Installation, Tuning and Trouble Shooting Instructions
MaxG MotorSports Variable Rate of Gain Regulator models:
2025 VRG-NA (for naturally aspirated engines)
2025 VRG-SC (aftermarket supercharged engines)
2025 VRG-OE (OEM supercharged engines)

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Overview

Purpose of the MaxG MotorSports Variable Rate of Gain Regulator

The MAXG 2025 VRG Regulators are designed specifically to add fuel to EFI engines modified to increase power output. This includes better breathing naturally aspirated engines, turbos, and superchargers. The 2025 VRG regulator is designed to increase fuel pressure as the engine demands more fuel. This is accomplished by using the manifold vacuum/pressure to drive the fuel pressure up as the boost rises, or with the N/A engines as the vacuum goes toward atmospheric pressure.

Regulator Models and Application:

- Model 2025-SC: for aftermarket turbo and supercharger (forced induction) applications
- Model 2025-OE: for factory (OEM) turbo and supercharger; this applies only if the factory ECU is used
- Model 2025-NA: for naturally aspirated engines (no forced induction)

General Information

1. The MaxG 2025 VRG Regulator fits into the fuel system after the stock regulator and in series with it. It becomes the last item before the fuel returns to the tank. **Do not remove the stock regulator, as it still controls the fuel flow under most manifold vacuum conditions**. See figure 3 for typical installation routing.
2. The regulators can be mounted in any position. For convenience, place the adjustment screws within easy access.
3. "In" is marked on the body of the regulator. Connect the fuel line coming from the stock regulator to this port.
4. The unmarked port on the body of the regulator goes back to the fuel tank.
5. Threads at the fuel line fittings are 1/8 NPT.
6. If you need to remove or replace the inlet fittings supplied with the regulator we recommend the use of a thread sealer. Use a paste or liquid sealer that is compatible with your fuel. We do not recommend using Teflon tape. Tape slivers can get into the fuel system and clog orifices and cause seat leaks.
7. Run a line from the vent port (see figure 1) to an area outside the engine compartment and away from heat or ignition sources.

Manifold Pressure Sensing Line

The regulator is powered by manifold pressure (vacuum and boost). The manifold pressure "signal" must come from the intake manifold, **after the throttle plate**. The signal is transmitted by a sensing line that connects the manifold to the sensing port on the regulator. The regulator will not work properly if the signal comes from anywhere else. See Figure 1 for the location of the sensing line fitting on the regulator.

The Sensing Line Restrictor

On occasion, the regulator will not adjust to a sufficiently low fuel pressure (low rate of gain). In this instance, it is necessary to add the small restrictor to the sensing line. The restrictor is provided with the regulator but is not installed in the sensing line. Insert the restrictor into the sensing line and push the line onto the barbed fitting. This will push the restrictor into the line. The restrictor is non-directional; it can point either way.

Check Valve

Two functions are accomplished by the check valve. One, it allows boost pressure to be vented from the sensing chamber of the regulator. Second, when the manifold is operating under vacuum it prevents a vacuum leak and allows the regulator to sense the manifold vacuum. This allows venting the boost signal for adjustment, but will seal under vacuum.

To check the proper installation of the check valve remove the rubber line from the needle valve barb. Blow into the end of the line that was attached to the barb fitting. It should flow when you blow and shut off when you suck on the line. The unused barb on the check valve should not be plugged or restricted. It needs to communicate with the atmosphere**.**

Regulator Adjustments

The 2025-NA, -OE, and -SC regulators each require a different method of adjusting. These methods are discussed in the following sections. In all installations, we urge tuning be aided with a wide band air/fuel ratio gauge and a fuel pressure gauge.

MaxG offers a fuel pressure measuring kit (Part Number 10153). MaxG can also supply several different styles of wide band air/fuel ratio gauges. Please contact us to discuss your needs.

Fuel Pump Requirements

The MaxG 2025 VRG Regulators cannot increase the pressure supplied by the fuel pump. Please check your pump pressure before you install the MaxG regulator.

1. Naturally Aspirated (NA) engines usually are compatible with the stock or original pump, provided it is in proper condition. The pressure available should exceed 50 psi. These engines use the 2025-NA regulator.
2. A factory engine (OEM) that came with a forced induction system needs pressures in the 70/80 range to function well. These engines use the 2025-OE regulator.
3. Engines that have had an aftermarket forced induction system installed will need a minimum of 95 to 100 psi for 7 to 8 psi boost. These engines use the 2025-SC regulator.

These are general pressure ranges. To determine the pressure your application will require please see the section below for the specific model regulator. If you need to replace your stock fuel pump or wish to add an auxiliary fuel pump, please call us to discuss your options.

Checking Fuel Pump Pressures

Maximum available fuel pressure can be checked at idle. Install a fuel pressure test gauge between the fuel pump and the point where the return line will be pinched closed. With a pair of pliers, squeeze the fuel return line until it is pinched closed. When pinched closed, the pump will be forced to maximum output pressure. Observe the test pressure gauge reading.

The pressure available from the fuel pump should be about 10 psi higher than the desired fuel pressure, as the available pressure under real load conditions will be less than that measured at idle. This test does not actually prove the pump to be adequate under boost, but if it doesn't pass this test either, replace the stock pump or supplement the stock pump with an auxiliary pump.

Adjusting the 2025-NA Regulator for Naturally Aspirated Engines

For the 2025-NA regulator, the center screw (see figure 1) is the only adjustment possible. It determines the fuel pressure achieved at full throttle. Turning the center screw clockwise raises the fuel pressure. There is no needle valve, check valve, or restrictor with the 2025-NA regulator.

All regulator pressure adjustments are made at idle with the sensing line removed. When the sensing line is attached to the regulator, turning the center screw does not change the fuel pressure. Only adjust the center screw when the sensing line is disconnected.

A starting point fuel pressure can be calculated based on the estimated increase in Horse Power. This example assumes the stock injectors are retained.

Let the Horse Power increase be 10% greater than stock. For a 10% increase in HP, the new fuel pressure must be increased by (1+% increase) squared or 1.10 squared. That number would be 1.21. If a given engine's fuel system maintains 36 psi at full throttle, then an increase of

pressure to 36 x 1.21 = 44 psi, is required to achieve the 10% greater fuel flow. Just as a HP increase of 25%, must see the fuel pressure increase to (1+.25) 1.25 squared times 36. As a result it will require the fuel pressure to increase to 56 psi to maintain the same air fuel ratio as stock.

It is a common necessity to operate with richer mixtures than stock after such mods as discussed here. The MaxG 2025 VRG Regulator can easily account for this situation as well. If a mixture of 12 to 1 is desired rather than 14 to 1. Calculate the ratio percentage change (14/12 = 1.167), then square that number (1.167 x 1.167 = 1.36), and the 1.36 then suggests the previous fuel pressure must be increased by 36% to effect that change in the mixture. Therefore the 56 psi in the previous example becomes 56 x 1.36 = 76 psi.

MaxG offers a fuel pressure measuring kit (Part Number 10153). MaxG can also supply several different styles of wide band air/fuel ratio gauges. Please contact us to discuss your needs.

Adjusting the 2025-OE Regulator for OEM Turbo/Supercharged Engines

The OEM turbo/supercharger requires more fuel if the boost pressure is raised beyond the factory level. Additional fuel is only required for that extra increment of boost, and not through the entire boost operation. This adjustment is controlled solely by the needle valve and must be determined while driving the car under boost. Start with the needle valve closed, which is fully clockwise. If the engine runs rich at full throttle turn the needle valve adjusting screw counter clockwise. This adjustment reduces the fuel pressure (gain in the regulator setting) which will reduce the Air/Fuel ratio (leaner mixture). Adjust the needle valve until the desired full Air/Fuel ratio is achieved.

A weak fuel pump will cause a drop in fuel pressure as the engine is revved higher. If the pump cannot maintain the desired fuel pressure all the way to the engine redline it is not in satisfactory condition to feed the engine. After checking the fuel filter and fuel supply lines for restrictions either replace the stock pump or supplement the stock pump with an auxiliary pump.

MaxG offers a fuel pressure measuring kit (Part Number 10153). MaxG can also supply several different styles of wide band air/fuel ratio gauges. Please contact us to discuss your needs.

The amount of increase required is modest and is suggested in *Figure 4*.

Adjusting the 2025-SC Regulator for After Market Turbo/Supercharged Engines

Two adjustments are necessary with this regulator. Engines that were originally naturally aspirated and are subsequently fitted with forced induction systems often exhibit extreme leanness in the range of 4 inches of vacuum to approximately 3 psi boost. This happens because the turbo/supercharger can achieve atmospheric pressure in the manifold prior to the throttle being fully open. Without fully opening, the throttle position sensor will not properly inform the ECU of what's going on, hence, a lean condition occurs. This is not as prominent in later model OBD2 automobiles where the O2 sensor feedback covers a broader range. The 2025-SC is designed to compensate for this lean condition by starting the increase in fuel pressure at the correct point. This is called the "On Set Point" and is adjusted by the regulator center screw (see *Figure 1*).

The first adjustment is to set the On Set Point. Make this adjustment with the sensing line disconnected and the engine at idle. Disconnecting the sensing line simulates passing through the zero point. Setting the On Set Point is done using the center screw (see *Figure 1*). Turning the screw clockwise will raise the On Set Point pressure. A suggested pressure for starters is 48 to 50 psi. Once adjusted, plug the vacuum line back onto the regulator and observe the fuel pressure drop back to the stock figure.

Please understand, this will vary from engine to engine, and is not a magic number. The "magic" number is whatever pressure your vehicle requires to pass thru the boost onset without the lean flat spot. It is not unusual to see pressure anywhere from 40 psi to 55 psi. Use whatever works best.

The second adjustment controls the rate of gain of fuel pressure versus boost pressure. This adjustment is made using the needle valve (see *Figure 1*). The lowest fuel pressure (lowest rate of gain) is with the needle valve fully open and the highest fuel pressure (highest rate of gain) occurs when the needle valve is fully closed. Clockwise closes the needle valve and increases fuel pressure. *Figure 5* gives a guide to good starting point fuel pressures versus boost pressure. Adjust the fuel pressure (rate of gain) until the desired air/fuel ratio is achieved.

The curves in *Figure 5* were calculated as follows (all pressures are in psi). Graph calculation assumes the atmospheric pressure is 14.7 psi and FP0 = 36 psi.

1. Determine the Pressure Ratio (PR): PR = (14.7 + boost pressure)/14.7
2. Measure the fuel pressure at no boost (idle) = FP0
3. Boost Pressure = BP
4. Calculate the fuel pressure need at the desired boost pressure (FPB)
5. Equation: $(PR^2 \times FP0) + BP = FPB$

Example: 6 psi boost is desired. The stock fuel pressure is 36 psi at zero boost.

$$FPB = (PR^2 \times FP0) + BP = (1.41^2 \times 36) + 6 = 77.5 \text{ psi}$$

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Installation

Instructions for Typical Motorcycle and ATV Application

Fuel Line Routing

The sequence of items in the fuel system (see figure 3 – non-automotive applications)

Boost Signal Source

Attach the manifold signal sensing line to a port after the throttle body. The small restrictor must be placed in this sensing line, preferably at the source end.

General Tuning

Set the base fuel pressure with the center screw of the regulator. The required pressure will vary with the size of injectors selected. If the injectors are bigger than stock, which is typical, the fuel pressure will be less than stock.
Clockwise on the center screw raises the fuel pressure. With the bike engine warm, adjust the pressure until the idle is smooth and the throttle response is good.

As the bike gains manifold pressure, the fuel pressure will rise. The rate of this rise is determined by the needle valve.

The maximum pressure will be determined by the power of the fuel pump. This can be checked with an idling engine by squeezing the fuel line shut between the rail and the MaxG 2025-SC regulator. The engine will likely stall as the pump will be forced to its maximum output, but enough time will be available to read the pressure gauge.

Tuning fuel pressures will vary with boost. Estimate the fuel pressure required by multiplying the boost pressure times six or eight and adding the idle pressure.

Typical Pressure = (Boost x 8) + idle pressure = Fuel Pressure at max boost

This should only be considered a ball park fuel pressure.

Troubleshooting

If your regulator exhibits one of the following problems, try one of the following solutions:

Problem:	Jams at maximum fuel pressure.
Solution:	The regulator is installed backwards.
	The center screw is bottomed out and must be backed off (turned counter clockwise).

Problem: Pressure does not rise.
Solution: Sensing line is blocked. Remove blockage or kink
Sensing line not attached to a manifold vacuum port. Select a port on the intake manifold with vacuum.
Fuel pump cannot deliver enough pressure. See section on checking fuel pressure for testing method.

Problem: Pressure rises, but not enough.
Solution: Close the needle valve.
Increase the One Set Point by turning the center screw clockwise (static) adjustment.
Check the pump again, but remember, it will have less pressure at high loads, than at idle.
If you installed the restrictor in the sensing line remove it.

Problem: Pressure rises, but too high.
Solution: Open the needle valve further.
Back off the On Set Point by turning the center screw counter clockwise.
Install the restrictor in the sensing line.
Check Valve is attached backwards.

Problem: Fuel pressure won't return to stock at idle.
Solution: No check valve.
Check valve installed backwards. Should allow flow from the needle valve to the atmosphere and block flow from the atmosphere to the needle valve.

Problem: Fuel pressure oscillates.
Solution: A slow oscillation of about one pulse per second can also result from the regulator being hooked up backwards. A faster oscillation, more like a buzz, but without the noise, is usually induced by a rapid pulsation from the fuel pump. Not much can fix it this short of a different brand of pump or a pulse damper. The condition is not harmful at boost pressures of 8 psi or less.
If buzzing, turn the center screw a 1/4 of a revolution, and it usually ceases.

Problem: Regulator buzzes under boost.
Solution: This fault occurs occasionally when fuel pump and manifold pressure oscillations overlap to reinforce each other. Usually, it can be quieted by turning the center screw a small amount. Contact us if this problem persists.

If none of the above proves effective in tuning the regulator, call us at 830-885-0009.

WARRANTY

The regulators are warranted for workmanship for one year from the date of shipment from our facility.

If problems arise from using a Teflon tape, cross threading or tightening the center screw too much, MAXG reserves the right to refuse warranty coverage for damages caused to the regulator.

Please contact us if you have an issue with the regulator.

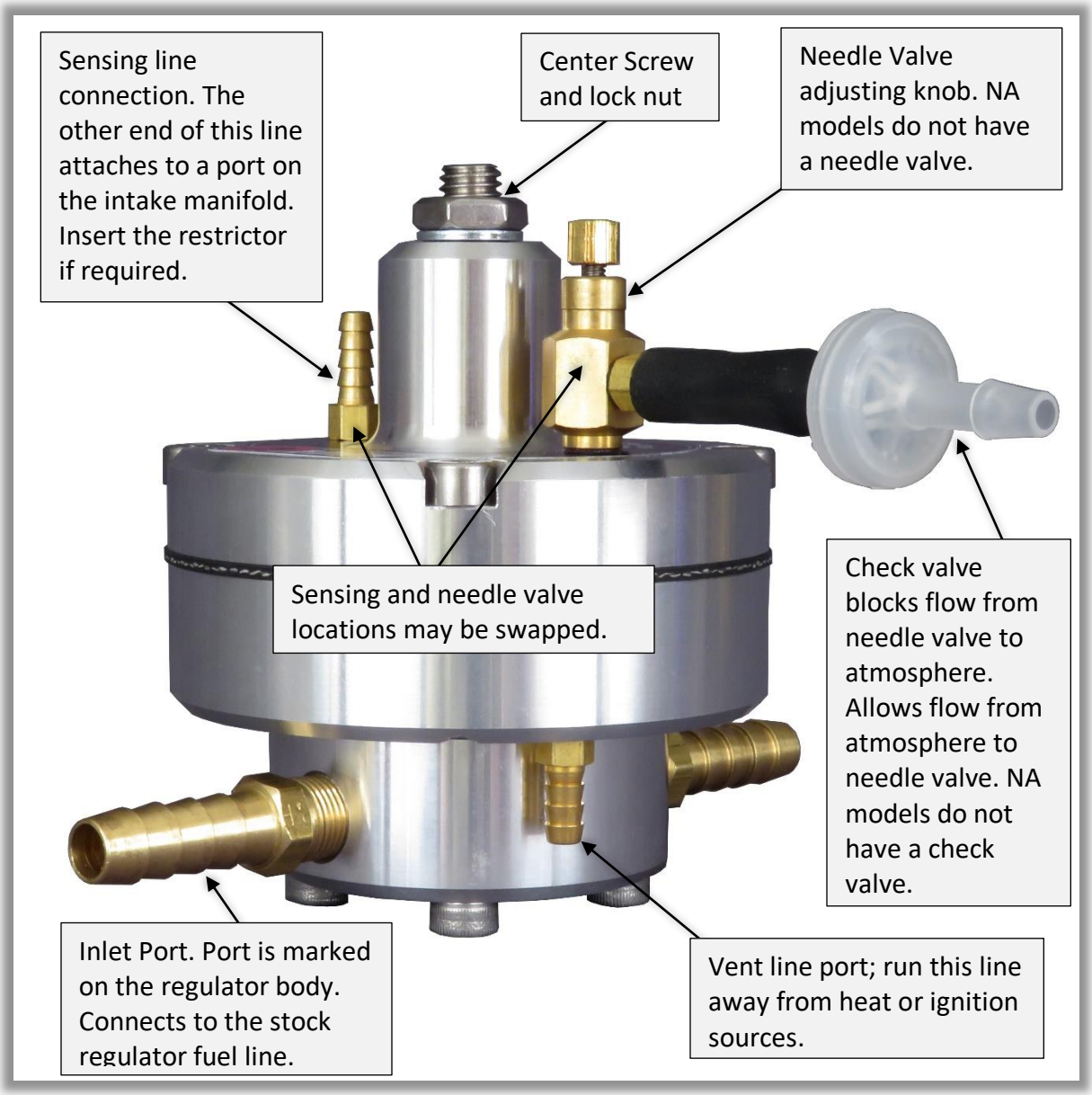
Sensing line connection. The other end of this line attaches to a port on the intake manifold. Insert the restrictor if required.
Center Screw and lock nut
Needle Valve adjusting knob. NA models do not have a needle valve.
Sensing and needle valve locations may be swapped.
Check valve blocks flow from needle valve to atmosphere. Allows flow from atmosphere to needle valve. NA models do not have a check valve.
Inlet Port. Port is marked on the regulator body. Connects to the stock regulator fuel line.
Vent line port; run this line away from heat or ignition sources.

Figure 1

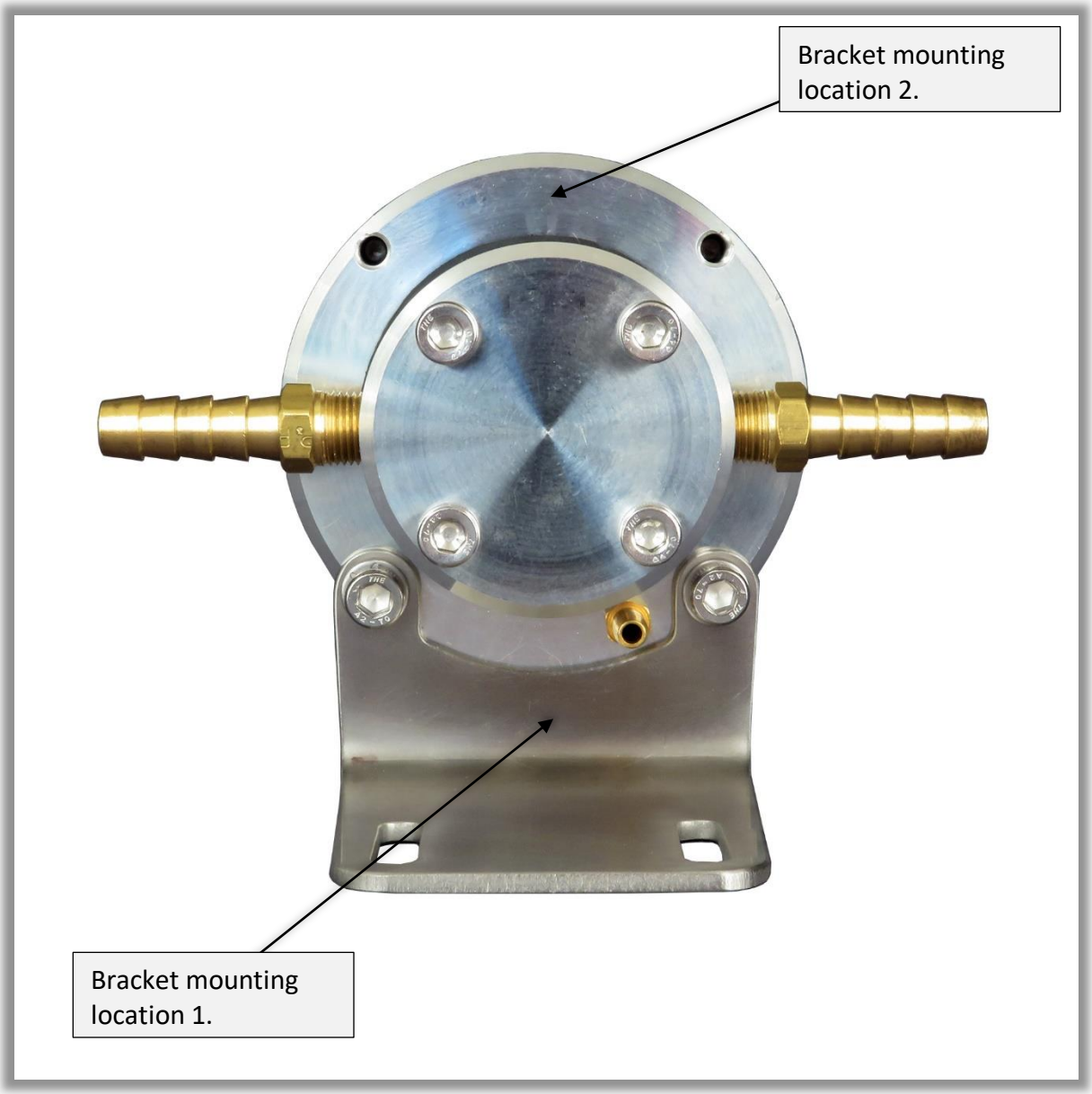

Figure 2

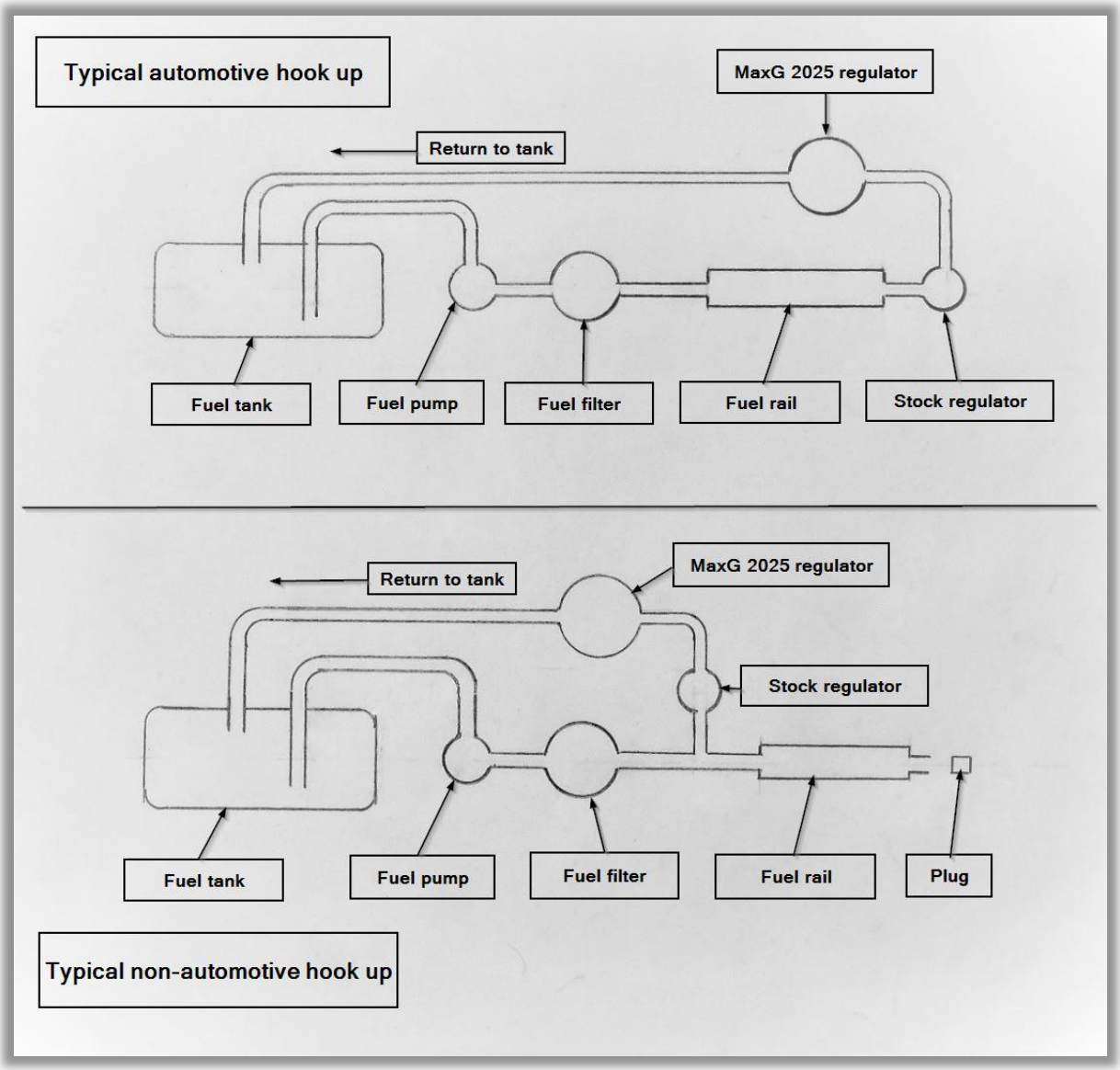
Typical automotive hook up
MaxG 2025 regulator
Return to tank
Fuel tank
Fuel pump
Fuel filter
Fuel rail
Stock regulator
Return to tank
MaxG 2025 regulator
Stock regulator
Fuel tank
Fuel pump
Fuel filter
Fuel rail
Plug
Typical non-automotive hook up

Figure 3

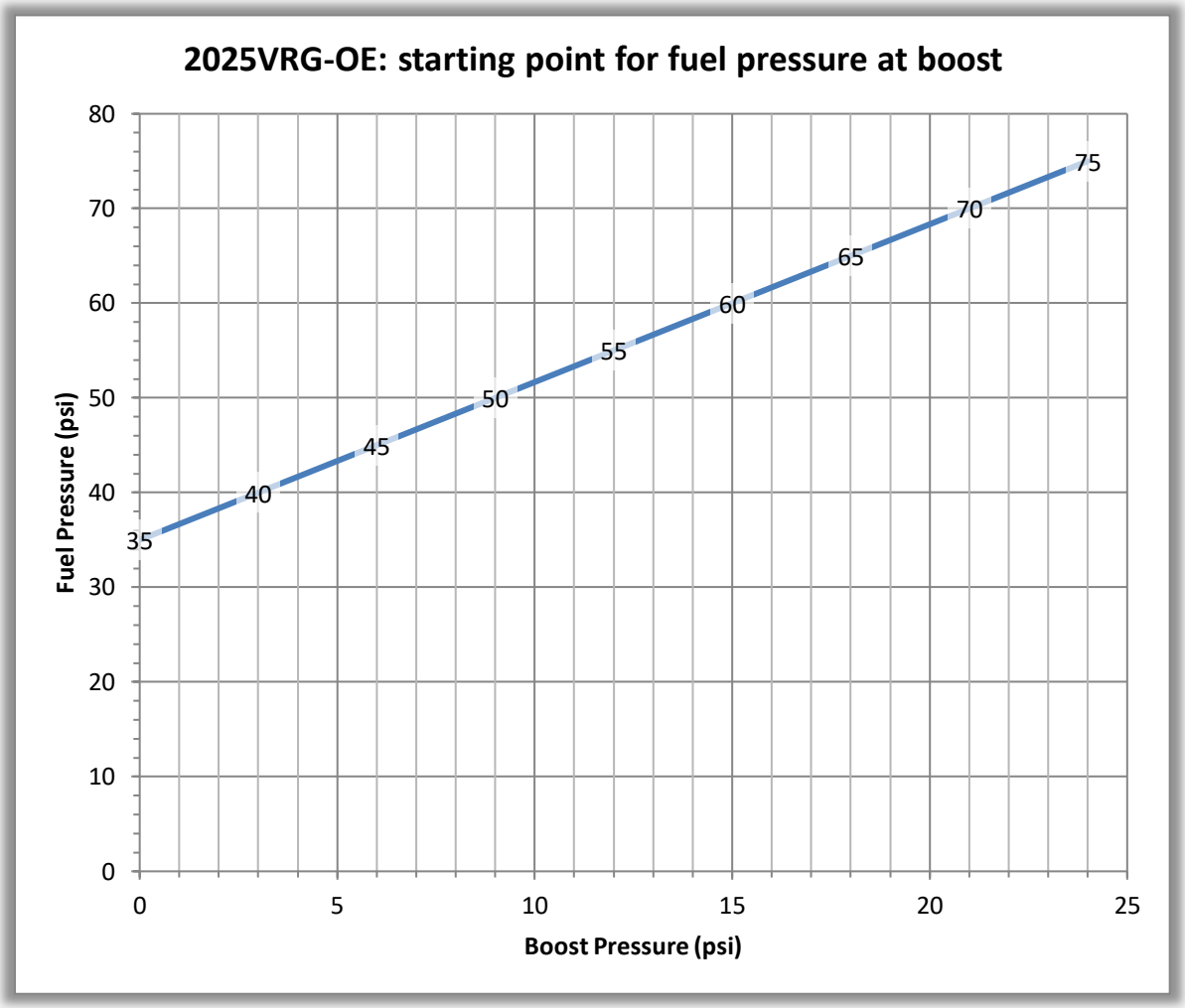
2025VRG-OE: starting point for fuel pressure at boost
Fuel Pressure (psi)
Boost Pressure (psi)
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
35
40
45
50
55
60
65
70
75

Figure 4

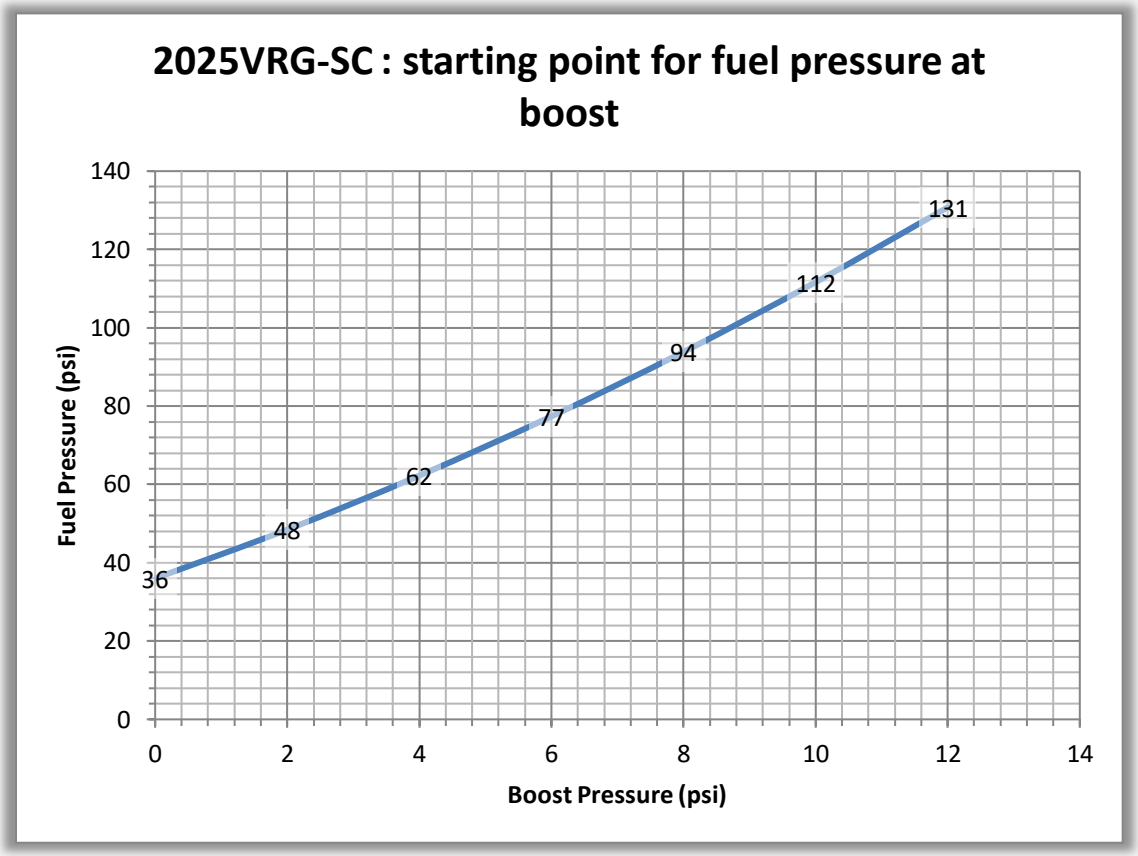
2025VRG-SC : starting point for fuel pressure at boost
Fuel Pressure (psi)
Boost Pressure (psi)
140
120
100
80
60
40
20
0
0
2
4
6
8
10
12
14
36
48
62
77
94
112
131

Figure 5