

Why do you need a high-output, high-pressure fuel system?

Today's race cars need more fuel system than ever before because of improvements in torque, RPM and horsepower. As carburetors, manifolds and cylinder heads improved in airflow capacity, the need for more efficient racing fuel systems grew substantially. More efficient chassis and tires created the need for more fuel in order to maintain the maximum output power of the engine. Simply put, the harder the race car launches, the higher the system pressure must be to overcome the effects of gravity that cause restriction to flow. Firemen plan for this restriction to flow by adding 5 psi to the fire hose pressure per floor above street level. Pilots flying in high-performance fighters must control their blood supply with exercises and special flight suits when in high g-factor maneuvers or they suffer "redouts" or "blackouts" because they can't control their blood pressure. Aircraft launched with catapults from aircraft carriers must take off with fuel systems in high boost or the engine will starve for fuel. High g-factor launches coupled with wheel stands increase the demands on fuel systems whether the application is for Pro Street, Stock, Bracket or Pro Stock.

How much fuel flow is enough?

The correct volume of fuel is that which is required to support the amount of horsepower that the engine can produce. Most engines that are using gasoline burn approximately .5 pounds per horsepower-hour. This is sometimes called BSFC (Brake Specific Fuel Consumption). What this means is that for each horsepower produced, it takes 1/2 pound of fuel. This is a general statement and sometimes engines can be a little more efficient than .5lb/hp-hr., but it is a good practice to plan and measure fuel system operation using this number. Carburetors must have a stable supply of fuel in order to maintain the correct liquid fuel height. This is most difficult with drag racing vehicles that sometimes have forward acceleration and wheel stand at the same time. Each time that a nitrous system is engaged, additional fuel supply demands must be met or melted parts may result from "system lean-out." The fuel required is in excess of the .5 lb/hp-hr. for normally aspirated conditions. The additional fuel requirements for nitrous system planning is about .7 lb/hp-hr.

How much fuel pressure is necessary?

First, the fuel system pressure (provided by the fuel pump) must be enough to oppose the effects of gravity during the launch and during the run for drag racers. The system pressure of at least 8 to 10 psi per g is generally adequate. MagnaFuel ProStar 500 Series pumps are factory set to 28 to 30 psi. They are field adjustable from 24 to 36 psi. The MagnaFuel QuickStar 300 Series pumps are factory set to 25 psi and field adjustable from 25 to 36 psi. The QuickStar 275 series pumps are factory preset to 18 psi (these units are not field adjustable). MagnaFuel regulators need to be adjusted to 6.5 to 7.5 psi WITH FUEL FLOWING at a rate of about 1/2 cc per second (that's about 10 drops per second). Higher fuel pressure will generate more foam in the float bowl.

How can you plan your racing fuel system?

Use a handheld calculator and plan on .5 lbs/hp-hr. (gasoline). Methanol alcohol requires about 1.0 lbs/hp-hr. Use .7 lbs/hp-hr when planning a gasoline system for nitrous assist.

EXAMPLE: You have a 650 hp engine. $650\text{hp} \times .5 = 325\text{ lbs/hr. (gasoline)}$. Although you need to know how much your fuel weighs, assume for this example that it weighs 6.2 lbs/gal. $325\text{ lbs/hr.} \div 6.2 = 52.42\text{ gal/hr.}$ Dividing by 60 (minutes per hour) yields .847 gal/min (GPM).

Check the graph and specification information for a pump selection for your application. Note that this flow number is what your engine needs at the float bowls. So you also need to check out the graphs and specs for a MagnaFuel regulator.

Is it necessary to plumb your system for a return line to the fuel tank?

Yes, because all MagnaFuel pumps are equipped with external bypass system. We don't think that any well-engineered racing fuel system should use internal bypasses because all they do is heat up and add foam (bubbles) to the fuel. It is a little more difficult to plumb, but it provides a better and more efficient system. See the drawings on pages 14-21 for proper placement of the return line in the tank.

How important is the size of the tank vent?

Attention to this detail may make the difference between winning and losing. It should be equipped with a filter so

that trash and dirt cannot enter the fuel system. Absolute minimum size vent is -6 AN, but -8 AN is preferred for any application over 600 hp. Some specialty applications actually need a -10 AN. MagnaFuel rollover/vent (MP-3125) is -8 AN and provides some safety benefits if the vehicle flips over.

Should you use a fuel filter?

All fuel systems are dirty and need to use a filter in the system. The filter should be located on the suction side (between tank and pump) of the pump. The filter cartridge is washable. Replacements are available.

How can you check a system for flow and pressure?

Free-flow ratings of racing fuel systems are a joke, so MagnaFuel stresses that the only way to test a system is AT RATED PRESSURE. MagnaFuel rates all its systems at FLOW vs. PRESSURE.

Have a fire extinguisher handy. Observe safe practices when dealing with fuel. NO Smoking. You will need an accurately scaled jug (semi-clear polypropylene is ideal) of at least one gallon capacity. One gallon = 128 fluid ounces. One gallon = 4 quarts. One gallon = 231 cubic inches. You need to test the complete fuel supply system, so this measurement will be after regulated control. You will need a stop watch or a watch with a second counter. You will need to provide a variable orifice (brass draincock or petcock works well) for attachment to the end of the fuel line.

Run the test at various fuel pressures (regulated flow) and you will learn what your system can do.

Use the previous example under fuel system planning.

This is particularly important for nitrous enrichment fuel applications so that you will know the result of changing the fuel pressure 1/4 psi at a time.

General Notes:

Proper Electrical Supply: The DC electric motors in electric fuel delivery systems are dependent on consistent electric supply. They require good battery voltage, solid connections, proper wire gauge, good ground and a properly operating alternator.

Debris in System: Fuel delivery systems are composed of valves, seals, diaphragms and orifices. Dirt and other debris can disrupt the proper operation of these components. A clean system is imperative. Clean or change your filters often, and periodically check the system for debris. If you are about to install a new system, make sure you clean all installation trash out of the fuel lines. Pay

close attention to stainless steel lines.

Voltage Step-down Devices: Never use step-down devices (voltage reduction boxes) on MagnaFuel fuel pumps. Never operate any electric motor on lower voltage than the motor was designed for. Low voltage can cause motor fluctuation and excessive amp draw. MagnaFuel recommends 12.5V and higher

Gauges: Gauges are tuning tools only, and should be removed from vehicle during racing conditions.

Air in System: Any air going into fuel pump on the intake side causes the fuel to foam. Foam will create fluctuation in regulated pressure, oscillation in the pump motor and lean air/fuel mixture. Poor seals on the inlet side fittings, poor placement of the fuel pickup and/or return lines can cause this problem. Return line to fuel cell should be as far as possible from the pick up line fitting.

Fuel Cell Vent Size: If the fuel cell vent is too small, it can cause excessive load and heat in the pump. You should run a minimum of a #8 vent for all applications.

Questions and Answers

Q. Why does my fuel pressure vary from one pass to the next?

A. Faulty fuel pressure gauge can cause fuel pressure fluctuation. If your gauge is a few years old, test it. Under-hood heat can affect gauge accuracy. Dirty regulator. Clean it or send it in. You should always set the regulator in a flowing condition. The engine should be running at about 1,700 to 2,000 RPM. Battery low. Check voltage. Low pump pressure. Look for inlet line obstructions such as fuel-cell foam.

Q. Why is my fuel pressure too low, or I have no pump pressure?

A. Check the voltage to the pump, relay switch. Could be faulty. They can be bad without going out. Weak relay reduces voltage. Replace them. Check wiring, look for an improper ground. Check the battery voltage. Check the filter and inlet line for obstructions. Look for leaks on inlet side. Adjust bypass. Is there debris in pump bypass (poppet). The bypass valve could be stuck open. Clean filter. Replace deteriorated fuel-cell foam. If no pressure, the pump may be operating in reverse. Check the wiring diagram. No fuel in fuel cell, or fuel cell improperly vented.

Q. Why is my fuel pressure too high?

A. The return line could be too small. The voltage could be too high. If you need

to run the pump at a pressure lower than it is designed for, call us and we'll send you a special spring. Improperly adjusted bypass. See pump instruction sheet for proper setting.

Q. Why won't my pump run at all?

A. This is most likely a low- or no-voltage problem. Check battery condition. Check for a bad fuse or bad relay. Look for improper ground. Check diagram, make sure you have wired everything correctly. Check any in-line switches for proper operation and voltage rating.

Q. Why does my pump seem excessively hot?

A. Note that normal operating temperature can reach 137 degrees Fahrenheit. Anything below this is OK. If the pump is warmer than this, look for low voltage. If there is excessive pressure, there could be debris in pumping mechanism causing too much load. Check to see if the bypass is obstructed. Check instructions for proper pressure setting.

Q. What could cause my pump to operate noisier than usual?

A. Aeration, or air in the system, can cause excessive noise. Check for poor inlet side sealing, check O-rings, fittings, damaged sealing angles on fittings. We recommend rubber isolator between pump and frame mounting surfaces. Mounting the pump solid to the frame of the vehicle can accentuate the noise. If the fluid level in the tank/cell is too low, the pump can suck a vortex and induce air into the system. Check pump mounting brackets for tightness. If the fuel cell return line dumps fuel near the suction line, it can cause air to enter the system also. Keep this return line's fuel input as far away from the supply line as possible.

Q. What can I do about a leaky pump?

A. Leaks are almost always caused by a worn or damaged pump seal. You need a new one. Return to factory. Seal should be replaced every two years under heavy use or if it sets unused for a long time. Return pump to factory for service. If pump leaks from vent hole, you need a new seal. Return pump to factory for service and bench flow testing.

Q. Why does my regulator's pressure fluctuate?

A. MagnaFuel considers excessive fluctuation to be over 1-1/2 pounds of pressure. Vibration, aeration, faulty

gauges, or sharp changes in supply/pump pressure usually cause this. You should isolate the regulator with rubber mounting to tame vibration.

Q. Why am I getting pressure spikes?

A. Poor gauges, too high or too low pump pressure, or sharp drops in system pressure could cause large pressure spikes at the regulator.

Q. Why does my fuel system pressure seem to drop throughout the day?

A. Heat can effect liquid-filled gauges. Voltage drop can also cause this problem (battery, ground, connections, and incorrect wire gauge. Avoid mounting fuel system close to heat sources.

Q. Why does my car seem to slow halfway through a quarter-mile run?

A. Not enough fuel volume. If it falls off in high gear, it is a pump volume issue; pump may be too small. If it falls down during launch, it is a fuel-pressure issue.

Q. Why does my regulated pressure seem to creep higher and higher or go to full pump pressure?

A. Debris in fuel system has contaminated the valve-to-seat seal. Disassemble per regulator exploded view. Wash with brake cleaner or similar cleaner and reassemble. Be sure you reassemble correctly. CAUTION: Do not over-tighten cartridge. Check fuel filter. Make sure to flush lines before using a newly installed fuel system. A common problem of new systems when there is debris left over from cutting fuel lines and other installation trash.

Q. Why is my regulator noisy when I first start the engine?

A. Vibration or chatter is common when the engine is first started due to air in system. This is amplified due to the metal-to-metal valve/seat assembly. Should go away in less than a minute. Regulators used for Nitrous are "dead-headed" to the solenoid. MagnaFuel suggests you use an air-bleed system to purge trapped air from the system.