



Holley GM LS3/L92 Lo-Ram Modular Intake Manifold Kits

Holley P/N	Engine Application & Induction Configuration
300-670	LS3/L92 Lo-Ram, Base Manifold Kit w/ Fuel Rails, Top-Feed Plenum, Single Fuel Injector per Cylinder, Satin Finish (As Shot-Blast Aluminum)
300-670BK	LS3/L92 Lo-Ram, Base Manifold Kit w/ Fuel Rails, Top-Feed Plenum, Single Fuel Injector per Cylinder, Black Matte Powder Coat Finish
300-671	LS3/L92 Lo-Ram, Base Manifold Kit w/ Fuel Rails, Top-Feed Plenum, Two Fuel Injectors per Cylinder, Satin Finish (As Shot-Blast Aluminum)
300-671BK	LS3/L92 Lo-Ram, Base Manifold Kit w/ Fuel Rails, Top-Feed Plenum, Two Fuel Injectors per Cylinder, Black Matte Powder Coat Finish
300-672	LS3/L92 Lo-Ram, Base Manifold Kit w/ Fuel Rails, Front-Feed Plenum, Single Fuel Injector per Cylinder, Satin Finish (As Shot-Blast Aluminum)
300-672BK	LS3/L92 Lo-Ram, Base Manifold Kit w/ Fuel Rails, Front-Feed Plenum, Single Fuel Injector per Cylinder, Black Matte Powder Coat Finish
300-673	LS3/L92 Lo-Ram, Base Manifold Kit w/ Fuel Rails, Front-Feed Plenum, Two Fuel Injectors per Cylinder, Satin Finish (As Shot-Blast Aluminum)
300-673BK	LS3/L92 Lo-Ram, Base Manifold Kit w/ Fuel Rails, Front-Feed Plenum, Two Fuel Injectors per Cylinder, Black Matte Powder Coat Finish
300-676	LS3/L92 Lo-Ram Throttle Body Adapter Kit, Satin Finish (As Shot-Blast Aluminum): -LS3/L92 Lo-Ram Front-Feed, 1 x 105 Throttle Body
300-676BK	LS3/L92 Lo-Ram Throttle Body Adapter Kit, Black Matte Powder Coat Finish: -LS3/L92 Lo-Ram Front-Feed, 1 x 105 Throttle Body
300-679	LS3/L92 Lo-Ram Complete Intake Manifold Kit, Satin Finish (As Shot-Blast Aluminum): -Base Intake Manifold - Top-Feed Plenum, Single Fuel Injector per cylinder -Fuel Rail Kit – Single Fuel Injector per Cylinder, Black Anodized -Plenum Top – Hi-Ram EFI, 1 x 105mm LS Throttle Body (longitudinal mount)
300-679BK	LS3/L92 Lo-Ram Complete Intake Manifold Kit, Black Matte Powder Coat Finish: -Base Intake Manifold - Top-Feed Plenum, Single Fuel Injector per cylinder -Fuel Rail Kit – Single Fuel Injector per Cylinder, Black Anodized -Plenum Top – Hi-Ram EFI, 1 x 105mm LS Throttle Body (longitudinal mount)
300-680	LS3/L92 Lo-Ram Complete Intake Manifold Kit, Satin Finish (As Shot-Blast Aluminum): -Base Intake Manifold - Front-Feed Plenum, Single Fuel Injector per Cylinder -Fuel Rail Kit – Single Fuel Injector per Cylinder, Black Anodized -Plenum Top – Lo-Ram Front-Feed, Standard -Throttle Body Adapter – LS1/2/6 Lo-Ram Front Feed, 1 x 105mm LS Throttle Body
300-680BK	LS3/L92 Lo-Ram Complete Intake Manifold Kit, Black Matte Powder Coat Finish: -Base Intake Manifold - Front-Feed Plenum, Single Fuel Injector per Cylinder -Fuel Rail Kit – Single Fuel Injector per Cylinder, Black Anodized -Plenum Top – Lo-Ram Front-Feed, Standard -Throttle Body Adapter – LS3/L92 Lo-Ram Front Feed, 1 x 105mm LS Throttle Body
300-682	LS3/L92 Lo-Ram Complete Intake Manifold Kit, Satin Finish (As Shot-Blast Aluminum): -Base Intake Manifold - Front-Feed Plenum, Single Fuel Injector per Cylinder -Fuel Rail Kit – Single Fuel Injector per Cylinder, Black Anodized -Plenum Top – Lo-Ram Front-Feed, w/ Integral Burst Panel Flange -Throttle Body Adapter – LS3/L92 Lo-Ram Front Feed, 1 x 105mm LS Throttle Body
300-682BK	LS3/L92 Lo-Ram Complete Intake Manifold Kit, Black Matte Powder Coat Finish: -Base Intake Manifold - Front-Feed Plenum, Single Fuel Injector per Cylinder -Fuel Rail Kit – Single Fuel Injector per Cylinder, Black Anodized -Plenum Top – Lo-Ram Front-Feed, w/ Integral Burst Panel Flange -Throttle Body Adapter – LS3/L92 Lo-Ram Front Feed, 1 x 105mm LS Throttle Body
300-683	LS3/L92 Lo-Ram Complete Intake Manifold Kit, Satin Finish (As Shot-Blast Aluminum): -Base Intake Manifold - Top-Feed Plenum, Two Fuel Injectors per cylinder -Fuel Rail Kit – Two Fuel Injectors per Cylinder, Black Anodized -Plenum Top – Hi-Ram EFI, 1 x 105mm LS Throttle Body (longitudinal mount)
300-683BK	LS3/L92 Lo-Ram Complete Intake Manifold Kit, Black Matte Powder Coat Finish: -Base Intake Manifold - Top-Feed Plenum, Two Fuel Injectors per cylinder -Fuel Rail Kit – Two Fuel Injectors per Cylinder, Black Anodized -Plenum Top – Hi-Ram EFI, 1 x 105mm LS Throttle Body (longitudinal mount)

300-684	LS3/L92 Lo-Ram Complete Intake Manifold Kit, Satin Finish (As Shot-Blast Aluminum): -Base Intake Manifold - Front-Feed Plenum, Two Fuel Injectors per Cylinder -Fuel Rail Kit – Two Fuel Injectors per Cylinder, Black Anodized -Plenum Top – LS1/2/6 Lo-Ram Front-Feed, w/ Integral Burst Panel Flange -Throttle Body Adapter – LS1/2/6 Lo-Ram Front Feed, 1 x 105mm LS Throttle Body
300-684BK	LS3/L92 Lo-Ram Complete Intake Manifold Kit, Black Matte Powder Coat Finish: -Base Intake Manifold - Front-Feed Plenum, Two Fuel Injectors per Cylinder -Fuel Rail Kit – Two Fuel Injectors per Cylinder, Black Anodized -Plenum Top – LS3/L92 Lo-Ram Front-Feed, w/ Integral Burst Panel Flange -Throttle Body Adapter – LS1/2/6 Lo-Ram Front Feed, 1 x 105mm LS Throttle Body
300-685	LS3/L92 Lo-Ram Billet Throttle Body Adapter Kit, Clear Anodized Aluminum Finish: -LS3/L92 Lo-Ram Front-Feed, 1 x 105 Throttle Body
300-685BK	LS3/L92 Lo-Ram Billet Throttle Body Adapter Kit, Black Anodized Aluminum Finish: -LS3/L92 Lo-Ram Front-Feed, 1 x 105 Throttle Body

INSTALLATION INSTRUCTIONS

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(Before installation, please read these instructions completely.)

NOTE: Holley EFI LS main harnesses have a map sensor connecter designed for use with an LS1/2 style map sensor. The 558-416 is an adapter harness that can be used to adapt any LS harness that uses a LS1/2 MAP sensor connection to a LS3 MAP, which is recommended for this manifold.

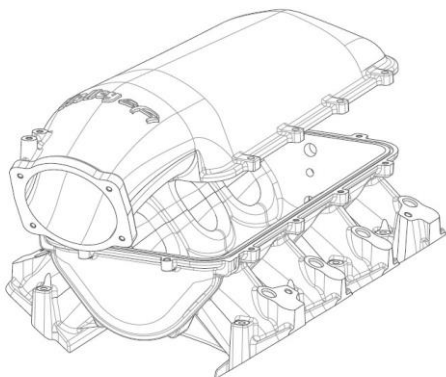
APPLICATIONS:

The Holley LS3/L92 Lo-Ram intake manifold kits are designed for GM LS Gen IV engines equipped with GM LS3/L92 (rectangular port) cylinder heads. These intake manifolds will work with OE or aftermarket cylinder heads as long as the head is made with the intake flange bolt pattern and intake port opening locations matching the OE LS3/L92 rectangular port configuration.

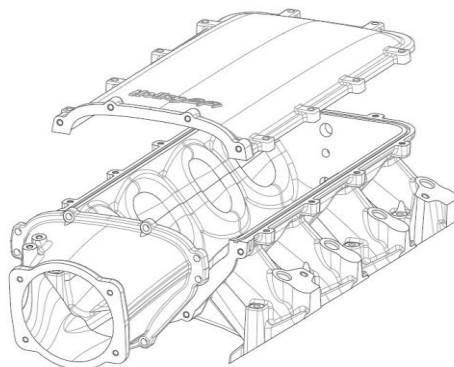
The Lo-Ram intake manifolds are designed mainly for forced induction (supercharged or turbocharged) engine applications. The base intake manifold is designed with a low height to aid the packaging of a plenum mounted air-to-water intercooler in a top-feed configuration or to fit under a stock or mildly modified hood in the front-feed configuration.

Due to the modular design of the LS3/L92 Lo-Ram intake manifold, there are different configurations that can be built-up depending on the customer requirements. Among the configuration options are:

Top-Feed or Front-Feed – The base intake manifold is supplied in two plenum entry configurations. The Top-Feed plenum entry configuration is designed to allow the currently available Hi-Ram plenum tops to be fitted to a low-profile base intake manifold. The short runner, low-profile base intake manifold intended for forced induction applications was conceived to package with an air to water plenum mounted intercooler with a shorter overall height than possible with other existing intake manifolds.



Lo-Ram with Top-Feed Plenum



Lo-Ram with Front-Feed Plenum

The Lo-Ram Front-Feed plenum entry was configured to provide a very low profile modular intake manifold suitable for turbocharged or centrifugally supercharged engines. Along with the current and future available throttle body adapters, the front entry plenum flange allows the design and fabrication of special throttle body adapters or inlet ducts for custom engine installations.

Single or Dual Fuel Injectors – The Lo-Ram base intake manifold was designed to package with either one or two fuel injectors per cylinder. In either the top or front-feed version, the base manifold is available with either one or two sets of the fuel injector ports machined. Fuel rail kits to match are supplied with the base intake manifold kit. Two fuel injectors per cylinder allows enough fuel flow, with various fuels, to make a great deal of power while still maintaining proper fuel metering at idle and part throttle conditions.

The fuel rail kits come with two sets of brackets. A set for long (usually standard length) fuel injectors and a set for short (such as Pico, or LS7) fuel injectors.

Front-Feed Plenum Top Without or With a Burst Panel Flange – The front-feed plenum top casting can be machined for a 6-1/8" x 3-1/8" burst panel. The plenum top is available with this flange machined or left un-machined. A billet aluminum burst panel exit duct is also available.

Satin or Black Matte Powder Coat Finish – The intake manifold castings are available either in a satin (as-shot blasted), or a black matte powder coat finish. The billet burst panel exit duct is available in clear or black anodized finishes.

EMISSIONS EQUIPMENT:

Holley Lo-Ram intake manifolds do not accept any emission-control devices. This part is not legal for sale or use for motor vehicles with pollution-controlled equipment.

DIMENSIONS:

NOTE: All heights measure to the lifter valley cover flange on the engine block.

NOTE: Unless otherwise stated, the dimensions and information applies to the LS3/L92 Lo-Ram application.

- Lo-Ram Base Intake Manifold Plenum Top Mounting Flange Height – 5.67"
- Total Height:
 - Top-Feed Plenum Configuration w/105mm Long. Mount EFI Plenum Top – 9.57" (without an intercooler installed)
 - Top-Feed Plenum Configuration w/105mm Long. Mount EFI Plenum Top, w/an intercooler installed – 9.57"+ the intercooler thickness
 - Front Feed Plenum Configuration w/105mm Throttle Body Adapter – 7.36"
- Port Size – 2.49" Height x 1.21" Wide.
- Mounting Flange Gasket Type – 3/32" Round Viton O-Rings, Size 2-146, 2.612" I.D. (included with the int. man. install kit).
- Plenum Top Gasket Type – 3/32" Round Viton O-ring Cord (included with the intake manifold installation kit).
- Throttle Valve Flange Location:
 - Top Feed Plenum Configuration with 105mm Long. Mount EFI Plenum Top: Height – 5.66", Longitudinal Location – 4.25" (forward from engine block front flange), Lateral Location – On-Center, Angle – 25 deg. (down from vertical)
 - Front-Feed Plenum Configuration w/105mm Throttle Body Adapter: Height – 4.17", Longitudinal Location – 2.29" (forward from engine block front flange), Lateral Location – On-Center, Angle – 10 deg. (down from vertical)
- Runner Length – 3.55"
- As-Cast Runner CSA - Tapered, 4.24 in² at the entry to 2.73 in² at the port flange.

BASE INTAKE MANIFOLD INSTALLATION KIT CONTENTS:

- ❑ 1 – 4.5 ft – O-ring Cord, 3/32" Dia. Round Section Viton, Plenum Flange Seal, Holley Service P/N 508-21
- ❑ 8 – O-Ring, 3/32" Dia. Round Sect. Viton, Size 2-146, 2.612" I.D., Port Flg. Seals, Holley Service P/N 508-22
- ❑ 1 – 1/8 NPT Hex Steel Pipe Plug
- ❑ 1 – 1/4 NPT Hex Steel Pipe Plug
- ❑ 1 – 3/8 NPT Hex Steel Pipe Plug
- ❑ 10 – Stud, M6 x 1.0 Threads, Intake Manifold to Cylinder Head Mounting
- ❑ 10 – Hardened Flat Washer, M6 x 13mm O.D x 2mm Thick, Intake Manifold to Cylinder Head Mounting
- ❑ 10 – Flanged Nut, M6 x 1.0 Threads, Intake Manifold to Cylinder Head Mounting
- ❑ 1 – Installation Instructions

FUEL RAIL KIT CONTENTS:

SINGLE INJECTOR PER CYLINDER – FUEL RAIL KIT P/N 534-260

TWO INJECTORS PER CYLINDER – FUEL RAIL KIT P/N 534-261

- ❑ 2 – Fuel Rail, High Volume, Configured with 3/4-16 O-ring Ports (AN-8)
- ❑ 4 – Bracket, Fuel Rail Mounting, Long (tall injectors)
- ❑ 4 – Bracket, Fuel Rail Mounting, Short (short injectors)
- ❑ 4 – 5/16-18 UNC x 7/8" Long 12-Point Head Cap Screws, Zinc Plated, Fuel Rail Bracket to Manifold Mounting
- ❑ 4 – 5/16-24 UNF x 1.47" Long Hex Head Cap Screws, Zinc Plated, Fuel Rail to Bracket Mounting

TOP-FEED PLENUM TOP INSTALLATION KIT CONTENTS:

- ❑ 1 – Gasket, 105mm LS Throttle Body, Holley Service P/N 508-24
- ❑ 12 – 1/4-20 UNC x 1" Long 12-Point Head Cap Screws, Zinc Plated, Plenum Top and Throttle Body Adapter Mounting
- ❑ 12 – Flat Washer, 1/4" I.D. x 0.468" O.D. x 0.063" Thick, Plenum Top and Throttle Body Adapter Mounting

FRONT-FEED PLENUM TOP INSTALLATION KIT CONTENTS:

- ❑ 1 – 2 ft. O-ring Cord, 3/32" Dia. Round Section Viton, Throttle Body Adapter Flange Seal
- ❑ 18 – 1/4-20 UNC x 1" Long 12-Point Head Cap Screws, Zinc Plated, Plenum Top and Throttle Body Adapter Mounting
- ❑ 18 – Flat Washer, 1/4" I.D. x 0.468" O.D. x 0.063" Thick, Plenum Top and Throttle Body Adapter Mounting

FRONT-FEED THROTTLE-BODY ADAPTER INSTALLATION KIT CONTENTS:

- ❑ 1 – Gasket, 105mm LS Throttle Body, Holley Service P/N 508-24
- ❑ 1 – 2 ft. O-ring Cord, 3/32" Dia. Round Section Viton, Throttle Body Adapter Flange Seal

BURST PANEL EXIT DUCT INSTALLATION KIT CONTENTS:

- ❑ 24 – 10-32 UNC x 3/4" Long Socket Head Cap Screws, Zinc Plated, Burst Panel Exit Duct Mounting

INSTALLATION INSTRUCTIONS:

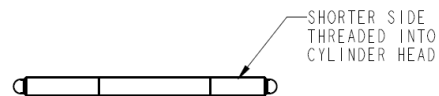
Installation on Modified Engine Components –

These LS3 Lo-Ram intake manifolds are designed to provide maximum performance for racing engines. The intake manifold will have the best fitment when the engine block and cylinder heads are machined to standard OE dimensions. If the engine block or cylinder head deck surfaces have been milled significantly, the alignment of the mounting bolt holes and the port flange openings to the cylinder head may be shifted and not match-up satisfactorily. If your engine has had the cylinder head or engine block deck surfaces milled, the following may be necessary for proper intake manifold installation.

- The bolt holes in the intake manifold would have to be slotted to allow each fastener to properly pass through the manifold mounting holes. The mounting fasteners must freely thread into the cylinder head while passing through the mounting holes or the manifold may not seat properly onto the cylinder head surfaces when the fasteners are tightened.
- As the O-ring grooves are located in the intake manifold mounting flanges, material may not be removed from the intake manifold mounting flanges without jeopardizing the sealing of the manifold. Any material removal required to align the port flange openings should be removed from the cylinder head not the intake manifold.
- When port matching the intake manifold port openings to the cylinder head openings, care should be taken not to break into or damage the O-ring groove or the O-ring seal will not be effective. The intake manifold mounting surfaces on the cylinder heads should be in good condition, free of nicks or scratches, where the sealing O-rings will seat to ensure proper sealing.

Installation of the Base Intake Manifold –

1. Before installing the base intake manifold, perform a test fit of the intake manifold without the O-rings installed. Make sure that the mounting studs supplied thread freely into the cylinder head. The threaded intake mounting holes in most LS3 cylinder heads are through holes. Because of this, when installing the studs into the cylinder head, make sure that the side of the stud with the shorter length of threads goes into the cylinder head to ensure proper exposed stud length when manifold is installed. Using thread locker on stud threads when installing the studs in the heads is not recommended. A drop of engine oil is all that is needed. Hand tighten only to prevent damage to cylinder head threads. The intake manifold should slide over the studs freely into place so that the manifold mounting flanges seat properly on the cylinder head flanges. Be sure that there is no interference between the base intake manifold and the engine valley cover or engine block preventing the manifold from seating down fully.



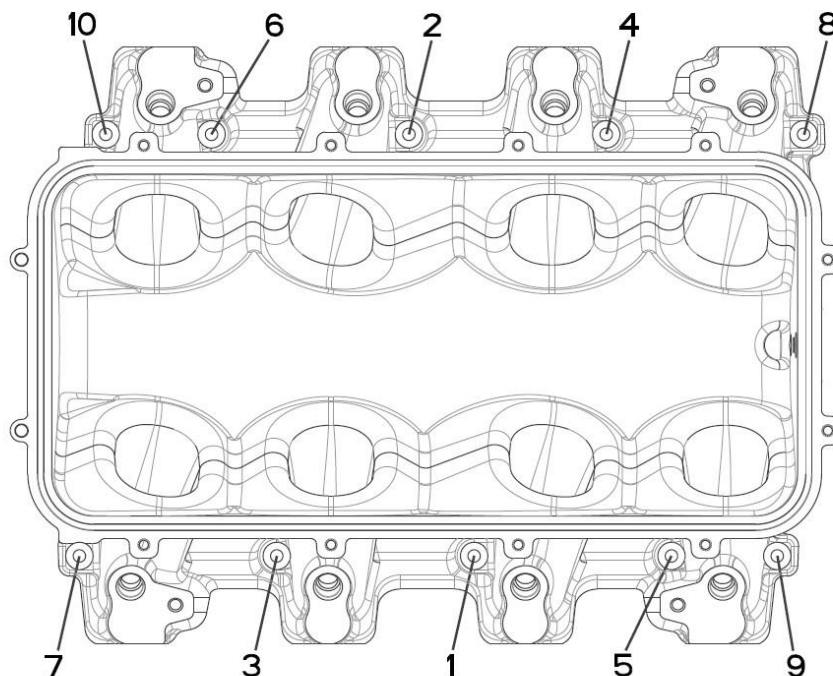
(Note: If it is desired to reverse the orientation of the plenum top, then the orientation of the base intake manifold will also need to be reversed, putting the sensor flange towards the “front” of the engine. The plenum tops recommended for the Lo-Ram base intake manifold use a “bolt-down through design” for the plenum attachment fasteners. All of the 12-point capscrews except at the two “front” bosses thread into the flange on the manifold through the bosses on the plenum top. At the two “front” bosses, the cap screws thread into the plenum top through the bosses on the manifold.)

2. Check the port opening alignment. Test fit the mating parts, such as intercooler, plenum top, throttle body adapter, injectors, fuel rails, fuel and vacuum plumbing, throttle linkage, wiring, etc. to ensure there are not any fit issues before performing the final intake manifold installation.

- For installation, apply a light coat of bearing grease or preferably silicone brake lube to the eight mounting flange O-rings provided. The O-ring grooves in the mounting flanges are of a dove-tail design. Be careful when inserting the O-rings into the grooves to not cut the O-ring on the leading edges of the groove. Stretching length-ways the section of the O-ring being inserted into the groove will shrink the cross-section of the O-ring and allow it to more easily slip into the groove.
- Install the manifold base into place on the mounting flanges. Be sure that all of the O-rings are still in the grooves and are not being crushed between the flanges.

WARNING! The M6 x 1 threads in the aluminum cylinder head will not withstand abuse. Care must be taken to have proper thread engagement and to tighten the fasteners to the proper specifications.

- Install the washers and nuts provided. Engine oil should be applied to the threads and nut flange faces. Gently tighten the nuts working side to side and out from center (see the tightening sequence diagram below), until manifold is seated on the mounting flanges and the O-rings have been compressed. In two steps, tighten the mounting nuts first to 50 in-lbs and then to 106 in-lbs following the tightening sequence diagram below.



Manifold Tightening Sequence

- There is a flange on the rear of the base manifold for vacuum sources and a GM LS style MAP sensor. On these manifolds, there is a 3/8 NPT port, a 1/8 NPT port, and a port for a GM LS3 style MAP sensor (grommet seal on the nipple and retained with a single bolt).

NOTE: Holley EFI LS main harnesses have a map sensor connector designed for use with an LS1/2 style map sensor. The 558-416 is an adapter harness that can be used to adapt any LS harness that uses a LS1/2 MAP sensor connection to a LS3 MAP, which is recommended for this manifold.

LS3 MAP sensor, GM P/N 12591290, will cover naturally aspirated (1 bar) applications; an LS9 MAP sensor (post blower), GM P/N 12592525 (red label) should cover forced induction applications up to 3 Bar (28.8 psig of boost). The LS3 MAP sensor does not have the same absolute pressure measurement to voltage output range as a LS1 or LS2 MAP sensor. An ECU set up for the manifold absolute pressure to voltage output of the LS1 or LS2 MAP sensor will need to recalibrate to properly operate the engine with the LS3 MAP sensor. Consult the ECU manufacturer or tuner for the proper ECU MAP sensor calibration for the MAP sensor that you plan to use.

If the use of a GM bolt-on type MAP sensor is not desired, the MAP port can be tapped 1/4 NPT, and a fitting used in the port to plumb a hose to a MAP sensor mounted at some other location. **NOTE:** A 1/4 NPT pipe plug is included if it is desired to tap and plug the MAP port. The GM LS type sensors can be mounted with a simple hand-made sheet metal bracket and a hose connected to the nipple that is on the MAP sensor with the grommet seal removed.

MAP sensors and pressure transducers of varying maximum pressures are available at <https://www.holley.com>

Installation of the Top-Feed Plenum Top –

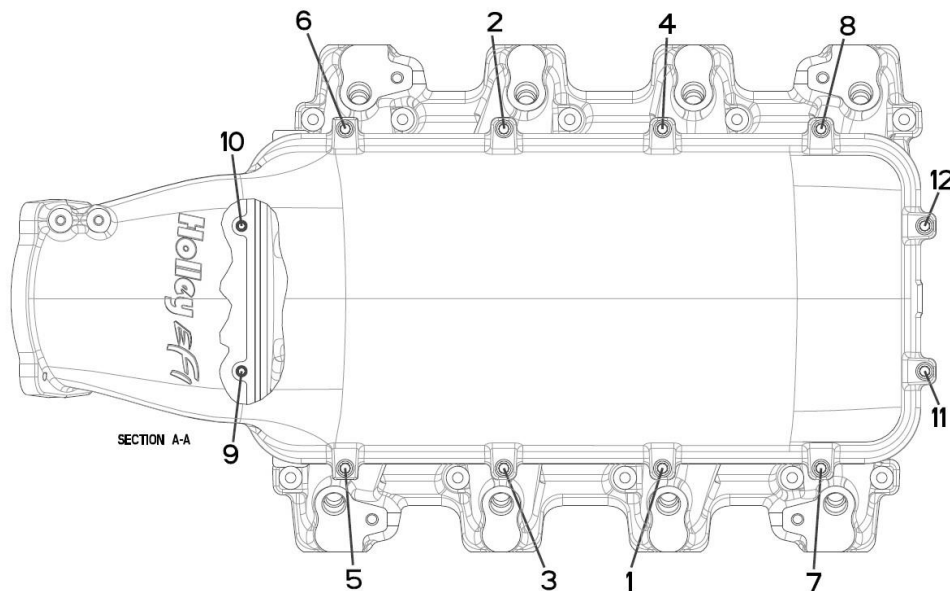
NOTE: If an air to water plenum-mount intercooler is being used, follow the intercooler manufacturer's instructions for its installation.

1. Before installing the plenum top, the supplied O-ring cord (4.5-feet long) will need to be cut to length and glued together.
 - Lay the O-ring cord into the groove on the plenum flange of the base manifold with the free ends overlapped.
 - Mark the position of the cut to be made across both O-ring cord ends.
 - Lay the O-ring cord on a flat surface with the ends overlapped and the marks aligned as they were when the marks were made.
 - With a sharp razor blade, cut through both ends of the O-ring cord at the mark simultaneously.
 - With a drop of super glue (Cyanoacrylate), bond the ends of the O-ring cord together. The glued joint should be smooth, not offset or kinked.
 - To ensure sealing at the glued joint, apply a thin film of silicone sealer around the O-ring at the glued joint, allowing the silicone to partially cure before installation of the joined O-ring cord in the groove.

2. Install the glued O-ring cord in the groove on the base intake manifold plenum top mounting flange. Place the plenum top in place.

As previously noted, if it desired to reverse the orientation of the plenum top, then the orientation of the base intake manifold on the engine will also need to be reversed, putting the sensor flange towards the "front" of the engine. For the carbureted type tops (2 x 4500 and 2 x 4150), the side with the three bosses would go towards the side for the throttle linkage (normally on the driver's side of the car).

3. Using the supplied 1/4" flat washers, apply a drop of engine oil to, and thread in the supplied 1/4-20 x 1" long 12-point capscrews through the plenum top and into the base manifold plenum flange (10 places) and through the base manifold into the plenum top from the underside (2 places).
4. Gently tighten the fasteners evenly - starting from the middle of the sides, crossing side to side, and moving towards the ends until the plenum top is seated and the O-ring is compressed. Tighten the fasteners in two steps using the tightening pattern shown in the figure below. Tighten to 75 in-lbs for the first step and 130 in-lbs for the second step.

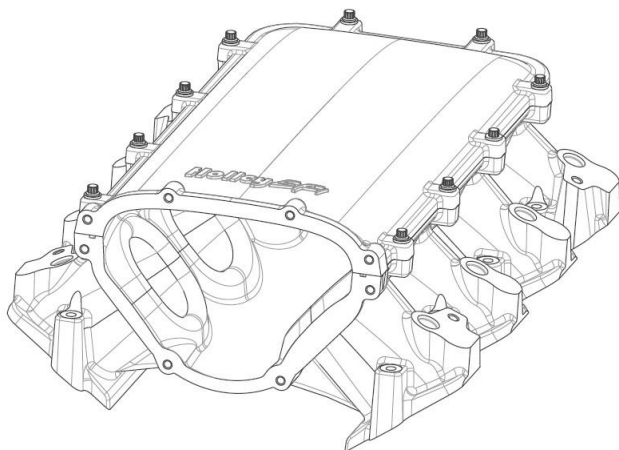


Plenum Top Tightening Sequence

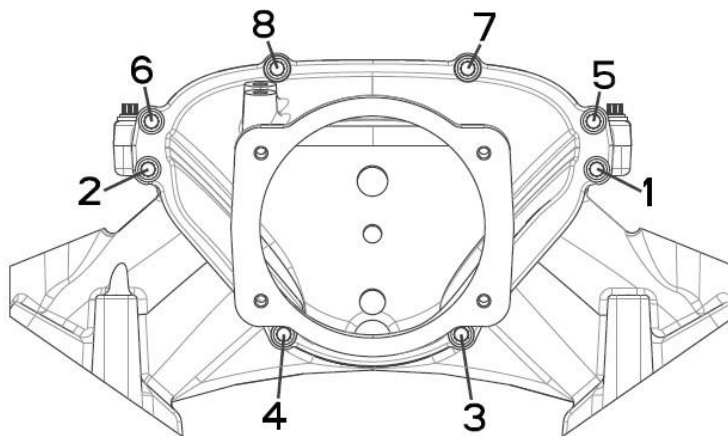
Installation of the Front-Feed Plenum Top and Throttle Body Adapter –

1. Install the supplied O-ring cord in the groove on the base manifold plenum flange so that the ends of the O-ring cord extend out of the groove at the throttle body adapter flange. Place the plenum top in place.
2. Using the supplied 1/4" flat washers, apply a drop of engine oil to, and thread in the supplied 1/4-20 x 1" long 12-point capscrews through the plenum top and into the base manifold plenum flange (10 places). Without regard to the alignment of the throttle body adapter flange, gently tighten the fasteners evenly until the plenum top is seated on the intake manifold plenum flange and the O-ring is fully compressed.

3. Using a sharp razor blade, trim-off the two ends of the O-ring cord flush to the throttle body adapter flange on the base intake manifold. Once the O-ring cord ends are trimmed, loosen the plenum top fasteners enough that the plenum top throttle body adapter flange can be aligned to the base intake manifold throttle body adapter flange by doing a preliminary install of the throttle body adapter.
4. Make sure the O-ring seal is not installed in the throttle body adapter during the preliminary installation of this part. Using the supplied 1/4" flat washers, apply a drop of engine oil to, and thread in the supplied 1/4-20 x 1" long 12-point capscrews through the throttle body adapter into the throttle body adapter flange formed by the base intake manifold and then into the plenum top flange (8 places). Lightly tighten the TB adapter fasteners until the throttle body adapter flanges of the base intake manifold and the plenum top are aligned. There may need to be several iterations of loosening and re-tightening the fasteners of the plenum top to make sure the TB adapter flanges are aligned as one flange and the plenum top is seated on the intake manifold with the O-ring compressed. Once the plenum top is properly in position with the fasteners tight enough to retain it in position, remove the throttle body adapter.



5. The supplied O-ring cord, 2-foot long, to seal the throttle body adapter needs to be cut to length and the ends glued together.
 - Insert the O-ring cord into the groove on the mounting flange of the throttle body adapter with the free ends overlapped.
 - Mark the position of the cut to be made across both O-ring cord ends.
 - Lay the O-ring cord on a flat surface with the ends overlapped and the marks aligned as they were when the marks were made.
 - With a sharp razor blade cut thru both ends of the O-ring cord at the marks simultaneously.
 - With a drop of super glue (Cyanoacrylate), bond the ends of the O-ring cord together. The glued joint should be smooth, not offset or kinked.
 - To ensure sealing at the glued joint, apply a thin film of silicone sealer around the O-ring cord at the glued joint, allowing the silicone to partially cure before installation of the joined O-ring cord in the groove.
6. Install the glued O-ring cord in the groove on the throttle body adapter mounting flange. The O-ring groove in the throttle body adapter mounting flange is of a dove-tail design. Be careful when inserting the O-ring into the groove to not cut the O-ring on the leading edges of the groove. Stretching length-ways the section of the O-ring being inserted into the groove will shrink the cross-section of the O-ring and allow it to more easily slip into the groove. The joined area of the O-ring should be positioned in the groove to be opposite of the area where fluid is most likely to gather in a pool at the flange.
7. Before installing the throttle body adapter, apply a dab of silicone sealer on the mating flange, (2 places), where O-ring seal groove for the plenum top mounting flange intersects throttle body adapter mounting flange. Using the supplied 1/4" flat washers, apply a drop of engine oil to, and thread in the supplied 1/4-20 x 1" long 12-point capscrews through the throttle body adapter and first into the throttle body adapter flange formed by the base intake manifold and after the plenum top flange (8 places). Gently tighten the eight fasteners for the throttle body adapter evenly until the O-ring seal is fully compressed and the adapter is seated on the mating flange.
8. Using the plenum top tightening sequence (disregarding 9 & 10 in the figure), tighten to plenum top fasteners to 75 in-lbs for the first step. Then following the throttle body adapter tightening sequence, tighten the TB adapter fasteners to 75 in-lbs. Repeat the tightening procedure at 130 in-lbs for the second step, tightening first the plenum top fasteners and then the TB adapter fasteners in sequence.



Throttle Body Fastener Tightening Sequence

Installation of the Fuel Rails –

All of the LS3 Lo-Ram intake manifold kits contain a fuel rail kit.

IM Kits including the single injector per cylinder fuel rail kit are P/N's:

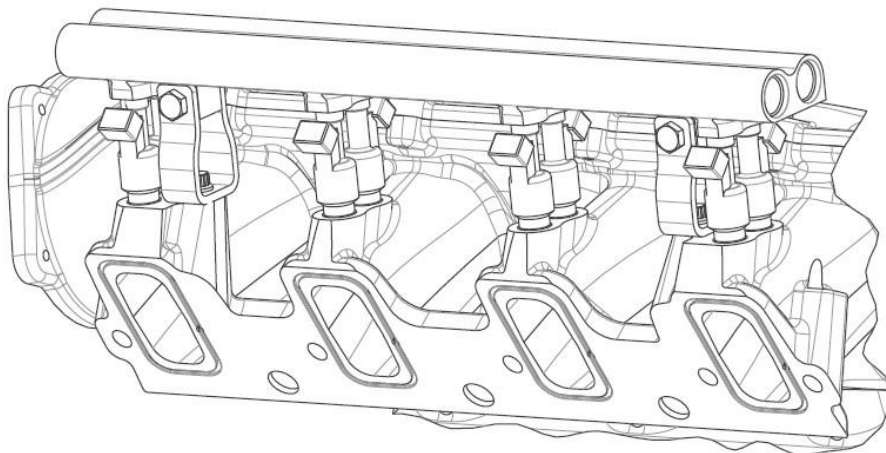
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300-682 & 300-682BK

IM Kits including the two injectors per cylinder fuel rail kit are P/N's:

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300-683 & 300-683BK
300-684 & 300-684BK

The fuel rail kits have two sets of mounting brackets. The longer brackets position the fuel rail to install an injector of the longer length of a standard Bosch style EV-1 fuel injector. The shorter set of brackets position the fuel rail to install an injector of the shorter length of a LS7 or Pico style fuel injector.

For the dual-injector, two-injectors per cylinder, fuel rail kit the center to center distance of the paired injectors is 0.880". A result of this spacing is that if the average overall diameters of the two injectors being paired together exceeds about 0.820" the injectors will not fit with the dual-injector fuel rail configuration. For example, two EV1 type injectors, which may have an outer diameter of up to 0.945" may not be paired together. There are many injectors available with outer diameters that can be paired together. Injectors with flow volumes as much as 220PPH, which dimensionally may be paired together, are available from Holley. See <https://www.holley.com>



Fuel Rail & Injector Installation (two-injector/cyl. version shown)

Installation Steps

1. Install the fuel rail mounting brackets. Use the appropriate length bracket supplied for the injectors being used. Using a drop of oil on the fastener threads, thread the 5/16-18 x 7/8" long 12-point capscrews through the bracket until the capscrews are hand tight. To orient the brackets install the fuel rails in the brackets with the supplied hex bolts being inserted from outside-in, threading into the threaded boss on the bracket which should be turned towards the plenum. Tighten the 5/16-18 capscrews to 20-22 ft-lbs being careful that the brackets remain correctly oriented while being tightened.
2. Remove the fuel rail from the brackets so that the injectors may be inserted into the fuel rail.
3. Apply a silicone lubricant to the O-ring on the inlet end of fuel injectors and insert the fuel injectors into the ports of the fuel rail. To insert each injector without tearing the O-ring, gently rock the injector in the inlet of the port while applying pressure to insert the injector.
4. Position the injectors to properly orient the wiring plugs, apply silicone lubricant to the injector outlet O-rings. Place the fuel rail into position, inserting all four (or eight) injectors into the injector bosses in the base intake manifold applying gentle downward pressure on the fuel rail. The proper orientation for the fuel rail is with the logo facing inward toward the plenum.
5. Once the injectors are inserted into the intake manifold and the fuel rail is in position, apply a drop of oil to the threads of the 5/16-24 x 1.47 hex bolts. Insert both into the brackets through the fuel rail, threading the bolts into the opposite ear of the bracket until snug. Tighten the hex bolts to 18-20 ft-lbs.
6. Check and make sure each injector is floating on the O-rings. Rotate the injectors back and forth to confirm that there are no loads on any of the installed fuel injectors.
7. Repeat the installation for the second set of fuel rail and injectors.

The fuel rail is designed to provide enough flow and volume to dampen fuel pressure oscillations and variations at the inlet of the fuel injectors. The fuel rails are machined to receive an adapter fitting for 3/4-16 (AN-8) O-ring port.

Available Earl's -6AN & -8AN male flare to 3/4"-16 AN O-ring port adapter fittings are:

Standard 7/8" wrench hex

P/N – 985068ERL – Adapter, Earl's -6AN male to 3/4"-16 (AN8) O-ring Port – Blue Anodized Aluminum
P/N – AT985068ERL – Adapter, Earl's -6AN male to 3/4"-16 (AN8) O-ring Port – Black Anodized Aluminum
P/N – 985008ERL – Adapter, Earl's -8AN male to 3/4"-16 (AN8) O-ring Port – Blue Anodized Aluminum
P/N – AT985008ERL – Adapter, Earl's -8AN male to 3/4"-16 (AN8) O-ring Port – Black Anodized Aluminum

Reduced Size 3/4" wrench hex

P/N – 991959ERL – Adapter, Earl's -6AN male to 3/4"-16 (AN8) O-ring Port – Red Anodized Aluminum
P/N – AT991959ERL – Adapter, Earl's -6AN male to 3/4"-16 (AN8) O-ring Port – Black Anodized Aluminum
P/N – 991958ERL – Adapter, Earl's -8AN male to 3/4"-16 (AN8) O-ring Port – Red Anodized Aluminum
P/N – AT991958ERL – Adapter, Earl's -8AN male to 3/4"-16 (AN8) O-ring Port – Black Anodized Aluminum

Fuel Plumbing Recommendations:

- For power levels below 700-750HP, AN-6 (3/8") plumbing to and from the fuel rails should be sufficient.
- For power levels above 750HP, AN-8 (1/2") plumbing is recommended.
- It is always recommended to only use tubular hose ends when a non-straight hose end is required.
- The best configuration for plumbing the fuel rails is to split from the supply line with a "Y" type distribution block or fitting, then feed into the inlet end of each fuel rail. The hoses from the exit end of each fuel rail would then feed into each inlet port of a fuel pressure regulator with two inlet ports or into another "Y" type distribution block or fitting connecting to a hose leading to the fuel pressure regulator.

Installation of the EFI Throttle Bodies –

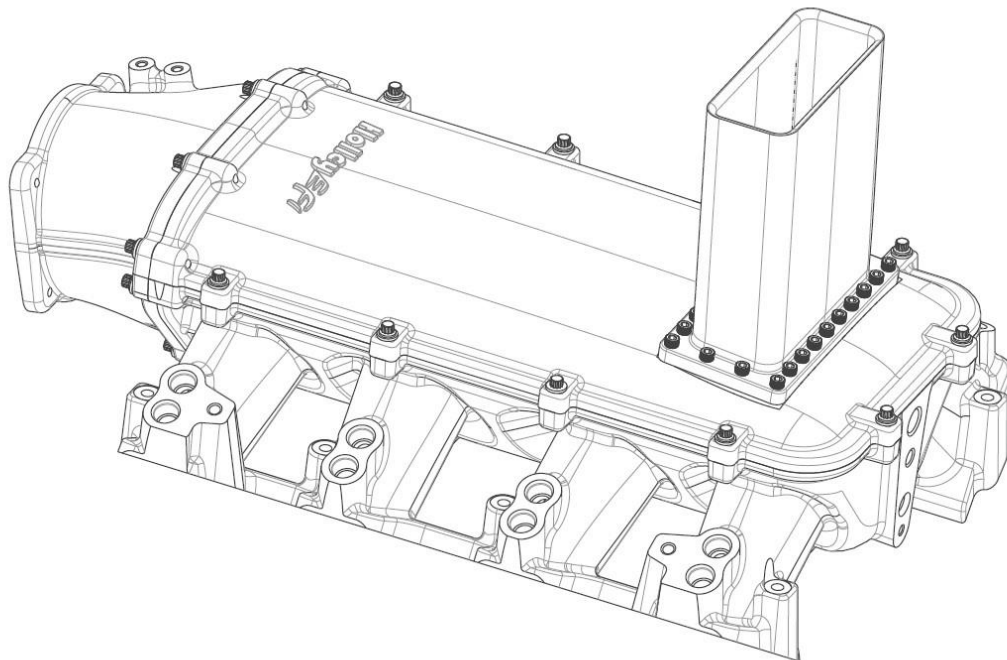
1. When installing the throttle bodies and the connecting throttle linkage, check to be sure that all throttle levers and linkage components have adequate clearance from the intake manifold and plenum top components.
2. The plenum tops for the 2 x 4500 and 2 x 4150 carb. flange configurations have bosses for the mounting of throttle linkage. The three bosses are positioned for the mounting of heim joints that would carry a throttle linkage motion transfer shaft.
3. The EFI 1 x 105mm LS throttle body plenum tops and throttle body adapters provide bosses near the throttle body flange for the mounting of a throttle cable bracket. Holley throttle cable brackets are available for the Hi-Ram EFI plenum top (P/N 20-149) and for the Lo-Ram 105mm throttle body adapter (P/N 20-154). These brackets are configured for a GM throttle cable from 98-02 Camaro/Firebird, GM P/N 12563339, and various GM cruise control cables from the same vehicle application. For

other cable configurations, a custom bracket may need to be fabricated by the user for their throttle cable and throttle body configuration. It should be noted that the throttle body flange on the Lo-Ram intake manifolds plenum top may fit a GM LS 4-bolt flange drive-by-wire throttle body.

Installation of the Burst Panel and Exit Duct –

Lo-Ram intake manifold kits 300-682/300-682BK, 300-684/300-684BK, and plenum top kits 300-605/300-605BK are machined for a standard "large" 6-1/8" x 3-1/8" burst panel. Burst panels, burst panel frame sets, and gaskets may be purchased from various manufacturers – some are listed in the parts section shown later in this instruction sheet.

Holley offers a billet aluminum burst panel exit duct, 300-608 (clear anodized) & 300-608BK (black anodized). The burst panel flange on the plenum top is configured to receive the burst panel and the exit duct flange is made to clamp the burst panel in place. Twenty-four 10-24 x 3/4" socket head capscrews are included with the exit duct. The burst panel exit duct is approximately six inches long. It is intended to be long enough to pass through the body panel above the intake manifold and to be shortened to the desired length.



Burst Panel & Exit Duct Installation

Installation Steps

1. The burst panel should be installed on the plenum top flange so the raised area of the panel is oriented up. There is a 10-24 threaded hole in the center of the burst panel flange. A 10-24 button head screw (not included) should be threaded into this hole and spaced up with washers under the screw head to a height that the button head will just touch the underside of the panel when the panel is seated in place. The button head will support the burst panel when there is high manifold vacuum in the plenum. Be sure the center button head screw is tight.
2. Either gaskets supplied by burst panel manufacturer or an anaerobic flange sealer such as Loctite 518 should be used to seal the burst panel to the plenum top flange. The gasket or sealant should only be applied between the plenum top flange and the burst panel. With a gasket or the flange sealant in place, put the burst panel in place.
3. With the burst panel in place, place the exit duct on top of the burst panel. Thread-in three or four of the 10-24 socket head capscrews through the exit duct and into the plenum top until finger tight. Now that the exit duct is located and seated on the burst panel flange, thread-in the rest of the 10-24 socket head capscrews.
4. Working from the middle out tighten the 10-24 socket head capscrews to 50 in-lbs. Clean any excess sealer that may have squeezed out of the flange as the fasteners were tightened.

LO-RAM & HI-RAM PLENUM TOPS, THROTTLE BODIES, AND SERVICE PARTS AVAILABLE SEPARATELY:

Plenum Tops

Top-Feed Plenum Configuration

NOTE: The LS3 Lo-Ram is designed as an EFI intake manifold, the plenum is not designed for carbureted applications, these plenum tops should only be mated with the Lo-Ram Top-Feed Base IM's to accommodate EFI throttle bodies only.

NOTE: The plenum top attachment for the LS3 Lo-Ram Intake Manifold uses a "bolt-down through design". Except for the front two plenum bolt holes, the plenum bolts thread into the base intake manifold passing through clearance holes in the plenum top. Plenum tops from earlier Hi-Rams used a "bolt up through the base manifold threaded into the plenum top" configuration. The earlier plenum tops would require modification to mate with a LS3 Lo-Ram Top-Feed base intake manifold.

300-207	2 x 4150, up to 1.75" bores, sideways mount 4150, in-line mount 4160, (note: bolt-down through design)
300-207BK	2 x 4150, up to 1.75" bores, Black, sideways mount 4150, in-line mount 4160, (note: bolt-down through design)
300-208	Blank Flange Configurable Top, (note: bolt-down through design)
300-208BK	Blank Flange Configurable Top, Black, (note: bolt-down through design)
300-239	2 x 4500, up to 2.25" Throttle Bores, (note: bolt-down through design)
300-245	1 x 95mm LS Throttle Body, Longitudinal Mount (note: bolt-down through design)
300-245BK	1 x 95mm LS Throttle Body, Longitudinal Mount, Black (note: bolt-down through design)
300-246	1 x 105mm LS Throttle Body, Longitudinal Mount (note: bolt-down through design)
300-246BK	1 x 105mm LS Throttle Body, Longitudinal Mount, Black (note: bolt-down through design)
300-302	1 x 95mm LS Throttle Body, Side TB Mount (note: bolt-down through design)
300-302BK	1 x 95mm LS Throttle Body, Side TB Mount (note: bolt-down through design)
300-304	1 x 105mm LS Throttle Body, Side TB Mount (note: bolt-down through design)
300-304BK	1 x 105mm LS Throttle Body, Side TB Mount (note: bolt-down through design)

Front-Feed Plenum Configuration

300-604	Front-Feed Plenum Top, Standard (no burst panel flange)
300-604BK	Front-Feed Plenum Top, Standard (no burst panel flange), Black
300-605	Front-Feed Plenum Top, with Burst Panel Flange
300-605BK	Front-Feed Plenum Top, with Burst Panel Flange, Black

Throttle Body Adapters (Front-Feed Plenum Configuration)

300-676	Throttle Body Adapter, LS3 Lo-Ram, 105mm GM LS Throttle Body
300-676BK	Throttle Body Adapter, LS3 Lo-Ram, 105mm GM LS Throttle Body

Fuel Rail Kits

534-260	LS1/2/6 & LS3/L92 Lo-Ram Fuel Rail Kit, Single-Injector per Cylinder, 3/4-16 O-ring Port (AN-8) Connection
534-261	LS1/2/6 & LS3/L92 Lo-Ram Fuel Rail Kit, Two-Injectors per Cylinder, 3/4-16 O-ring Port (AN-8) Connection
534-262	LS1/2/6 & LS3/L92 Lo-Ram Fuel Rail Bracket & Fastener Mounting Kit

Throttle Bodies

112-578	2000 CFM 4500 Dominator Flange Throttle Body, 4 x 2.25" Throttles, Clear Anodized
112-587	1000 CFM 4150 Flange Throttle Body, 4 x 1.75" Throttles, Hard Core Gray
112-588	1000 CFM 4150 Flange Throttle Body, 4 x 1.75" Throttles, Polished
112-581	Billet 105mm LS Throttle Body, w/Low-RPM Tapered Throttle Bore
112-583	Billet 105mm LS Throttle Body, w/Straight Throttle Bore

Burst Panel Exit Ducts & Burst Panel

300-608	Billet Burst Panel Exit Duct, 6-1/8" x 3-1/8" Panel x 6" Long, Clear Anodized
300-608BK	Billet Burst Panel Exit Duct, 6-1/8" x 3-1/8" Panel x 6" Long, Black Anodized
Burst Panel 6-1/8" x 3-1/8", SFI Approved	Purchase from various suppliers:
Specialty Fasteners	P/N BP, 909-393-3999, https://www.specialty-fasteners.com
Blower Shop	P/N 2585, 208-985-7655, https://theblowershop.com
Allstar Performance	P/N ALL26310, 269-463-8000, https://allstarperformance.com

Fabrication Flanges

300-220	Hi-Ram Plenum Fabrication Flange, 0.50" Billet Machined Aluminum Plate
300-221	Hi-Ram 92mm LS Throttle Body Fabrication Flange, 0.50" Billet Machined Aluminum Plate
300-222	Hi-Ram 102mm LS Throttle Body Fabrication Flange, 0.50" Billet Machined Aluminum Plate
300-610	Lo-Ram/Hi-Ram 105mm LS Throttle Body Fabrication Flange, 0.50" Billet Machined Aluminum Plate
300-732	LS3 Lo-Ram Front-Feed Throttle Body Adapter Mounting Fabrication Flange, 0.50" Billet Machined Alum. Plate

Service Parts

20-149	Throttle Cable Bracket Kit, Hi-Ram/Mid-Rise/Top-Feed Lo-Ram Intake Manifolds using the 92, 95, & 105mm Throttle Bodies on a Hi-Ram EFI Plenum Top
20-154	Throttle Cable Bracket Kit, Lo-Ram Front-Feed Intake Manifold Kits
300-613	Fastener & O-ring Cord Kit, Lo-Ram Plenum Top & Throttle Body Adapter Mounting
300-614	Fastener Kit, LS1/2/6 Lo-Ram Burst Panel Duct Mounting
300-686	Stud Kit, LS3/L92 Lo-Ram Base Intake Manifold Mounting
508-20	Throttle Body Gasket, 92/102mm LS Throttle Body
508-21	Hi-Ram Plenum O-ring Cord, 3/32" Round, Viton, 4.5' Long (use for plenum or throttle body adapter flange seal)
508-22	LS3/L92 Hi-Ram Port Flange O-rings, 3/32" Round, Size 2-146, Viton, set of 8
508-24	Throttle Body Gasket, 105mm LS Throttle Body
534-104	Fuel Injector O-rings, set of 16 (O-ring supplied in LS7 fuel injector adapter mount kit 300-230)

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Revision Date: 4-26-21



Throttle Body Installation Instructions for GM LS Race Series

860007-1 (Silver) & 860008-1 (Black) – 90MM
860001-1 (Silver) & 860004-1 (Black) – 92MM
860002-1 (Silver) & 860005-1 (Black) – 102MM

Kit Contents:

- Throttle Body
- (4) Throttle Body Mounting Bolts
- Installation Instructions

Installation Instructions:

1. Please read through the entire instruction sheet to familiarize yourself with the parts of the vehicle the installation will cover.
2. Disconnect the negative battery terminal.
3. Remove the air inlet tube, all vacuum hoses, and electrical connectors from the stock throttle body. Mark all hoses and wires to ensure that they are installed correctly on the new throttle body.
4. Disconnect the throttle linkage by opening the throttle manually and slipping the cable from the cam groove on the linkage.
5. Remove the (x4) nuts securing the throttle body to the intake manifold and remove it.
6. Attach the IAC (**Holley replacement part # 543-34**) and TPS (**Holley replacement part # 870001**) to the new throttle body. Make sure each O-ring is in the groove and does not slip out while installing. Torque bolts to **18 in/lbs (1.5 ft/lbs)**.
7. Make certain the gasket-mating surface on the intake manifold is clean and free of debris. Using the included bolts, attach the throttle body to the intake manifold. Torque nuts and bolts down to **89 in/lbs (7 ft/lbs)**.
8. Slip the throttle cable on the linkage arm.
9. Observe the throttle body (while an assistant presses and releases the gas pedal) to ensure that the throttle blade opens and closes while also operating smoothly.
10. Re-attach the air inlet tube, all vacuum hoses, and electrical connectors on the new throttle body.
11. Re-connect the negative battery terminal.
12. Start the engine and check for loose connections or vacuum leaks, etc.
13. After the engine is warmed up, check the idle speed (refer to owner's manual).
14. Double-check all fasteners, clamps, and electrical connections to ensure they are all secure.

Any questions?

Please contact Technical Service: **1-866-464-6553** or **270-781-9741**.

For online help, please refer to the website: **www.holley.com**.

LIMITATION OF LIABILITY – DISCLAIMER:

The regulation of emissions production, noise levels, and safety standards is undertaken by the federal government, each of the fifty state legislatures, and by many local municipalities, towns, and counties.

Holley Sniper EFITM makes no warranties of merchantability, of fitness for particular purpose, or that its products are approved for general use, or that its products are approved for general use, or that its products comply with laws, regulations, or ordinances in the state where they may be sold to the ultimate purchaser, the consumer. Unless expressly stated to the contrary in the catalog, instruction sheet; or price list, the entire risk as to the conformity of any company product in any such state and as to repair should the product prove to be defective or non-conforming, is on the retail purchaser, the buyer, the ultimate consumer, of such product and it is not upon the seller, distributor, or manufacturer. In this connection, the retail purchaser, the buyer, the ultimate consumer assumes the burden of the entire cost of any and all necessary service, alterations, or repair.

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Revision Date: 4-3-18



Injector Off Times to use with Terminator X and Terminator X Max ECUs

MPFI Injectors	Rated Flow per Injector (lb/hr)	Rated Injector Pressure (psi)	Minimum Injector Opening Time (msec)	Injector Off Time (msec)																
				8.0V	8.8V	9.6V	10.4V	11.2V	12.0V	12.8V	13.6V	14.4V	15.2V	16.0V	16.8V	17.6V	18.4V	19.2V	20.0V	
Term X 42 lb/hr	42.5	60.0	1.20	1.35	1.17	0.90	0.82	0.69	0.51	0.43	0.35	0.34	0.23	0.21	0.11	0.09	0.05	0.02	0.00	
Term X 76 lb/hr	76.2	60.0	1.20	2.12	1.85	1.39	1.20	0.96	0.86	0.71	0.65	0.57	0.50	0.38	0.35	0.33	0.26	0.24	0.21	
Term X 100 lb/hr	100.0	60.0	1.20	3.05	2.18	1.73	1.34	1.17	0.99	0.83	0.74	0.63	0.56	0.49	0.42	0.37	0.30	0.26	0.23	
Term X 120 lb/hr	120.0	60.0	1.20	2.78	2.21	1.94	1.65	1.43	1.30	1.15	0.99	0.92	0.88	0.81	0.73	0.70	0.67	0.64	0.62	
Term X 220 lb/hr	220.0	43.5	1.20	2.96	2.19	1.84	1.56	1.32	1.12	0.96	0.83	0.72	0.63	0.55	0.47	0.41	0.35	0.30	0.25	
Accel 150830 30 lb/hr	28.8	43.5	1.00	1.85	1.42	1.16	0.98	0.83	0.71	0.60	0.50	0.42	0.34	0.28	0.23	0.18	0.13	0.09	0.04	
Accel 150832 32 lb/hr	31.5	43.5	1.00	1.98	1.51	1.23	1.04	0.89	0.76	0.63	0.54	0.46	0.37	0.30	0.23	0.17	0.12	0.08	0.03	
Accel 150844 44 lb/hr	43.5	43.5	1.00	1.63	1.33	1.08	0.92	0.81	0.75	0.59	0.51	0.43	0.35	0.29	0.23	0.18	0.14	0.16	0.06	
Accel 151845 45 lb/hr	47.0	43.5	1.00	1.98	1.04	0.81	0.74	0.63	0.54	0.45	0.37	0.31	0.25	0.20	0.15	0.11	0.08	0.05	0.02	
Accel 151848 48 lb/hr	49.8	43.5	1.00	2.52	0.81	0.62	0.53	0.44	0.34	0.25	0.18	0.13	0.08	0.04	0.00	-0.04	-0.07	-0.09	-0.12	
Accel 151853 53 lb/hr	58.1	43.5	1.00	2.99	2.14	1.75	1.50	1.29	1.12	0.98	0.86	0.75	0.65	0.58	0.51	0.45	0.38	0.31	0.25	
Accel 151861 61 lb/hr	63.9	43.5	1.00	1.89	1.45	1.21	1.03	0.87	0.73	0.62	0.55	0.48	0.39	0.31	0.23	0.16	0.10	0.05	0.02	
Accel 74620L 62 lb/hr	64.0	43.5	1.00	1.63	1.29	1.12	0.93	0.77	0.65	0.55	0.45	0.37	0.28	0.21	0.15	0.10	0.06	0.02	-0.02	
Accel 151880 80 lb/hr	77.0	43.5	1.00	1.74	1.41	1.21	1.03	0.87	0.75	0.67	0.59	0.50	0.43	0.35	0.28	0.23	0.18	0.13	0.10	
19LB Holley 522-198	19.0	43.0	1.00	1.48	1.24	1.02	0.85	0.72	0.62	0.53	0.46	0.40	0.35	0.30	0.26	0.22	0.19	0.15	0.12	
24LB Holley 522-248	24.0	43.0	1.00	1.33	1.09	0.87	0.70	0.56	0.46	0.37	0.29	0.22	0.16	0.10	0.06	0.01	0.01	0.01	0.01	
30LB Holley 522-308	30.0	43.0	1.00	1.73	1.46	1.22	1.03	0.87	0.75	0.65	0.56	0.49	0.43	0.37	0.32	0.26	0.22	0.19	0.16	
36LB Holley 522-368	36.0	43.0	1.00	1.59	1.34	1.12	0.93	0.79	0.67	0.57	0.48	0.41	0.35	0.31	0.27	0.23	0.19	0.15	0.11	
42LB Holley 522-428	42.0	43.0	1.00	1.69	1.42	1.18	0.98	0.83	0.72	0.61	0.51	0.43	0.36	0.30	0.24	0.20	0.15	0.11	0.07	
48LB Holley 522-488	48.0	43.0	1.00	1.47	1.24	1.02	0.84	0.70	0.59	0.50	0.42	0.35	0.29	0.23	0.18	0.13	0.09	0.06	0.03	
Mopar - RL032713AB	27.3	43.5	1.00	2.43	2.01	1.70	1.45	1.28	1.13	0.98	0.86	0.78	0.70	0.63	0.55	0.48	0.41	0.34	0.29	
Mopar - 4591851AB	26.8	43.5	1.00	2.53	2.08	1.75	1.50	1.33	1.17	1.04	0.91	0.83	0.75	0.69	0.62	0.56	0.49	0.43	0.37	
Mopar - 5037479AA	31.5	43.5	1.00	2.40	2.03	1.74	1.51	1.32	1.16	1.01	0.92	0.84	0.75	0.67	0.60	0.52	0.44	0.38	0.33	
Mopar - 5038337AB	35.0	43.5	1.00	2.65	2.12	1.81	1.54	1.34	1.19	1.04	0.92	0.83	0.74	0.67	0.59	0.52	0.45	0.39	0.33	
Mopar - 68170238AB	52.0	43.5	1.00	1.35	1.10	0.89	0.70	0.62	0.53	0.44	0.37	0.32	0.26	0.21	0.16	0.11	0.07	0.03	0.00	
Mopar - 5038838AA	61.0	43.5	1.00	2.00	1.83	1.53	1.32	1.15	1.01	0.89	0.79	0.70	0.63	0.56	0.51	0.45	0.40	0.36	0.32	
Ford 19 lb/hr Yellow Big Body	19.0	43.5	1.00	1.83	1.46	1.24	1.06	0.93	0.82	0.73	0.65	0.58	0.51	0.45	0.40	0.36	0.30	0.25	0.21	
Ford 24 lb/hr Blue Big Body	24.0	43.5	1.00	1.78	1.40	1.17	0.99	0.86	0.73	0.65	0.58	0.51	0.45	0.40	0.35	0.30	0.26	0.21	0.18	
Ford 30 lb/hr Red Big Body	30.0	43.5	1.00	2.25	1.73	1.42	1.21	1.06	0.95	0.85	0.76	0.68	0.60	0.53	0.47	0.42	0.37	0.32	0.27	
Ford - BR329F593A	34.0	43.5	1.00	2.02	1.65	1.40	1.20	1.05	0.93	0.82	0.71	0.62	0.55	0.48	0.42	0.36	0.31	0.25	0.27	
FRPP M-9593-LU47	51.0	43.5	1.00	2.31	1.69	1.50	1.35	1.18	1.03	0.82	0.82	0.72	0.64	0.56	0.50	0.44	0.39	0.34	0.29	
FRPP M-9593-G302	51.0	43.5	1.00	2.95	2.10	1.77	1.53	1.33	1.17	1.04	0.92	0.82	0.73	0.65	0.59	0.52	0.47	0.41	0.36	
FRPP M-9593-MU52	59.6	43.5	1.00	3.27	2.21	1.88	1.65	1.44	1.27	1.13	1.01	0.91	0.82	0.73	0.66	0.60	0.54	0.48	0.43	
FRPP M-9593-LU60	64.0	43.5	1.00	1.94	1.46	1.17	0.99	0.85	0.71	0.58	0.49	0.42	0.35	0.29	0.22	0.16	0.10	0.04	0.00	
FRPP M-9593-LU80	77.8	43.5	1.00	1.86	1.54	1.28	1.11	0.97	0.83	0.69	0.62	0.55	0.49	0.42	0.35	0.28	0.22	0.17	0.12	
LS3 12576341	41.1	60.0	1.00	1.80	1.49	1.21	1.00	0.84	0.73	0.63	0.54	0.46	0.40	0.34	0.29	0.24	0.20	0.15	0.10	
GM 12580426 5.3 Flex Fuel	35.9	60.0	1.00	1.67	1.37	1.11	0.90	0.76	0.64	0.54	0.45	0.37	0.32	0.27	0.22	0.18	0.14	0.10	0.05	
GM 12580681	29.6	60.0	1.00	0.95	0.80	0.66	0.54	0.45	0.36	0.32	0.27	0.23	0.20	0.17	0.14	0.12	0.10	0.08	0.06	
GM 17113698	24.4	60.0	1.00	0.70	0.59	0.48	0.38	0.31	0.23	0.19	0.15	0.12	0.09	0.06	0.04	0.02	0.00	-0.02	-0.03	
GM 25317628	24.4	60.0	1.00	0.70	0.59	0.48	0.38	0.31	0.23	0.19	0.15	0.12	0.09	0.06	0.04	0.02	0.00	-0.02	-0.03	
GM 17113553	24.7	60.0	1.00	0.72	0.59	0.46	0.37	0.31	0.25	0.19	0.14	0.10	0.06	0.03	0.01	-0.01	-0.03	-0.05	-0.06	
GM 25323974	24.7	60.0	1.00	0.72	0.59	0.46	0.37	0.31	0.25	0.19	0.14	0.10	0.06	0.03	0.01	-0.01	-0.03	-0.05	-0.06	
GM 25320288	24.7	60.0	1.00	0.72	0.59	0.46	0.37	0.31	0.25	0.19	0.14	0.10	0.06	0.03	0.01	-0.01	-0.03	-0.05	-0.06	
GM 89017586	33.3	60.0	1.00	1.80	1.52	1.24	1.03	0.88	0.74	0.65	0.56	0.48	0.41	0.35	0.30	0.25	0.21	0.18	0.14	
GM LS3 12576341	41.0	60.0	1.00	1.80	1.49	1.21	1.00	0.84	0.73	0.63	0.54	0.46	0.40	0.34	0.29	0.24	0.20	0.15	0.10	
GM 12580426 5.3 Flex Fuel	35.9	60.0	1.00	1.67	1.37	1.11	0.90	0.76	0.64	0.54	0.45	0.37	0.32	0.27	0.22	0.18	0.14	0.10	0.05	
GM 12594512	36.9	60.0	1.00	1.79	1.53	1.26	1.07	0.93	0.79	0.72	0.64	0.57	0.51	0.45	0.40	0.35	0.31	0.28	0.25	
GM 12609749	48.2	60.0	1.00	2.00	1.69	1.39	1.16	1.00	0.84	0.75	0.66	0.58	0.51	0.45	0.40	0.34	0.30	0.26	0.22	
GM 12613411	36.4	60.0	1.00	1.80	1.52	1.24	1.02	0.88	0.74	0.65	0.56	0.48	0.42	0.36	0.32	0.27	0.23	0.19	0.16	
GM 12587																				