise a 7.5:1 compression ratio to an effective 9.8:1 compression ratio. An 8.5 compression ratio will be raised to an effective 11.2:1, and a 10.0:1 compression ratio will be raised to an effective 13.5:1 ratio.

This higher effective compression ratio of the engine makes detonation a potential problem, particularly with the lower octane fuels that are now available. There are several methods that may be used to keep detonation under control, but it is essential that there be no detonation. A very limited amount of detonation will result in severe damage to the engine. A supercharged engine will be much less tolerant of detonation than a normally aspirated engine.

The basic means of controlling detonation are compression ratios, spark advance, fuel mixture and water injection. A lower compression ratio is the best way to control detonation, but this may require building a special engine. For normal street use with the boost pressure in the 5-7 psi range a compression ratio of up to 8.5:1 can be used, although some spark retard may be needed.

Spark retard will always reduce detonation, although it is best for the spark to be retarded only when the supercharger is producing boost and to have more spark advance at part throttle. This improves the part throttle performance and the fuel economy. There are several ways to reduce the spark advance under boost without reducing the part throttle spark advance. We have achieved our best results with 12 to 20° of initial lead with a total lead of 32 to 36°. The advance should be in by 2,000 to 2,500 rpm. Excessive ignition timing will not produce appreciably better performance and can be potentially very harmful.

A richer fuel mixture will reduce detonation, but will have only a limited effect compared to spark retard. It is always desirable to have the WOT mixture on the rich side for any supercharged engine to reduce piston failures.

Octane booster additives can give a substantial increase to the octane of pump fuel. A series of tests were run at San Diego State University where different "octane booster" additives were added to 92 octane Super Unleaded gasoline. The octane number of the fuel was measured on a supercharged CFR engine. The highest measured octane was 104.5 for Moroso 2 additive. They mixed 16 oz. of additive to 22 gallons of gasoline. This is a gain of 12.5 octane numbers. Other additives that were checked gave smaller, but still significant gains in octane. This, however, can be expensive. The Moroso 2 additive in the concentration tested, adds about \$0.65 to the cost of each gallon of gasoline. Higher octane leaded "racing" gasolines with octane ratings of 107 or higher are also available in most areas, but these gasolines are also very expensive. Generally both the racing gasolines and the octane booster additives are too expensive to consider for the everyday street driven vehicle.

## ENGINE COMPONENT RECOMMENDATIONS

It is not necessary to build a special engine to go with a Holley supercharger if the boost is limited to the 5-7 psi range. Above that boost the engine will need a lower compression ratio. Even a specially built engine does not need to use O-rings between the head and block, dead soft copper gaskets, or other "tricks" used with blown engines. The engine requirements for using a blower are much simpler than most people expect. Good oil pressure, proper cylinder sealing (rings and valves) and oil control, an adequate radiator - usually the factory original, an ignition system in proper working order, and a properly sized carburetor are all that one needs to effectively use a supercharger.

For a higher boost (9-12 psi) engine, other than forged low compression pistons, there are few special parts required. It is not necessary to use forged crankshafts or four bolt bearing caps on a blown engine, since the high loading of these parts comes from high engine speeds, not high cylinder pressures. A supercharger produces extra power in the normal speed range and does not have to be turned to high engine speeds, as is normally required for a high output unblown engine. We have found that

Felpro head gaskets with a wire sealing ring work very well in a blown engine. We have also had very good results with Lunati Pro-Series or Sealed Power Speed Pro Plasma Moly-coated piston rings.

## **CAMSHAFTS**

High overlap camshafts are actually detrimental to a supercharged street engine's performance. The longer the exhaust and intake are open at the same time, the more usable air/fuel mixture is blown out the tailpipe. We have found that a cam with a 114° lobe centerline works best on a street driven vehicle. When choosing a cam profile to work well with a blower, moderate lift and duration are desirable, but excessive overlap is undesirable. Cams generally produce additional power only at higher engine speeds usually above 4,500 rpm. If higher engine speed performance is not desired, a stock cam is actually better than a modified cam.

Valve springs are more critical on a blown engine than on a normally aspirated one, since you have supercharger boost pressure acting on the backside of the intake valve, trying to push it open. You need stronger valve springs with a supercharger. Special valve springs are included with all Holley cams.

## **CYLINDER HEADS**

Enlarging and polishing the intake ports of a cylinder head is of medium value on a supercharged street engine. While it cannot hurt performance, whatever gain you may see from this type of modification may not be worth the trouble and expense. A free breathing exhaust system has always been a big performance plus, and is a good idea with a supercharged engine. Engines with small stock exhaust ports (such as 302 and 351-W Fords) will improve with opened up exhaust ports. Headers do not provide as great an increase with a blown engine as on a normally aspirated engine, but do help performance. Larger valves only increase the engine output above 4,500 rpm or so, but they do not hurt performance at any speed. Increasing the exhaust valve size usually gives greater increases in performance than increasing the intake valve size. Expect to see a boost drop with a good flowing set of heads. Despite the boost drop the engine performance will increase.

## **IGNITION SYSTEMS**

A "hot" ignition system, especially one equipped with a knock sensor, will be an asset to a supercharged engine, especially when producing more than recommended boost. A capacitive discharge, electronic or high-energy system will be a very worthwhile addition to your engine. If you are installing a blower on a late model engine with computer controlled spark advance it is necessary that all elements of the engine computer control system be operational or else the computer may not provide the correct spark advance. If this is not possible it will be necessary to replace the computer controlled distributor with an earlier model for the same engine that has mechanical spark advance in the distributor. You can use either an OEM distributor or an aftermarket performance distributor. We have found that for all of the engines that we have dyno-tested that the best power is obtained with 32 degrees of total spark advance, with the entire advance coming in by 2,800 rpm. This is the maximum power with 108-octane race gasoline. You will probably not be able to use this much advance with pump gasoline. Our tests have shown that dropping the total spark advance back to 25 degrees results in a loss of only two percent of power and torque up to 4,000 rpm and four percent of power and torque at 5,500 rpm. For this small loss in power there will be a considerable reduction in detonation. With a boost retard system, you can use full advance in the distributor and have the spark retarded when the boost comes in.

## **CARBURETION**

Necessary carburetor modifications are minimal with the Holley blower. The installation of a blower increases the distance from the carburetor to the cylinder, which makes a larger volume accelerator pump necessary. If you are using a Holley carburetor, a 50cc accelerator pump kit (Holley PN 20-11) works well. A richer mixture is always desirable on a blown engine to control detonation. The mixture of the secondary side of the carburetor and the WOT or power valve mixture are the more important. Late model "emission" carburetors tend to be jetted much leaner than non-emission or "universal" carburetors. These carburetors need larger jets on both the primary and secondary sides.

We have run tests with all makes of four barrel carburetors on supercharged engines and received good results with all of them. OEM carburetors will work well on engines that are used in the low and mid speed range. These carburetors usually have a lower air flow capacity than is needed for high engine speed running or for boost of over 7 psi. If a new carburetor is being purchased for a supercharger, we would recommend a Holley carburetor, mainly because of the wide range of sizes available and the easy availability of jetting and other parts for these carburetors. Detailed information of the operation and tuning of Holley carburetors is available in the book "Holley Carburetors and Manifolds" by Mike Urich and Bill Fisher published by H. P. Publishing.

The rated flow capacity of a carburetor is a way of measuring carburetor size. It is the quantity of air flow through the carburetor that gives a specified pressure drop across the carburetor: usually 1.5 inches of mercury for four barrel carburetors and 3.0 inches of mercury for two barrel carburetors: the higher the flow rating, the bigger the carburetor. Or, the bigger the carburetor the lower the pressure drop across it at any given air flow. A carburetor can flow more air than its rated capacity, but when it does so it has a greater pressure drop across the carburetor. The pressure drop through the carburetor reduces the pressure into the supercharger and also reduces the boost pressure in the intake manifold. Therefore the bigger the carburetor the higher the blower boost and the higher the maximum power. The problem with this is at the other end of the air flow range. Too big of a



carburetor will have low air velocity through the carburetor at idle and in low speed driving and will give poor driveability. The required air flow capacity for a carburetor on a supercharged engine depends on the displacement of the engine and the boost pressure desired. For single carburetor installations with boost in the 5-7 psi range we recommend that you consider the following carburetor flow capacities:

Engine Displacement	Carburetor Capacity
300 CID	650 CFM
350 CID	750 CFM
400 CID	850 CFM
450 CID	850 CFM

Use the available carburetor size that is closest to what is recommended for your engine size. The carburetor capacities are for 5-7 psi boost. For higher boost levels (10-12 psi) the carburetor capacity should be about 15% larger. We strongly recommend vacuum secondary carburetors for street use, since they provide better low and mid speed driveability than mechanical secondary or "double pumper" carburetors. Air valve secondary carburetors like the Holley vacuum secondary carburetors are normally available only up to 750 CFM capacity. Holley does make an 850 CFM vacuum secondary carburetor that is available only on special order. Holley now offers a 950 CFM carburetor for higher boost applications. This carburetor is good for higher revving big block engines and high boost 350 CID engines. If you need more than 850 CFM the best choice is the Holley 1050 CFM or 1150 CFM Dominator carburetors. These are basically race-only type carburetors and do not have good driveability on the street. The Dominator requires an adapter plate since it has a unique bolt pattern.

If you are using two carburetors on a 250 Powercharger, we recommend that you use two 750 CFM vacuum secondary carburetors for 350 cid engines and two 750 CFM double pumper carburetors for engines up to 460 cid. For larger engines two 850 CFM carburetors should be used. For very high output engines two 1050 CFM or 1150 CFM Dominator carburetors can be used. These carburetors require special adapters and are basically race only carburetors with poor low speed performance.

The two carburetor mounting pads are tapped so that the two carburetors can be mounted either fore and aft or sideways. .

Because the height of the carburetor is raised when the Holley supercharger is installed, the stock air cleaner may not be reusable, or you may wish to install an aftermarket air cleaner. In either case, when selecting an air cleaner, make sure it has provision for PCV inlet and has as large a filtering area as possible. In this case, more is better. Be careful to allow enough room for the choke on the carburetor to operate, without hitting the air cleaner.

## MAINTENANCE

The supercharger is designed for long trouble-free service. The only area that should be checked regularly is the oil level in the gear case. The oil level should be checked every 1,000 miles. If it is below the level of the sight plug, SAE 80/90 gear oil should be added.

At the same time the oil is checked the drive belt should be examined. Ploy-V belts should be replaced, if it shows signs of excessive wear on the inside surface or if it is slipping excessively. In normal use, the belt should last a minimum of 20,000 miles. You can detect excessive slippage by the black powdered rubber collecting on top of the idler assembly. Gilmer belts should be replaced, if they show signs of excessive wear. In normal use, a Gilmer belt should last a minimum of 25,000 miles. Be sure to check the Gilmer belt tension. There must be a minimum of 1/2-5/8" slack in the belt when the engine is hot, or the blower or crankshaft can be over stressed.

## TECHNICAL QUESTIONS

During the development of this supercharger, we encountered a variety of popular misconceptions and questions related to roots type superchargers. Most of the questions arise as a result of lack of familiarity with supercharging in general. The questions answered here apply to most supercharger systems, not just the Holley unit. Below are some of the most asked questions and some answers.

**What is the difference between a roots type supercharger and a centrifugal type supercharger?** A roots (or positive displacement) type supercharger pumps the same quantity of air fuel mixture to the intake manifold for each revolution of the blower at any speed. This gives the same theoretical boost pressure at any engine speed. In actual practice this is not quite true. There is internal leakage in the blower due to the clearances between the rotors and the housing. This results in less boost below 2,500 engine rpm, but relatively constant boost pressure at higher speed. A centrifugal blower on the other hand generates boost by speeding up the air and forcing it into the intake manifold, similar to a turbocharger. The quantity of air it moves depends on the speed that the blower is running. The boost pressure increases with engine speed. This results in much less boost at lower speeds.

If both a roots blower and a centrifugal blower are set up to give 10 psi of boost at 6,000 engine rpm, the roots blower will have about the 10 psi boost between 2,500 and 6,000 engine rpm with the boost dropping off below 2,500 rpm. The centrifugal blower will have 10 psi boost at 6,000 engine rpm, about 7 psi boost at 5,000 rpm, 4 psi at 4,000 rpm and 2.5 psi boost at 3,000 rpm.

Since the increase in engine torque over the unblown engine is relative to the boost, the roots blown engine will have a major advantage in torque and acceleration between 2,000 and 5,000 rpm.

**When does the Weiland supercharger produce boost?** The boost pressures mentioned above are the wide open throttle boost numbers. If the throttle is less than wide open there will be less boost or even a vacuum in the intake manifold. When cruising at 60 mph there will be 10-15 inches of vacuum in the intake manifold, the same vacuum that the vehicle would have without a blower. To get the desired boost from the blower, the throttle must be wide open.

**How much boost will I get?** The wide open throttle boost of a roots blower will depend on the displacement of the engine the displacement of the blower and the drive ratio of the blower. Changing the blower driven pulley (the upper pulley) changes the drive ratio and therefore changes the boost. Other factors such as camshaft timing, valve size and port size will also change the wide open throttle boost. Check with the Holley supercharger catalog or customer service to get the specific boost level you need.

**NOTE:** The equation for figuring boost with a certain size blower on a certain size engine, and different pulley combinations are as follows:

$$\frac{[(25.58) \times (\text{Blower Displacement}) \times (\text{Blower Drive Ratio})]}{(\text{Engine Cubic Inch Displacement})} \quad (-) \quad 14.7 = \text{BOOST}$$

**EXAMPLE:** 350 cu. In. with a 144 blower and 1.95 - 1 drive

$$25.58 \times 144 \times 1.95 \mid 350 = 20.52 - 14.7 = 5.82 \text{ psi of boost}$$

**BLOWER DISPLACEMENTS** (cubic inch displacement for one revolution of rotors)

142 = 142	6-71 = 411
144 = 144	8-71 = 436
174 = 174	10-71 = 469
177 = 177	12-71 = 497
250 = 250	14-71 = 522
256 = 256	
420 = 420	

### **BLOWER DRIVE RATIO**

Divide the lower pulley diameter by the top pulley diameter (serpentine style).

This should be all the information you need to figure boost. Keep in mind that these are generic figures, because there are too many variables when you include barometric pressure, humidity, air temperature, and engine configuration. There is no way to take these factors into account with an equation.

**What maintenance will the Holley blower require?** Very little. Check the oil level in the gear case reservoir at 1,000 mile intervals. Change the oil every 7,500 miles. Check the belt condition at the same time. Belt life should be at least 20-40,000 miles

**Will the supercharger give me better mileage?** No. While the supercharger under normal driving conditions has proven to be no real detriment to gas mileage, you should not expect any improvement. Because a supercharger, under full throttle conditions, makes a small engine perform as a larger one might, the more you use full throttle, the more your gas mileage will suffer. We have found that for a typical street driven car the fuel mileage will decrease by about 4% once the novelty of the supercharger has worn off.

**Should I use a different heat range spark plug when running the Holley blower?** Usually a one or two step colder plug is beneficial. Too high a heat range can lead to pre-ignition under boost conditions.

**What ignition timing works best?** This will vary, depending on the boost pressure, compression ratio and fuel octane level. We have found, for a good starting point, that good results are achieved with 16 degrees of initial lead with a total lead of 32 to 35 degrees. Excessive lead will not produce appreciably better performance and will potentially be harmful. Also having the timing come in too soon may cause detonation. The full advance should be in no sooner than 2,000 rpm and no later than 2,800 rpm.

**Why do my exhaust pipes run red hot?** Either incorrect ignition timing or a lean mixture can cause this. Without enough initial advance the engine will run hot and the exhaust pipes will glow in the dark. Check that your timing is within the ranges listed in the ENGINE COMPONENT RECOMMENDATIONS section.

**What is the major advantage to a Weiland Supercharger?** An instant, responsive performance increase, without major engine modifications. The Holley supercharger is complete as shipped. The horsepower per dollar ratio is one of the highest for the aftermarket industry. Tests run show a gain of 40% in peak horsepower just by the addition of the Holley supercharger. The responsiveness of the vehicle with the supercharger is also very impressive.

**How long will the Weiland supercharger last?** We have seen several superchargers that have run over 100,000 miles with no problems and one that has run 127,000 on a big block Chevy. There are very few parts in the supercharger that can wear out, so you should have many trouble free miles with the Holley supercharger

**If the drive belt breaks is the car immobile?** Not at all. Simply drive the car. The blower should spin freely. The car won't have as much power, but it will not be immobile. If for some reason the blower seizes, remove the belt. The car can be driven, due to the leakage around the blower rotors. The car will accelerate slowly, but it will get you home. Belt breakage is extremely rare.

**Why is there no pop off valve on the manifold of Poly-V drive kits?** We do not incorporate a pressure relief (or pop off) valve in our superchargers driven by a Poly-V drive belt. We use a spring-loaded idler on a multiple rib Poly-V belt. Our intake manifold has a small volume. This limits the force of any backfire. If a backfire does happen, the belt slips and no damage occurs. A severe backfire may result in damage to the supercharger.

**What kind of fuel should I use?** Always use premium fuel. If available, leaded premium is the best for vehicles that are not restricted to "unleaded fuel only". With a water injection unit, a knock sensor or a boost retard system slightly lower octane fuel can be used, but should be avoided if possible. When using a blower, especially under heavy load conditions, the higher the fuel's octane the less chance there is of damaging the engine due to detonation. As the octane rating drops, the need for water injection, spark retarding, or octane-boosting additive increases. High octane is cheap insurance.

**Why do I have a poor idle?** Rough idle or high idle speeds are usually caused by a vacuum leak. It can also be caused by a radical camshaft, incorrect ignition timing or improperly adjusted carburetor(s).

**What happens if I float the valves on my engine?** Floating the valves on a blown engine can be potentially very serious. A blower is actually putting additional pressure on the underside of the valve head (as much as 30 pounds) it is therefore possible to float the valves at a much lower engine rpm than you would if the engine were unblown, especially if the valve springs are a bit weak. Additionally, valve float can produce backfiring. In the event a valve is held open too long with a full charge in the cylinder as well as in the manifold and blower the resulting explosion can damage the blower. We recommend that you maintain good quality valve springs with adequate (not excessive) tension and secondly that you do not over-rev your engine. We feel that 5,500 rpm is a safe limit for most applications.

**What types of gear lube are acceptable for use in the gear case of the Holley blower?** Holley uses SAE 80-90 gear lube in the supercharger. When installing the blower on the manifold, be sure to follow the installation instructions regarding oil level. Synthetic gear oil may also be used.

**Can I run Nitrous Oxide with the Holley blower?** Yes. The power output will be somewhere in the 60% increase range with both the blower and nitrous. The caution we would like to present here is that you should be very sure that your engine components are up to the loads of that kind of power. You should, at least, have the engine components described in the high boost section of these instructions. Also be sure that your fuel lines and fuel pump are up to par for a nitrous system. The nitrous oxide and extra fuel should be injected before the blower, usually between the carburetor and blower, to help cool the blower.

**Will I be able to run propane with the blower?** We recommend against it. We rely on the cooling effect of the fuel vaporizing as it goes through the blower to cool the blower's internal components. Propane is almost completely vaporized as it leaves the carburetor, and contributes nothing from there on to cool the blower. This means that the blower is more likely to run hot and malfunction. Several customers have reported running the Holley supercharger successfully with propane, but we have not actually seen one of these installations.

**Why doesn't my boost level come up to the level advertised?** There are a variety of reasons, most are not directly the fault of the blower. Please see the Low Boost Trouble Shooting Guide elsewhere in these instructions.

**Is there any particular camshaft to use with a blower?** Yes, depending on what kind of driving you are going to do. If the majority of your driving is to be done with the engine below 4,000 rpm, then a stock camshaft will work best. If your driving will take you to the 4,000+ rpm range on a regular basis then you should consider using a camshaft that is specifically designed for use with a blower. Basically you want a cam with more lift and duration on the exhaust side than on the inlet (about 10° more duration) and lobe centerlines at 112-114°.

**Can the camshaft profile make a difference in the amount of indicated boost?** Yes. In our dyno tests we found that for less than 4,000 rpm, the difference in boost and power is negligible. Above 4,000 rpm the difference was quite noticeable. The high-boost level obtained with the stock cam at high engine speeds is deceptive. The blower forcing more air into the manifold than the short duration cam will let into the cylinder causes the high boost level. The air piles up in the intake manifold and gives a high boost pressure. With the longer duration cam, the air can get into the cylinder and produce more power, but the measured boost in the manifold is less.

# LOW BOOST TROUBLESHOOTING GUIDE

## 1. AIR INLET RESTRICTION

- A. **The carburetor is too small.** The power rating of your engine with the addition of a supercharger, should increase about 40%, and the carburetor air flow capacity should be increased to match. Suggestions for the proper carburetor usage are given in this manual. Basically, when a blower is used on an engine, the rate at which the engine consumes air is increased by from 30 to 70 percent. This requires a proportionally larger carburetor. Too small a carburetor will not allow sufficient air to enter the supercharger.
- B. **Carburetor throttle blades are not opening fully.** There are a variety of reasons why you may not be getting wide-open throttle of both the primary and secondary throttle blades when the accelerator is pushed to the floor. Make sure the throttle lever is able to open fully, being unrestricted by the transmission kickdown linkage or throttle cable, by improper accelerator cable and/or linkage geometry, or blocked by other accessories. Make sure that the throttle cable or linkage travel matches the travel required by the carburetor. Check to see if the throttle blades interfere with the blower housing. Have someone step on the accelerator pedal and push it all the way to the floor, with the engine off. If the throttle blades do not fully open, correct this condition before proceeding.
- C. **Air inlet restriction.** Some air cleaners and filters can be extremely restrictive, either by inlet size, filter flow capacity, or the design of the air cleaner itself. If there is any doubt, use a larger capacity air cleaner. Always use a new air cleaner element.
- D. **Air inlet restriction test.** If there is any doubt about a restriction anywhere in the air inlet system, a simple test will show whether there is a restriction. Connect a vacuum gauge or the boost vacuum gauge to the bottom of the carburetor (not the intake manifold). Warm the car up and drive it at wide-open throttle through the rpm range up to at least 5000 rpm. Observe (or have a passenger observe) the vacuum under the carburetor. At low engine speeds, under 2500 rpm, with the throttle fully open, the vacuum under the carburetor should be 1 inch of mercury (1" Hg) or less. At higher engine speeds (2500-5000 rpm), the vacuum should be no more than 2.5-3.0" Hg. The vacuum reading should not be above 4" Hg at wide-open throttle under any full throttle conditions. If you show a higher vacuum than this at wide-open throttle, then check the three items above in A, B, and C.

## 2. Engine Condition and Configuration

- A. **Excessive overlap in the camshaft profile.** Too much overlap can be detrimental to the amount of boost that the blower can produce. When the intake and exhaust valves are both open, the air mixture is easily passed in and out of the cylinder, unused, and out of the tailpipe. A high overlap, or "race" profile camshaft can make an appreciable difference in the amount of boost the blower produces. Not only can an incorrect cam profile hurt performance as compared to a stock cam, but the correct choice of cam can make a marked increase in performance. With the Holley cam, the boost level may go down, but the power will go up.
- B. **Ring and valve condition.** If the piston rings and the valves are leaking or are in poor condition, the boost may be blowing by the rings into the crankcase or out the tailpipe. Please refer to the engine component and condition recommendation section for suggestions on checking the condition of your engine.
- C. **Gasket leaks.** Gasket leaks should show up as a vacuum leak when running the engine at idle. This is not normally a low boost cause, but if the gasket leak is sufficient, the volume of air lost can make a difference. Blower to manifold O-ring and manifold to cylinder head gaskets can let the boost escape, if they are not fully tightened.

## 3. Blower RPM too slow.

- A. **Matching the blower size and drive ratio to the engine size and desired boost is an approximation.** There are other factors that also come into play. Sometimes the most effective method of achieving the advertised boost is to simply run the blower slightly faster than calculated. This holds especially true when the boost is just a couple of pounds short.

**This practice should be limited to a maximum blower speed of 14,000 RPM. Speeds above 14,000 will VOID the warranty. To calculate blower speed, multiply the drive ratio by the maximum engine speed.**

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