

FALCONER V12

SERVICE MANUAL

Thunder Mustang Application

First Edition, Version 1.01

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INTRODUCTION

TECHNICAL DESCRIPTION

The Falconer V12 is a 600-cubic inch (9.83-liter) 90-degree liquid-cooled four-cycle engine with a single camshaft utilizing a pushrod-actuated valvetrain. The cylinder block, crankcase girdle, cylinder heads, valve covers and intake manifold base are all cast aluminum. Both the intake manifold top section and side plenums are cast magnesium. The cylinder block utilizes special alloy, dry iron sleeves, the cylinder heads are fitted with beryllium-copper and iron valve seats, bronze valve guides and stainless steel intake and exhaust valves.

A crankshaft-driven gear drive operates the valvetrain which consists of a roller-hydraulic camshaft, roller-hydraulic lifters, pushrods and dedicated roller-tip rocker arms with adjusters at the pushrod end.

Fuel injection and spark control are maintained by the use of two (2) MoTeC electronic control units (ECUs) and direct-fire ignition (no distributor) for redundancy. The fuel and spark tables (maps) are calibrated and set at the factory to ensure optimum performance throughout the engine's designated power band.

A billet steel Bryant crankshaft, special alloy Carrillo steel connecting rods and forged aluminum pistons comprise the rotating assembly which is dynamically-balanced at the factory to exacting tolerances.

The oiling system used on this variant of the Falconer V12 is dry sump (separate oil tank as provided with Thunder Mustang kits) using a windage tray in the oil pan to provide optimum oil scavenging at all rpm levels. Oiling is controlled by a specially-designed oil pump with high-pressure output, an adjustable oil-pressure regulator and separate scavenge sections.

Cooling for the engine is maintained by a high-flow Stewart water pump. The remote thermostat and radiator and header tank used on the Thunder Mustang complete the cooling system

The Falconer V12 was designed, manufactured and tested to provide excellent horsepower and torque delivery in a wide, useable power band. With its twelve cylinders (6 firings per revolution) the engine is uncommonly smooth.

THIS MANUAL

This manual is a service manual for the Falconer V12 engine variant used in the Thunder Mustang. It is written as a guideline which illustrates some of the special aspects of this engine that differ from other engines such as Small-block Chevrolets. It is assumed that the individual who takes on the responsibility of servicing the Falconer V12 has mechanical skills and competence in working with liquid-cooled internal combustion engines. This manual is not written as an educational guide for the novice or first-time mechanic, and it is highly recommended that people of this skill level seek a more qualified individual to do this work for them.

SPECIFICATIONS

ESSENTIAL DATA

DISPLACEMENT, POWER & SYSTEMS

Type	Falconer V12, 90-degree, 4-cycle
Displacement	600 cubic inch / 9.83 l
Bore & Stroke	4.125" x 3.750" / 104.78mm x 95.25mm
Compression ratio	11.0:1 static
Horsepower	640 @ 5000 rpm
Torque	725 @ 4500 rpm
Fuel system	Fuel injected, pressure feed with bypass
Oil system	Dry-sump with windage tray
Exhaust system	Individual 8-inch authentic "zoomie" pipes

DIMENSIONS & WEIGHT

Overall length <i>(minus PSRU and accessories)</i>	36.9" / 93.73 cm
Overall width <i>(minus PSRU and accessories)</i>	23.50" / 59.69 cm
Dry weight <i>(minus PSRU and accessories)</i>	500 lbs. / 227.27 kg

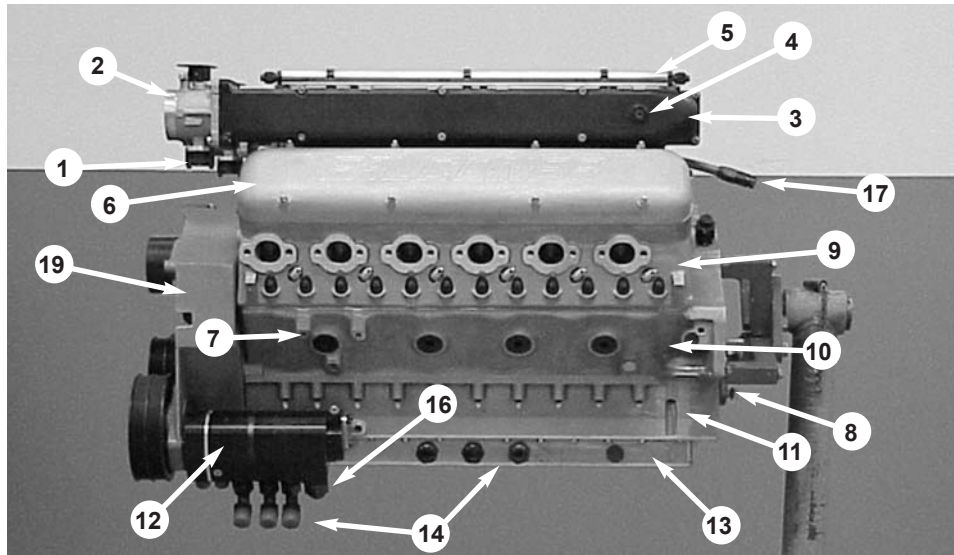
FLUIDS & SPARK PLUGS

Fuel requirement	100-octane low-lead Avgas
Oil requirement	Aero Shell 15/40, AmsOil 20/50
Coolant requirement	Blend varies by seasonal climate
Spark plug requirement	Bosch HR6DS

PRODUCT OVERVIEW

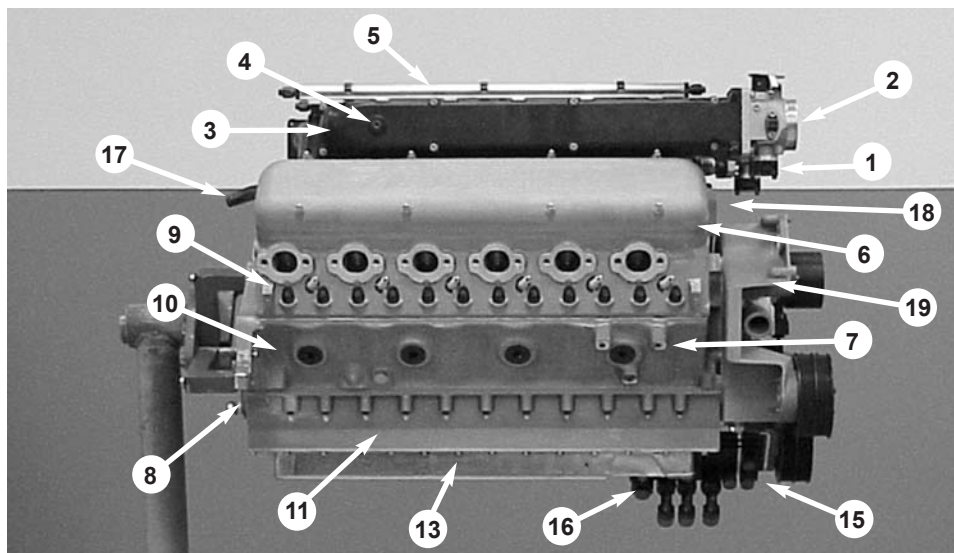
INDIVIDUAL COMPONENT IDENTIFICATION

EVEN-NUMBERED CYLINDER BANK VIEW



- | | |
|-----------------------------------|------------------------------------|
| 1. Throttle Position Sensor (TPS) | 10. Cylinder block |
| 2. Throttle body | 11. Crankcase girdle |
| 3. Intake plenum | 12. Oil pump |
| 4. Vacuum fitting location | 13. Oil pan |
| 5. Fuel rail | 14. Oil scavenge fittings |
| 6. Valve cover | 15. Oil fittings for PSRU |
| 7. Engine mounts | 16. Main oil feed fitting |
| 8. Flywheel flange | 17. Crankcase vent (PSRU end) |
| 9. Cylinder head | 18. Crankcase vent (accessory end) |
| | 19. Accessory drive |

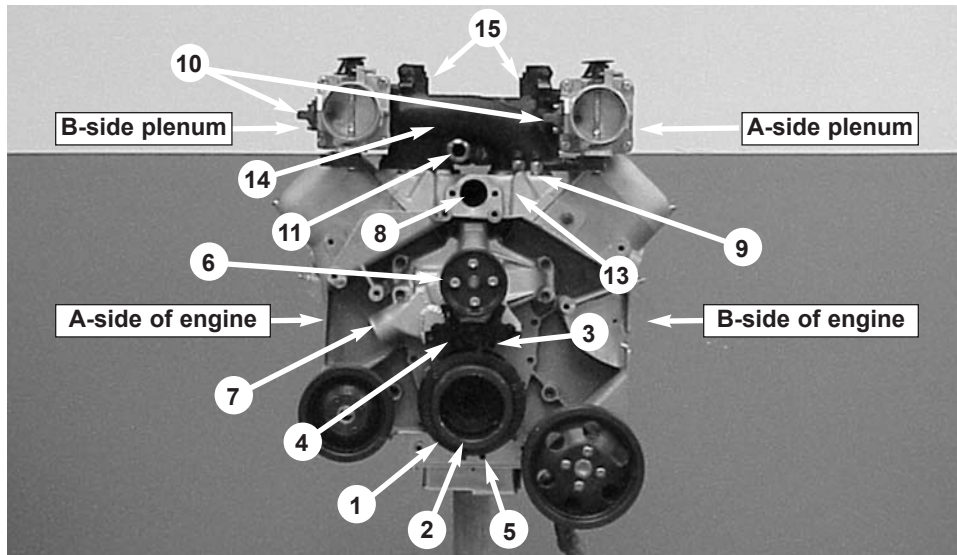
ODD-NUMBERED CYLINDER BANK VIEW



PRODUCT OVERVIEW

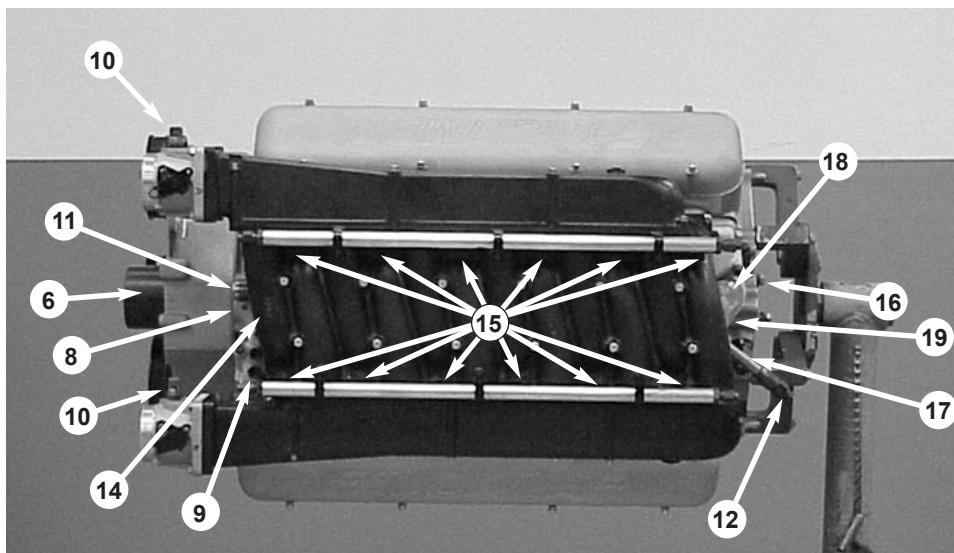
INDIVIDUAL COMPONENT IDENTIFICATION

ACCESSORY-END VIEW



- | | |
|-------------------------------|------------------------------------|
| 1. Dampener | 10. Air temperature sensors |
| 2. Crankshaft pulley | 11. Crankcase vent (accessory end) |
| 3. Ignition trigger "A" | 12. Crankcase vent (PSRU end) |
| 4. Ignition trigger "B" | 13. Intake manifold base |
| 5. Ignition trigger wheel | 14. Intake manifold top |
| 6. Water pump pulley | 15. Fuel injectors |
| 7. Water pump inlet | 16. Flywheel flange |
| 8. Engine water outlet | 17. Main oil feed fitting |
| 9. Engine temperature sensors | 18. Distributor hole plug |
| | 19. Oil pressure fitting location |

TOP VIEW



SECTION 1

INTAKE MANIFOLD & VALVE COVERS

DISASSEMBLY PROCEDURE 1-2

ASSEMBLY PROCEDURE 1-11

SECTION 1

INTAKE MANIFOLD & VALVE COVERS

DISASSEMBLY PROCEDURE

Service, maintenance or general inspection of the Falconer V12 requires the disassembly of some or all components used in its manufacture. General disassembly should be performed “top-down” beginning with the intake manifold and valve covers.

Although this procedure is not extremely difficult, careful and methodical attention must be paid to the disassembly process because of the specialized parts, exacting tolerances, and other unique components used in the Falconer V12.

During disassembly, adequate bench or shelf space, or a multi-level cart should be clean and at the ready. Smaller trays should be used to place the various hardware, fasteners and small parts as the engine is disassembled.

Keep in mind that machined surfaces, mating and sealing surfaces must not be marred or oth-

erwise damaged, so extreme care and handling should be applied to all parts removed from the Falconer V12.

PLEASE NOTE: It is necessary that a suitable engine stand be used during all of the procedures outlined in this manual. The engine, as depicted in this manual, has been readied for disassembly in order to provide the clearest view of the actual engine. The accessory drive system has been removed with the exception of the accessory drive plate, as has the flywheel and drive spline in order to clearly illustrate all key areas of the engine itself.

For specific information regarding the flywheel’s removal and replacement, see Appendix 1: *DIAGRAM 10 - FLYWHEEL TORQUING SEQUENCE* in addition to SECTION 3 - FIGURE 37.

SECTION 1 - DISASSEMBLY

INTAKE MANIFOLD & VALVE COVERS

FIGURE 1



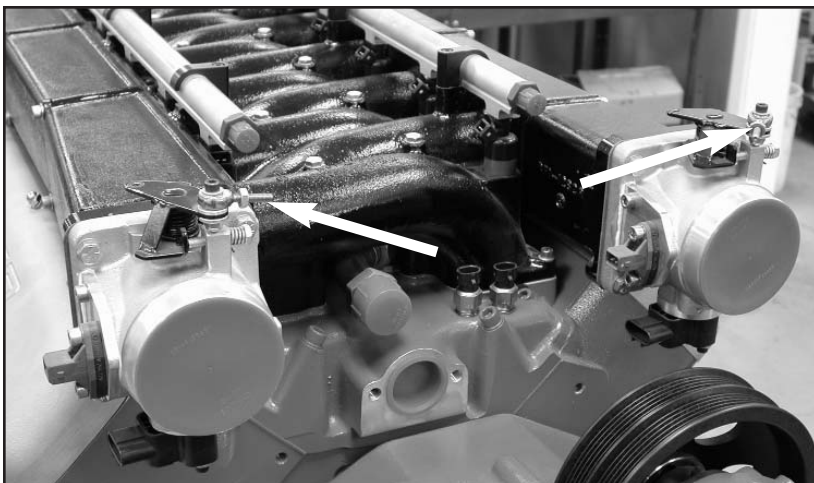
Begin engine disassembly by removing all twelve spark plugs. Use a spark plug socket on a ratchet or speed-handle to loosen each spark plug, then remove them by hand or by using a spark plug rubber as shown. Spark plugs should be kept in order by using a spark plug board and placed back into their respective cylinders upon reassembly.

FIGURE 2

Throttle linkage between the two throttle bodies must be removed prior to any top-end disassembly. Using 3/8-inch end wrenches, loosen the jam nuts on each end of the throttle linkage as shown. The throttle linkage is tapped standard “right-hand” thread on one end and “left-hand” thread on the other. The left-hand thread is marked by the grooves machined into one end of the center hex rod. Make sure not to mistakenly overtighten the left-hand thread instead of loosening it.



FIGURE 3



This view shows the throttle bodies after the center hex rod of the throttle linkage has been removed. Note that the spherical rod ends are left in place, attached to the throttle arms on each throttle body (arrows).

SECTION 1 - DISASSEMBLY

INTAKE MANIFOLD & VALVE COVERS

FIGURE 4

Using a 3/16-inch Allen (hex) socket on a ratchet or speed-handle, loosen each of the intake plenum screws on both sides of the intake manifold. Remove the screws, place them in a tray and keep them with all of the engine's hardware during disassembly. Steady the plenum with one hand as the final bolts are removed, and set it safely aside with the rest of the engine's hardware.

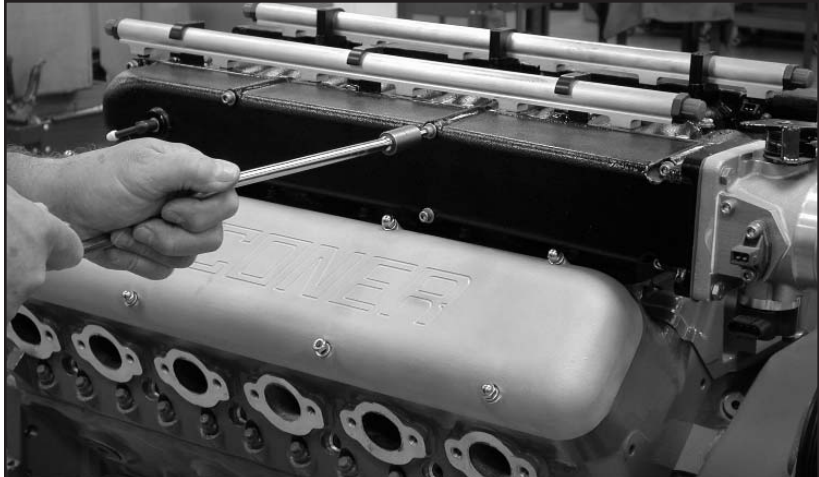
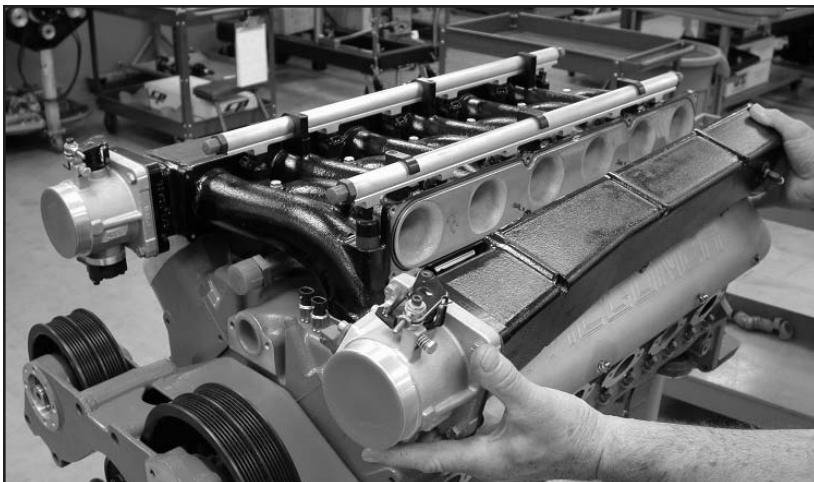


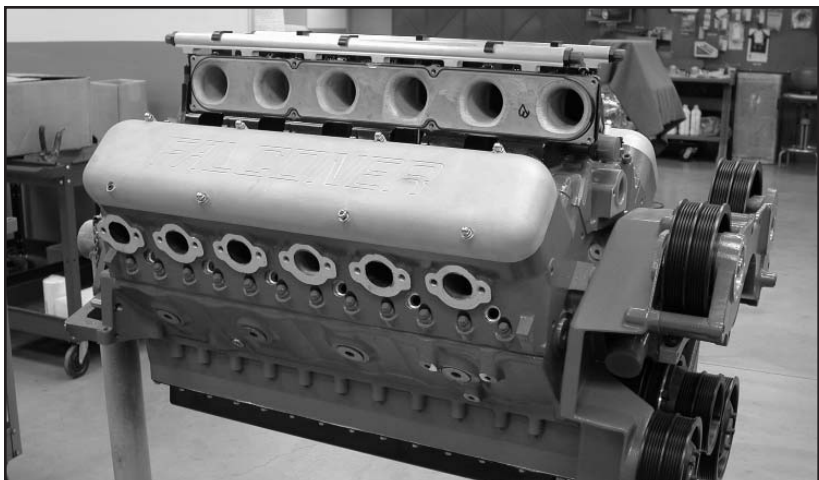
FIGURE 5



After removing the intake plenums, no further removal of components is necessary to remove the manifold top. Fuel rails and fuel injectors should be left in place.

FIGURE 6

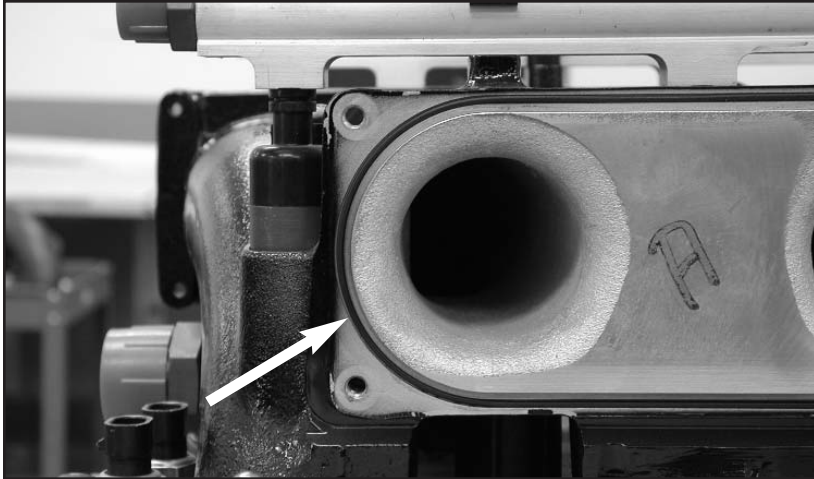
This view shows the engine with both plenums removed. The manifold top section can be removed from the engine next.



SECTION 1 - DISASSEMBLY

INTAKE MANIFOLD & VALVE COVERS

FIGURE 7



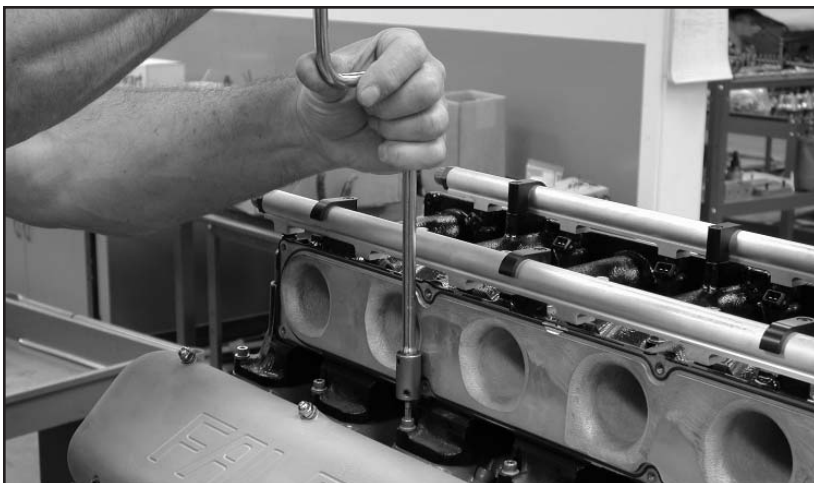
Note the o-ring (arrow) on the intake plenum flange. Make sure that this o-ring stays in the manifold top, or is accounted for if the top section is cleaned, as drying the manifold base with an air hose may blow this o-ring loose. This o-ring is a long piece of .070-inch Viton o-ring cord stock that must be inserted back into the groove in the plenum flange if removed.

FIGURE 8

Using a 7/16-inch socket on a speed-handle or ratchet, remove the 12 hex bolts that secure the intake manifold top and set them aside with the rest of the engine's hardware. A second row of screws on each side of the manifold base (arrow) must be removed before the manifold top can be taken off of the engine.



FIGURE 9



Using a 3/16-inch Allen (hex) socket on a ratchet with an extension or a speed-handle, remove the lower row of screws on each side of the manifold top where it mates with the manifold base as shown. These screws must be removed prior to taking the manifold top off of the engine.

SECTION 1 - DISASSEMBLY

INTAKE MANIFOLD & VALVE COVERS

FIGURE 10

This view shows the orientation of the rear breather fitting in relation to the intake manifold top and base. It can be left untouched in addition to the two water temperature sensors shown threaded into the manifold base.



FIGURE 11



The manifold base can be lifted off of the engine after all of the bolts and screws are removed. Be sure to set the manifold top on a clean surface, keeping it with the rest of the engine's hardware. Take care to lift the base clear of the two water temperature sensors shown in Figure 10 to avoid damaging them or the manifold base.

FIGURE 12

The mating surfaces between the manifold top and the manifold base are sealed with 12 $2^{5/8} \times 2^{1/2} \times 1/16$ -inch o-rings. Carefully remove each o-ring from the manifold base and keep them together in a small bag or tie a piece of string or wire through them, then place them with the rest of the engine's hardware.



SECTION 1 - DISASSEMBLY

INTAKE MANIFOLD & VALVE COVERS

FIGURE 13



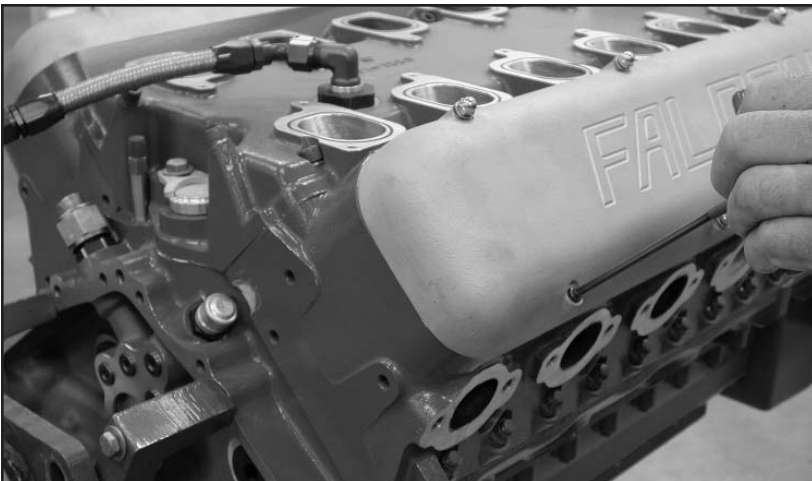
With the intake manifold top removed, the orientation of the rear breather fitting can be seen here. This fitting should not be removed, nor should the 90-degree elbow fitting that it attaches to (arrow).

FIGURE 14

The front breather should also be left in place, in addition to the special 90-degree fitting it attaches to (arrow). Leave it attached to the manifold base, flush out when cleaning the base and blow air through it after cleaning.



FIGURE 15



The valve covers are held in place with 7 studs and one countersunk Allen socket head cap screw on each side. Using a 3/16-inch Allen (hex) socket on a ratchet, speed-handle, or using a T-handle wrench as shown, loosen the screw, but do not remove it yet.

SECTION 1 - DISASSEMBLY

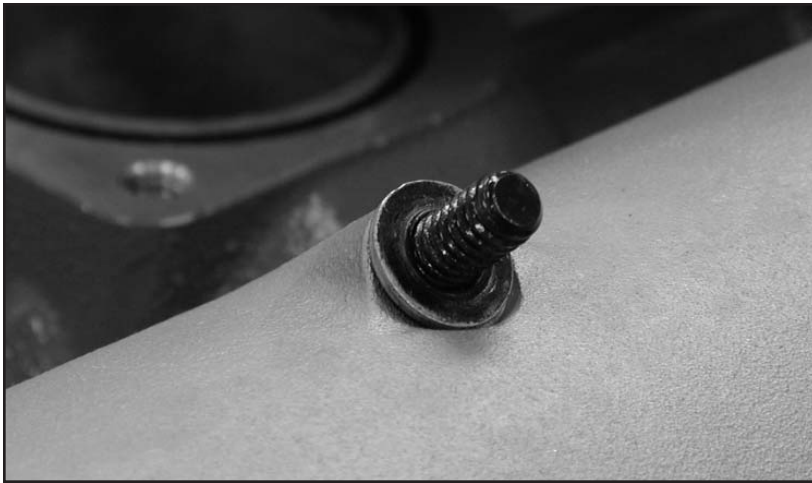
INTAKE MANIFOLD & VALVE COVERS

FIGURE 16

Using a 7/16-inch socket on a ratchet or speedhandle, loosen the acorn nuts from the 7 studs on each valve cover before removing them. Once all fasteners have been loosened, remove the Allen screw mentioned in Figure 15 along with the 7 acorn nuts on each valve cover and set them with the rest of the engine's hardware.



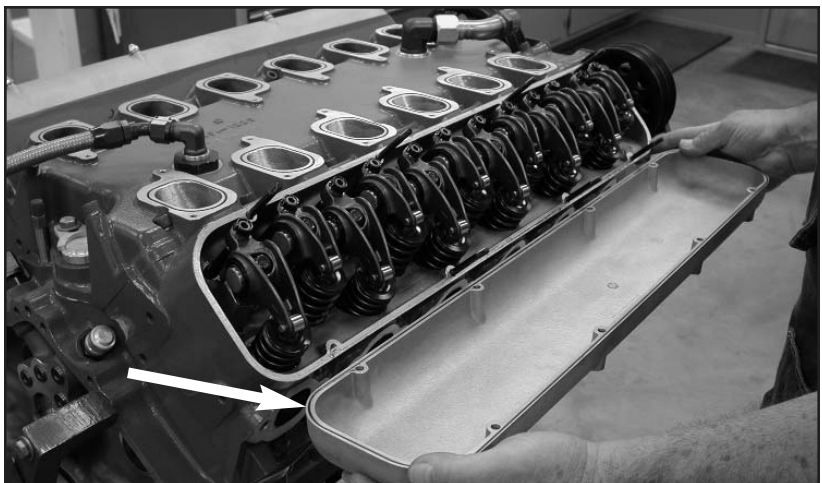
FIGURE 17



Underneath each acorn nut and washer used to secure each valve cover is a small Stat-O-Seal sealing washer shown here. Stat-O-Seals should be gently removed from the threaded studs, if necessary, remove or "unscrew" them like a regular nut so as not to damage the rubber seal on the threads of the stud.

FIGURE 18

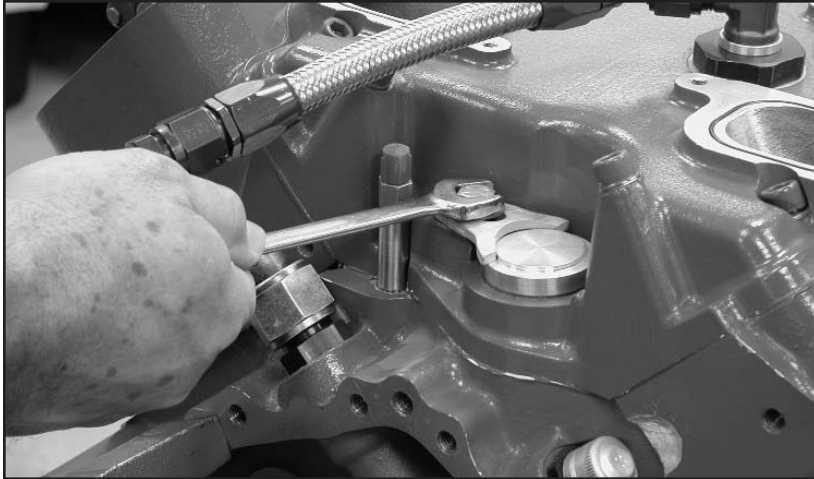
Gently lift the valve cover off of the mounting studs and wipe any oil from the sealing area of the cylinder head and also from the valve cover to prevent drips. Note that the sealing surface of the valve cover is o-ring sealed (arrow). Make sure that this o-ring stays in the valve cover, or is accounted for when it is cleaned, as drying valve cover with an air hose may blow this o-ring loose. This o-ring is a long piece of .070-inch Viton o-ring cord stock that must be inserted back into the groove in the valve cover if removed.



SECTION 1 - DISASSEMBLY

INTAKE MANIFOLD & VALVE COVERS

FIGURE 19



The Falconer V12 uses direct-fire ignition, so the distributor location is plugged and this plug is retained in the same manner as a normal distributor. This plug must be removed prior to removing the manifold base from the engine. Using a 9/16-inch socket on a ratchet, speed-handle, or using an end-wrench as shown, remove the bolt securing the clamp to the distributor hole plug. Set the bolt and clamp with the rest of the engine's hardware.

The distributor plug can be lifted out after gently prying underneath it with a flat blade screwdriver to lift it high enough to grab by hand. Set the distributor plug with the engine's other hardware.

FIGURE 20

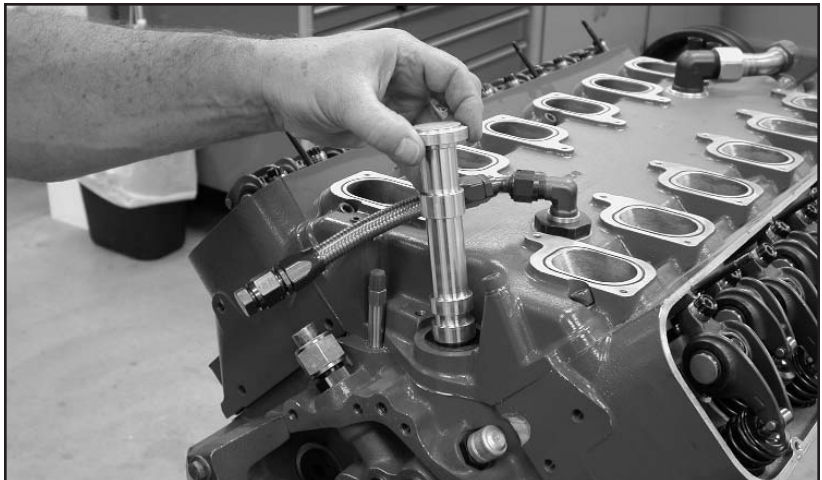


FIGURE 21



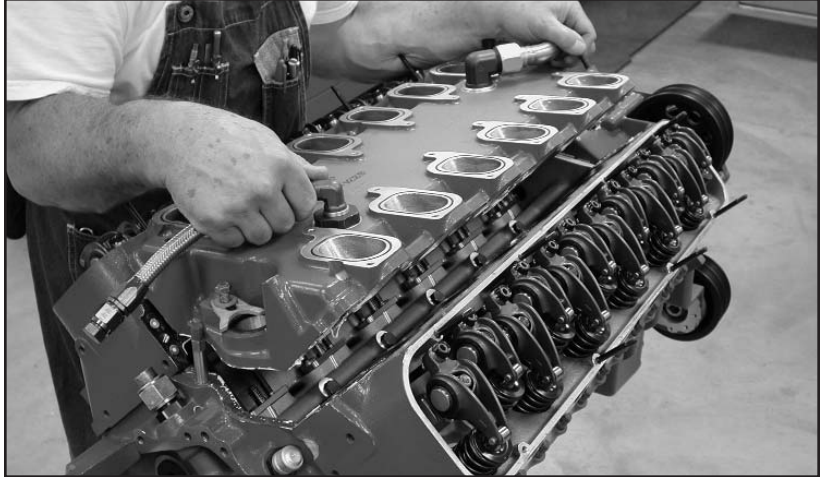
Using a 3/8-inch 12-point socket (or 5/16-inch Allen (hex) socket if Allen bolts are used) on a ratchet with extension, loosen all of the bolts that secure the manifold base plate to the cylinder heads. Once all bolts are loosened, remove them and place them with the rest of the engine's hardware.

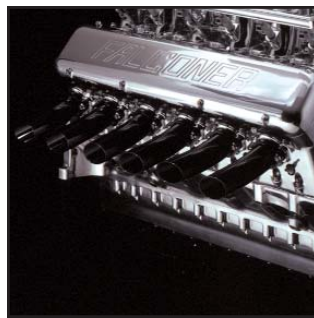
SECTION 1: DISASSEMBLY/ASSEMBLY

INTAKE MANIFOLD & VALVE COVERS

FIGURE 22

With all manifold base bolts removed, the base can be lifted free of the engine. Some prying with a pry-bar or rolling head punch may be necessary to break the manifold base's seal. Use caution when prying on the manifold base so as not to chip, mar or otherwise damage the manifold base, cylinder block or any engine accessories or bracketry.





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