1.8t Fueling FAQ

Note: I have some terminology that references brake systems. Brake systems are similar to fuel systems in that 1) they are critical and not allowed to fail for safety reasons and 2) they are high pressure lines filled with material that must be treated special (compared to water or similar). As such, brake line methodologies can be carried across to fuel line methodologies very nicely.

Terminology

- **AN vs. NPT: Understanding port threads, adapter fittings and line sizes.**
  What is AN?
The designation AN stands for Army/Navy and calls out mil/spec (military specifications) for dimensional standards of hydraulic lines, hose-end connectors and port adapter fittings. AN specifications are a popular standard met by all companies that manufacture AN style performance fuel hose and accessories. For many there has been much confusion about the subject of AN lines, NPT and ORB ports, and how all of this works together. Here are the answers for those wanting to know.

  **Flare Angles**
The flare angle used to seal AN connections is required to be SAE, 37 degree, as opposed to the 45 degree flare commonly found on household plumbing adapters. This angle can be found on the male point of the port adapter fitting and on the female inside the hose-end nut. AN port threads are not NPT or “pipe thread” but instead utilize straight threads (like any normal fastener) and SAE O-Ring Boss (ORB) technology for sealing. AN lines, ORB ports and the appropriate port adapter fittings are measured in inch/fractional sizes.

  **AN 'dash' sizing**
A dash (–) size in AN “speak” refers to the I.D. of a standard, thin wall, hard line as the basis to construct a comparable flexible hose that may be used in it’s place. A 1/2”, thin wall, hard line measures .500” on the outside diameter (O.D.), has an inside diameter (I.D.) of 0.440”, and a wall thickness of 0.030”. An appropriate, flexible replacement line would be –8 AN, with a minimum 0.440” I.D. Depending on line construction, rubber with stainless steel or nylon braid, or Teflon with stainless steel braid, the line’s wall thickness and O.D. may vary.

AN line sizes will have a dash (–) preceding the line size. The number after the dash refers to the number of 1/16 of an inch O.D., thin wall, hard line to which the flexible line will compare. For example, calling for a –8 AN line would mean the engineer or system designer requires a flexible line, made of certain materials suitable for the application, that would have the minimum I.D. of an 8/16” (1/2”) O.D. hard line. The actual line construction is dictated by the application with regard to line flexibility, vacuum and pressure capability, abrasion resistance and chemical compatibility, etc. Regardless, the engineer knows a -8 line of any construction will have a minimum I.D. equal to 1/2” hard line (.0440”), and be able to support similar flow rates.

**Modern, Best Practices**
Modern, high performance fuel systems are predominately fitted with safer, better sealing, higher flowing, AN-ORB ports. These ports require a straight thread adapter...
fitting, with a sealing O-Ring installed over the threads, up to the hex, that disappears into the port when properly installed. No additional thread sealer is required or recommended.

**NPT, AN, and adapters**
National Pipe Thread (NPT) ports, AN Ports and port adapter fittings:
Over the years, in low-pressure hydraulics, NPT has been a popular thread for ports and adapter fittings. When NPT ports are used in a fuel system with AN line, an adapter fitting to convert from NPT to AN is required. NPT was designed for use with thick walled pipe, typically black pipe, used in fixed structures like buildings, to handle distribution of water and natural gas. Black pipe isn’t particularly bendable, flexible or lightweight and hardly desirable for plumbing a high performance fuel system. As a result fittings that adapt NPT ports to AN line are common to allow flexible AN lines to be utilized in performance automotive fuel systems.

Unlike AN thread, which is straight, NPT ports and fittings are both tapered. NPT male to female adapters start loose, threading easily but get tight and harder to turn well before the hex touches the port. When threaded together, the NPT design creates a wedging effect, binding the thread in order to seal. The use of a thread sealant is common and required with NPT, as it does not consistently create a positive seal on it’s own, like an O-Ring configuration. It’s common to see a number of threads showing on the adapter fitting when NPT is sufficiently tight, making NPT assemblies bulkier and less clean appearing than a similar AN assembly.

NPT ports are commonly adapted to AN lines, but the NPT size designation is confusing, identifying the pipe I.D. rather than the O.D. Black pipe has a much thicker wall than hard line, so the pipe/port O.D. is much larger than the NPT size would seem to indicate. For example, a 3/8” NPT port will have an outside diameter of 5/8”, allowing for a wall thickness of 1/8” (0.125”). As a result, NPT port sizes allow use of a one step larger AN line than their indicated size would seem to support. As long as the wall of the adapter fitting is not overly thick, the following NPT Port to AN adapters will provide a common I.D. through-hole:

**AN -> NPT port sizing**
Maximum AN line for NPT port size:
1/4” NPT is compatible with up to -6 AN (3/8" hard line)
3/8” NPT is compatible with up to -8 AN (1/2" hard line)
1/2” NPT is compatible with up to -10 AN (5/8" hard line)
3/4” NPT is compatible with up to -16 AN (1" hard line)

**Connecting large AN fittings to smaller NPT fittings WARNINGS**
Adapter fittings are available for connecting larger than recommended AN lines to the above NPT ports. Beware, the inside diameter of the adapter fitting will necessarily be smaller on the NPT side, creating a flow restriction that many racers and hotrod enthusiasts overlook. This is a poor practice and should be avoided, but when no alternative is available, consider sourcing a steel NPT to AN adapter from a good hydraulic supplier. Steel adapters will have a thinner wall than aluminum, due to the increase in material strength, leaving a larger I.D. to support higher flow on the too small, NPT side of the adapter.

- **Common army/navy (AN) line and thread specifications**

<table>
<thead>
<tr>
<th>AN</th>
<th>Metal Tube (Hard Line) OD</th>
<th>Port &amp; Fitting (Diameter-TPI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1/8&quot;</td>
<td>5/16-24 SAE</td>
</tr>
<tr>
<td>3</td>
<td>3/16&quot;</td>
<td>3/8-24 SAE</td>
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<td>4</td>
<td>1/4&quot;</td>
<td>7/16-20 SAE</td>
</tr>
<tr>
<td>5</td>
<td>5/16&quot;</td>
<td>1/2-20 SAE</td>
</tr>
<tr>
<td>6</td>
<td>3/8&quot;</td>
<td>9/16-18 SAE</td>
</tr>
<tr>
<td>8</td>
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<td>3/4-16 SAE</td>
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<td>10</td>
<td>5/8&quot;</td>
<td>7/8-14 SAE</td>
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<td>12</td>
<td>3/4&quot;</td>
<td>1-1/16-12 SAE</td>
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<td>16</td>
<td>1&quot;</td>
<td>1-5/16-12 SAE</td>
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<td>1-1/4&quot;</td>
<td>1-5/8-12 SAE</td>
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<tr>
<td>24</td>
<td>1-1/2&quot;</td>
<td>1-7/8-12 SAE</td>
</tr>
<tr>
<td>28</td>
<td>1-3/4&quot;</td>
<td>2-1/4-12 SAE</td>
</tr>
<tr>
<td>32</td>
<td>2&quot;</td>
<td>2-1/2-12 SAE</td>
</tr>
</tbody>
</table>
A note about AN Flares versus SAE Flares:
Automotive flares and flare tools are 45-degree flares. "AN" flares are 37 degrees. It is not "technically correct" to use a 45-degree flared tube with the 37 degree AN fittings, and for military and aviation use, this is not allowed: The 37-degree flares are designed to operate safely in systems up through 3,000 psi, so a flared angle mismatch is not allowed under these conditions. We never see such pressures in auto fuel systems. In actual testing that I have done, I have found that the 45/37 combination works safely and reliably in pressure systems up to 250 psi. In applications above 250 psi, the line-interface created by the angle mismatch can start to leak if the fittings are not re-torqued. In automotive fuel systems operating at 4 to 8 psi, the 45/37 interface works reliably and flawlessly, without the need to re-torque. Much more reliably than a rubber fuel line with a clamp... However, if you want to create a "perfect" flare interface, 37-degree flare tools are available from aviation supply houses.

You will not notice any difference in system reliability between the two flare angles in this automotive fuel system application.

http://krystalforge.net/vwvortex/AN%20Flare.JPG
Example of AN Flare

Where are the different flares used on our cars?

There are four (more or less) flaring styles in common use for brake systems. British cars have a bubble flare (aka Girling flare) backed up with a male swivel nut or a 45 degree double flare backed up with a female swivel nut. Metric cars have ISO bubble flares, where the pipes and threads are metric sizes rather than inch. Detroit iron has a 45 degree double flare backed up by a male threaded nut. Most (non-British) race cars are plumbed with AN (aka JIC) type single flares - a 37 degree single flare with a backup sleeve and inch threaded swivel nut (some people make a double flare here, which is useless overkill and may lead to failure; see below). Lastly, some brake fittings use tapered pipe fittings.

Take the easy one first: tapered pipe fittings are not really a positive seal under adverse conditions. They may do the job for a street car, but they certainly have no place on a race car.

The bubble flare is used with a male swivel nut, and seals at the bottom of a drilled and tapped hole, with a nice angled bottom. While it can usually be resealed, it has a limited lifetime - there's no good way to get back the deformation that was crushed out for the first seal, short of remaking the flare from scratch.

Making such a flare is easy: if you are in possession of a standard 45 degree double flaring tool, the bubble flare is what results after the first half of the operation. Simply stop there, and you have the bubble flare which will seat nicely at the bottom of the hole. If you continue, inverting the form tool and finishing the job, you then have the more familiar double flare used by Girling and the US automotive industry.

The SAE 45 degree double flare usually has a male-threaded tube nut that bears directly on the OD of the flared tube- so you need a double flare to help control galling that can result in stress cracking right at the flare. In short, you need "give" there. Problem is, the deformation that results is kind of irreversible, so the next cycle or two will result in your having to use astronomical torques to keep the flare from weeping. Worse is trying to use a single flare in an SAE flare nut and seat, and worse still if the seat is brass- the flared tube is squashed from both sides, even as it is deformed by the nut galling on it. The brass seat deforms and work hardens. It may seal once, with a ton of torque and some luck. It's not recommended practice - it's not even a good idea.

Racers (and aircraft, which is where the system originated as the "Army-Navy" or AN standard in WWII) use the single 37 degree flare. The AN single flare is still a concave flare, but its 37deg angle seals by stretching, not squashing. The tube is supported by a separate sleeve that the female-threaded tube nut bears upon. This isolates the flare from the torques imparted by the nut. So rather than trying to get a seal despite the presence of rotating torques and the resulting galling, you press the flare between precisely-machined (steel!) seat and precisely-machined support sleeve. The sealing area under compression is at least double that of the SAE flare.
An additional bonus is that the OD of the nut is a lot larger than the 3/8" of an SAE nut, which means you won't kill as many trying to get the proper sealing torque. (Even so, you should always use a proper flare nut wrench on any tube nut.)

The SAE stuff was designed to go together once on the assembly line, and then be "immortal", as defined by Detroit. It's pretty good at it, too! The AN stuff is designed for field serviceability, long fatigue life, and a level of bulletproofness the SAE never considered. A further, Very Strong, recommendation is that single flared AN fittings are the only thing that Carroll Smith will suffer to put on his race cars.

The reason for harping on repeatability and multiple mate-demate cycles is that, to the best of my knowledge, I have never once put something on the car, and had it stay put on. I always forgot something, or broke something during the season, or needed to swap out something because it was at the end of its service life. While the double flare has that nice "squish" feeling as you tighten the flare nut the first time, the AN fitting has the same torque requirement for the second mating cycle as the first. That's where the reliability across multiple cycles comes from.

Never use compression fittings for brake plumbing.

I know racers that have gone so far as to purge all the SAE double flare fittings out of the plumbing of their track cars, except possibly the fittings at the master cylinder. The rationale is two-fold: first, the above-mentioned repeatability, and second, the fact that the AN parts are universally available at every race shop in every backwater in the country.

I have not gone quite so far on my British cars, which are plumbed with Girling flares. It is a happy coincidence (at least, it seems like a coincidence, perhaps it is by design) that the female Girling flare hardware will mate comfortably with a male AN-3 fitting; I have thus replaced the fancy fittings on the rubber hoses with the appropriate AN-3 male-to-male bulkhead fittings, and the hoses themselves with -3 female fittings on Teflon -3 line. My master cylinders all have machined flat surfaces, so the outlets are easy to adapt to -3 hoses as well (-4 for the clutch, typically).

A few words about Teflon lines: they may not have a place on your street car. For starters, the Teflon lines you make up at home don't have DOT approval, because they haven't been through the DOT approval process and you're not a certified manufacturer. Even the Teflon lines you can buy pre-built are probably not DOT approved (though there are a few coming onto the market) for the same certification reasons. The main reason for this lack of approval is that manufacturers of racing gear don't care to spend the money - they're building the hoses for racers. The next reason is that the DOT expected lifetime for such brake hoses is five years, and the prudent racer will replace his or her brake hoses every other season, just to be sure. (This is a good reason to make your own - then you can reuse the fittings and just buy new olives and hose.) There are some concerns about using Teflon line in cold environments, though Aircraft Spruce is willing to sell you lines custom made from Aeroquip Teflon hose and rate them to -40 degF, so I'm not so sure that's a concern. It may well be that the intended application for those lines is not subject to as much repeated deflection as the flex line snaking through your front suspension out to the caliper.

**Other Sealing Methods**

Other sealing methods

There is one other kind of sealing involved in braking systems, usually at caliper or cylinder entry and often when converting over from one kind of flaring system to another: a washer face at the top of a hole. This requires a crush washer of soft copper, aluminum, or in extreme cases, a Stat-O-Seal, which is a combination of O-ring and aluminum crush washer. To make this an effective seal, a precision machined surface is required around the drilling, exactly perpendicular to the axis of the threaded hole. If this is not there, you must use a bottom sealing fitting. Conversely, if the hole does not have a nicely formed drill point form at its bottom or the fitting will not reach the bottom, you must use a sealing washer (and, of course, provide the machined washer face for it to seal against).

A neat trick I learned a while back is that copper crush washers can be reused - IF
you anneal them. Place the washer in question on a brick and play your propane torch across it until it glows orange. Let it cool. It’s now as soft as it was originally and will re-crush and seal perfectly.

**DIY Links**
- Make your own Fuel Line
- Make your own fuel line
- Make your own fuel line
- Common Fueling Mistakes by Barry Grant
- How to choose a fitting type
  A good read on many types of flares with applications and uses

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**Pricing Summary**

**Fuel Line Price Summary ($/ft prices based off 10ft length), in increasing order**
- Aluminum Tubing - $0.80/ft
- Stainless Tubing - $2.40/ft
- Summit Racing Twist Tite - $2.50/ft
- Aeroquip AQP Socketless - $3.60/ft
- Summit Racing Stainless Braided - $4.00/ft
- Aeroquip AQP Stainless Braided - $5.00/ft
- Aeroquip Startlite - $6.90/ft

**Fitting Price Summary**
- Tube Sleeves + Tube Nuts - ~$7
- AN -> Twist-Tite - ~$3
- AN -> AN Hose - ~$7
- AN -> AQP Socketless
- Add a bend to any of those fittings - ~+$7
- AN -> AQP/ Startlite Crimp - ~$17
- Add a bend to any of these fittings - ~+$15
- AN -> Factory Fuel Line - ~$17 aluminum, ~$35 stainless

**Fuel Line Choices**
- Aluminum Tubing
  Soft material. Can be bent by hand or with an inexpensive tube bender. Smaller than flex tube for the same inner diameter. Compatible with hard line fittings.

  Use this for return line only. Does not have the pressure handling capabilities to be used for high pressure intake line.

  [http://static.summitracing.com/globa.../sum-g2538.jpg](http://static.summitracing.com/globa.../sum-g2538.jpg)
  Summit Racing SUM-G2516 - 5/16" Alum, 25ft - $20

- Stainless Steel Tubing
  Similar to aluminum tubing but requires higher quality flaring and bending tools to work with it. It can be polished much nicer than aluminum can and can be found without a seam weld line like aluminum. Compatible with hard line fittings.

  Pretty much this is the bee's knees of tubing. If you have the patience, tools, and ...patience to work with this stuff you can upgrade most every piece of your car. It can handle super high pressures, can withstand most every type of fluid (gas, E85, brake, hydraulic, A/C, jet fuel, whatever) and looks AWESOME when all set up right. Times where you should use a flexible line instead should be mating to a moving part. For instance, going from hardline in the body to the engine, you should couple the two pieces with some flex hose.

Twist-Tite (Reinforced Rubber Hose)
Think of this as an inexpensive version of the braided steel hose. It can withstand high pressures, is flexible, and is inexpensive. The rated pressures are only good if you get the matching fittings. And remember, not all rubber tubing is created equal! You have to get the stuff that is built to carry high pressure fuel! This can be used in twist-tite connectors only. A note on the flexibility. Although this hose can flex it is burly stuff! Figure on a generous bend radius when using this hose. Although it is rubber, it is thick and doesn't like sharp bends. Those sharp bend situations are a place hard lines shine.

Once you put this on the connector it cannot be just taken off. You will need to cut the tube off the connector, thus shortening the line length. This is good line, but when you connect it be 100% sure that it is where you want it because it's not coming off without you cutting it off.

Furthermore, the connection this hose has on the connectors is substantial. No hose clamps are necessary to aid keeping the hose on the connector.

Aeroquip AQP Socketless Hose (Reinforced rubber hose)
This is similar to the twist-tie hose above but is compatible with the AQP socketless hose connectors. More expensive probably because it's a brand name. This can be used in AQP socketless hose connectors only. Per user Richard_Cranium, he considers this stuff a PITA. He purchased a bunch of this and was so frustrated with the assembly of it that he moved to braided stainless steel instead.

Aeroquip Startlite Racing Hose
Similar to AQP socketless hose but it is sanctioned by many racing bodies and has a Nomex and kevlar cover for increased heat and abrasion resistance. Plus it's 45 percent lighter than similar hose from other brands. Handles similar pressure to the AQP socketless (200 PSI). Compatible with AQP fittings.

Aeroquip AQP Stainless Steel Braided Hose
This is similar to regular stainless braided hose, but it allows you to reuse your fittings if you'd like. Making a connection is as simple as pushing the AQp hose into the AQP fitting.

NOT SURE --- I think this is cross compatible with generic stainless steel braided hose (aka Summit Racing house brand Stainless steel braided hose)

Stainless Steel Flex Hose
This is a generic product that is less expensive than the brand name Aeroquip or similar. Flexible, durable. Good stuff.

Fittings
Obviously, this list can't be comprehensive and my intention is not to make this comprehensive. This is just to give you a rough idea of what's out there to help you plan. If you're running a different hose size then go source something that fits your plan. Also, I'm listing prices so you can pick fittings that keep you in your budget. Some fittings cost far more than others. Also, there are many other companies than summit racing that make this stuff, they just have a nice website that allows me to link images off it.

Also, I'm only going to post up one example of each fitting. You can get almost any of these fittings in straight (0 degree), 45 degree, 90 degree, and 180 degree variants.

Color. The hot rod gods deemed blue and red to be the color of speed (I think)...so most every fitting seems to come in a combination of blue and red. In the last couple years companies
started producing straight black fittings too. Of course, there is always the raw metal look (metal or nickel plated) So now’a’days you have some options

- Here’s what the angles look like...
  - 45 degrees
    [Image](http://static.summitracing.com/globa...-fbm1111_w.jpg)
  - 90 degrees
    [Image](http://static.summitracing.com/globa...-fbm1031_w.jpg)
  - 120 degrees
    [Image](http://static.summitracing.com/globa...fbm4044_cp.jpg)
  - 150 degrees
    [Image](http://static.summitracing.com/globa...fbm4053_cp.jpg)
  - 180 degrees
    [Image](http://static.summitracing.com/globa...-fbm4062_w.jpg)
- Aluminum Tubing -> AN Hose
  - Summit Racing SUM-2200075 - 6AN hose -> 3/8” Alum tubing - $6
    [Image](http://static.summitracing.com/globa...-2200075_w.jpg)
- Hard Line -> AN Hose (Tube Sleeves)
  - These work in conjunction with a tube nut. It goes like this...
    - Put the tube nut on the hard line.
    - Put the tube sleeve (smaller diameter side first) on the hard line.
    - Prep, cut, and flare the hard line.
    - Walla! You have a hard line with an AN female connection on it, ready to be mated to a male AN connection.
    - [Image](http://static.summitracing.com/globa...-fbm3679_w.jpg)
    - Summit Racing FBM3679 / 5AN / $4
  - AN Tube Nuts
    - The compliment to the tube sleeve
    - [Image](http://static.summitracing.com/globa...-fbm3591.jpg)
    - Summit Racing FBM3591 / 3AN / $3
  - AN Crimp
    - I don’t know what this crimps on to? Stainless braided? Rubber? Aeroquip specific?
    - [Image](http://static.summitracing.com/globa...FC3443-05S.jpg)
    - Summit Racing FC3443-05S / 6AN hose end crimp / $2
  - Male AN -> Twist Tite
    - [Image](http://static.summitracing.com/globa...m-220757_w.jpg)
    - Summit Racing SUM-220756 - 6AN male -> 6 AN barb - $3
  - Female AN -> Twist Tite
    - [Image](http://static.summitracing.com/globa...m-220708_w.jpg)
    - Summit Racing SUM-220706 - $10
  - Female AN -> AN Hose
    - [Image](http://static.summitracing.com/globa...m-220687_w.jpg)
    - Summit Racing SUM-220687 - $14
  - Male AN -> AN Hose
  - Female AN -> AN Hose
  - Female AN -> Aeroquip AQP
    - [Image](http://static.summitracing.com/globa...-fbm1012.jpg)
    - Summit Racing FBM1012 / 6AN -> AQP / $7
  - Male AN -> Aeroquip AQP
  - Male AN -> Aeroquip AQP Socketless
  - Female AN -> Aeroquip AQP Socketless (Crimp)
    - [Image](http://static.summitracing.com/globa...-fbm4274_w.jpg)
    - Summit Racing FBM4274 / 10AN -> 10AN / $31
  - Female AN -> Aeroquip AQP Socketless
    - [Image](http://static.summitracing.com/globa...-fbm1512_w.jpg)
    - Summit Racing FBM1512 / AQP Socketless -> 6AN / $6
  - Male AN -> Male NPT
    - [Image](http://static.summitracing.com/globa...-fbm2037_w.jpg)
    - Summit Racing FBM2037 / AN -> NPT / $10
  - Male AN -> Female NPT
    - [Image](http://static.summitracing.com/globa...-fc2725.jpg)
    - Summit Racing FBM2719 / 3AN -> 1/8” NPT / $10
  - Male AN Flare -> Metric
    - [Image](http://static.summitracing.com/globa...-fbm2608_w.jpg)
Summit Racing FBM2608 / 6AN -> 16mmx1.5 / $14
- Female AN -> Female AN
  http://static.summitracing.com/globa...fbm2916_w.jpg
Summit Racing FBM2916 / 8AN -> 8AN / $8
- NPT Plug
  http://static.summitracing.com/globa...fbm2277_w.jpg
Summit Racing FBM3685 / 1/8" NPT / $4
- AN -> Factory Tubing
  This will allow you to convert factory tubing to -AN. The stainless fitting costs about twice as much as the aluminum fitting. I don't know why most people would need the expensive stainless over the aluminum.
  http://static.summitracing.com/globa...ei-15117_w.jpg
Summit Racing 15117 / Stainless 6AN -> 5/16" OEM line / $35
  http://static.summitracing.com/globa...s-640863_w.jpg
Summit Racing 640863 / Aluminum 6AN -> 5/16" OEM Line / $19
- AN -> Factory Tubing
  http://static.summitracing.com/globa...ei-15103_w.jpg
Summit Racing 15103 / 6AN -> 5/16" OEM line / $35
- Male AN -> AN O-Ring
  http://static.summitracing.com/globa...ei-15607_w.jpg
Summit Racing 15607 / 8AN -> 8AN Oring / $13
- Female 6AN -> Male 3/8" Barb Fittings
  http://www.usrallyteam.com/images/044fittings.jpg
  USRT / $30
- Male M18x1.5 -> Male 6AN , Male M12x1.5 -> Male 6AN
  This fitting is pretty much perfect for the Bosch 044 pump.
  http://www.usrallyteam.com/images/044fittings_sm.jpg
  USRT / $25
- 10mmx1.0 -> 6AN
  This fitting is perfect for the Walbro fuel pump
  http://www.usrallyteam.com/images/la...an_kit_LRG.jpg
  USRT / $20
- O-Rings for AN-Oring connections
  ...list some compatible Viton and Buna-N o-rings

**Bulkhead Adapters**

- Use these when you need to get a line through a firewall, panel, or anything else for that matter. Much more secure than just drilling a hole and pulling lines through.
- 6AN -> 6AN
  http://static.summitracing.com/globa...fbm2072_w.jpg
  Summit Racing FBM2072 / 6AN -> 6AN / $5
- Bulkhead Nut
  http://static.summitracing.com/globa...fbm2103_w.jpg
  Summit Racing FBM2103 / 8AN / $3

**Reducers**

- 8AN -> 6AN
  http://static.summitracing.com/globa...fbm2410_w.jpg
  Summit Racing FBM2410 / 8AN -> 6AN / $8

**Splitters**

- 8AN -> 8AN -> 8AN
  http://static.summitracing.com/globa...fbm2283_w.jpg
  Summit Racing FBM2283
- 10AN -> 8AN -> 8AN
  http://static.summitracing.com/globa...aei-15620.jpg
  Summit Racing 15620 / $78
  http://static.summitracing.com/globa...ei-15675_w.jpg
  Summit Racing 15675 / $50
Gauge Adapters

- Flare -> Flare (w/ NPT Gauge Port)
  http://www.usrallyteam.com/images/la...e_tfit_LRG.jpg
  USRT / $9
- AN -> NPT (w/ NPT Gauge Port)
  http://static.summitracing.com/globa...-fbm2277_w.jpg
  Summit Racing FBM2277, $7
- AN -> AN (w/ NPT Gauge Port)
  http://static.summitracing.com/globa...-fbm2183_w.jpg
  Summit Racing FBM2183, AN6->AN6, $7

Links

- Twist-Tite Parts @ Summit Racing

Check Valves

- Aeromotive High Flow One Way Check Valves
  http://static.summitracing.com/globa...ei-15106_w.jpg
  Summit Racing 15106 / 6AN / $62
- Jay Racing Bosch 044 Check Valves (Inlet/Outlet
  Note: When I was researching their site was down. I need more info on this check
  valve.

  Quote:

  Originally Posted by jayracing.com

  Finally, a quick and easy solution to adding a high-flow check valve to your Bosch
  fuel pump. These neat little check valves attach directly to the Bosch 044 fuel
  pump (or others with a M12 x 1.5 female thread outlet). Machined from billet
  aluminum, the outlet end is -8AN (also available in -6AN).

  This will maintain fuel pressure in the lines to decrease/eliminate priming time.
  Also this will help fight pressure fluctuations on the pump itself, especially when
  used in a multiple fuel pump application such as two pumps in parallel.

  http://lh4.googleusercontent.com/FGo...KJ2ZrzTTcedIWA

Fuel Pumps

You need more fueling when you are using bigger injectors and can no longer flow enough fuel
into your engine. In other words, if under high boost you are loosing fuel pressure your pumps
can not keep up with the flow. The pumps we put on these cars rarely have a problem keeping
up with the pressure...it's the flow numbers that are the problems.

Normally a standard in-tank fuel pump will feed the in-line fuel pump. The in-line fuel pump will
feed the engine during high demand periods but can not sustain that high demand. The in-tank
fuel pump can not feed enough fuel to the in-line fuel pump and you will have fuel starvation
under sustained WOT driving. If you fall under this category then a surge-tank is for you.

Also, before choosing a fuel pump double check that it handles your fuel type. If you add for
instance, E-85 to the mix, not all fuel pumps can handle this. You've been warned. Read the
datasheets.

  Quote:

  Originally Posted by Richard_Cranium
you MUST PAY ATTENTION to the instructions with certain fuel pumps. not all of them are "pull" type. the A-1000 is the first that comes to mind. it is a "pusher" type pump, and needs to be gravity fed or pumped to feed it. it "may" run for a bit pulling fuel, but it won't last for long. some are pull-type pumps that can pull fuel as well as push. then there is the low-pressure high flow versus high pressure pumps as well. if using inline pumps and a surge tank, it would be good for a low pressure high flow pump to feed the surge, and then high pressure out of the surge to the motor. this way the surge is always full.

...I need to insert graphs into these

- **Walbro 255LPH - High Pressure Pump**
  Mfg Part # GSL392
  Capable of supporting ~400WHP cars
  Free Flow Rate: 255 LPH @ 3BAR
  Inlet: 10mm x 1.0 (Female)
  Outlet: 10mm x 1.0 (Female)
  Inlet/Outlet fittings can be sourced from [www.fuel-pumps.net](http://www.fuel-pumps.net) or ATP Turbo
  [http://www.atpturbo.com/mm5/graphics...oro-225225.jpg](http://www.atpturbo.com/mm5/graphics...oro-225225.jpg)
  **Install Kit @ USRT**
  ATP Turbo / Walbro 255LPH / $129

- **Bosch 0 580 254 044 Inline Fuel Pump aka. Bosch '044' fuel pump**

Bosch 044 fuel pumps mount inline (out side of your gas tank), most commonly rear center under your car or truck. Each Bosch 044 inline fuel pump provides 300LPH of flow and operate at 72.5 PSI. Bosch 044 fuel pumps are comparable to the Walbro 255LPH high pressure inline fuel pumps which can both support vehicles for up to 600-700 horse power. Can be used in sequence with an intank Walbro or Bosch 040 fuel pump.

**Bosch 044 Fuel Pump Specs:**
- Bosch Part Number: 0 580 254 044
- Minimum Current: 12 Volts
- Operating Pressure: 72.5 PSI (5 Bar)
- Minimum Flow @ Outlet: 80 GPH (300 LPH)
- Fuel Pump Location: In-Line
- High Temperature Reduction: 8 GPH (30 LPH)
- Weight: 1030 Grams (2.27 Pounds)

**Fuel Pump Connections:**
- Inlet: M18 x 1.5
- Outlet: M12 x 1.5
- Electrical: Positive M6 / Negative M5
  [http://www.lucasinjection.com/580%20...ow%20chart.jpg](http://www.lucasinjection.com/580%20...ow%20chart.jpg)
  [http://a763.g.akamai.net/7/763/1644/...69818/size/250](http://a763.g.akamai.net/7/763/1644/...69818/size/250)
  [http://i289.photobucket.com/albums/l...umpgraph-3.jpg](http://i289.photobucket.com/albums/l...umpgraph-3.jpg)

- Integrated Engineering / $225
- Loose Bolts Motorsports / $180

- **Bosch 0 580 254 040 In Tank Fuel Pump**

Bosch 040 fuel pumps are universal style in tank fuel pump replacements recommended for vehicles exceeding OE specifications. The Bosch 0-580-254-040 fuel pump is one of the only in tank fuel pump that can be compared with the Walbro 255LPH High Pressure series fuel pumps for use in vehicles with up to 700 horsepower.

**Bosch 040 Fuel Pump Specs:**
- Bosch Part Number: 0580254040
- Minimum Current: 12 Volts
- Operating Pressure: 94 PSI (6.5 Bar)
- Minimum Flow @ Outlet: 80 GPH (300 LPH)
- Fuel Pump Location: In Tank
- High Temperature Reduction: 8 GPH (30 LPH)
Weight: 930 Grams (2.05 Pounds)

Fuel Pump Connections:
Inlet: Open Base
Outlet: M10 x 1.0
Electrical: Positive M6 / Negative M5

Supposedly link the APR in-tank fuel pump finds its origins in the Audi TT225 model. For the TT225 APR stg3 GT2871r kit APR supplies an additional inline fuel pump which hints at the horsepower cap capable by this fuel pump alone. This makes me believe that this fuel pump is capable of supplying fuel for ~350HP. The TT225 is an AWD model and has a different gas tank and thus you can’t just buy a TT225 fuel pump instead. APR modified the pickup to fit the FWD fuel tank.

Flows xxx liters/hour
Can sustain 44 PSI (3bar) fuel pressure (unconfirmed...)

The reason for the fuel cell/ res tank note is because this is a push-type pump. Not a push/ pull pump. It needs to be either fed, or gravity fed. It will not pull. It would also work well if you put a low pressure, high volume pump behind it.

A good example of this is Richard_Cranium's new build where he has a fuel cell and an A1000 under it at his front driver's side corner.

The single stage pump is only recommend for use in conjunction with a surge tank to eliminate fuel starvation problems at less than 1/4 tank. Fully-compatible with...
USRT / $140
- Weldon
- MagnaFuel
- **Fuelab 40401**
  Billet, comes with mounting bracket, designed to be quieter than most of the competition
  Internal Speed Controller that is controllable via external PWM signal
  ![image](http://images.amazon.com/images/G/01/richmedia/images/cover.gif)
  Amazon/ $384
- Barry Grant

**Fuel Pump Mounting Kits**
- Bosch 044 Bracket w/ Isolation Rubber
  ![image](http://www.tweakit.net/shop/images/b...mp_bracket.gif)
  Tweakit Performance / $44
- Bosch 044 Bracket - Stainless
  Jay Racing / $35
- Bosch 044 Bracket - Aluminum
  Jay Racing / $50
- Generic 2.13" to 2.44" Mounting Bracket
  ![image](http://www.siliconeintakes.com/image...it_picture.jpg)
 Shown with a water pump instead...
  ![image](http://www.siliconeintakes.com/image...kit_sample.jpg)
  Frozen Boost.com / $7
- Universal Relay’d Fuel Pump Wiring Harness
  Integrated Engineering / $65

**Fuel Pressure Regulators**
- RMR FPR Adapter
  Allows Stock Bosch style FPR to convert to -6AN inlet/outlet. Very nice for hanging off the end of an aftermarket fuel rail
  ![image](http://krystalforge.net/vwvortex/rmr-fpr.JPG)
  Integrated Engineering / $75
- Stock
  ![image](http://a763.g.akamai.net/7/763/1644/...00613/size/250)
  Integrated Engineering / $80
- Aeromotive
  Pressure Range (BAR): 2.85 - 6.65
  Pressure (PSI): 30 - 70
  ![image](http://www.usrallyteam.com/images/la..._13109_LRG.jpg)
  USRT / $139
- Not sure who makes this???
  Drops into stock Bosch FPR socket
  Pressure Range (BAR): 3 - 5
  Pressure Range (PSI): 43.5 - 72.5
  ![image](http://www.usrallyteam.com/images/la...adjust_LRG.jpg)
  USRT / $99
- Fuelab 53501/ 53502 / 54501/ 54502
  xxx01 is adjustable up to 125 PSI
  xxx02 is custom pressure requirements
  535xx is return line on bottom
  545xx is return line on opposite side of feed line
  You can also get a 515/525 regulator..but they do the same thing, weigh 50% more,
and are larger

Quote:

Originally Posted by fuelab

FUELAB® 535 Series Fuel Pressure Regulators have all the same great features as our 515 series, only smaller and weigh 50% less. They accept port style and non-port style union fittings without interference. Several configurations are available, supporting fuel injected applications up to 125 PSID. The 535 Series Fuel Pressure Regulator has a -6AN return port located on the bottom.
Dimensions: 1.50” D x 2.00” W x 2.25” H
Weighs Only: 5.25 oz.
Fuel Pressure Regulator Features:
Two -6AN inlet ports and one -6AN return port
Gasoline, diesel, methanol, and ethanol fuel compatible
Billet Aluminum with anodize per military MIL-A-8625, Type II
Fine thread pitch for precise pressure adjustment
Versatile mounting bracket and stainless steel hardware
1/8” NPT gauge port with plug for external pressure gauge
1/8” NPT pressure reference port with barbed fitting
Backed by a 2-year limited warranty

http://fuelab.com/components/com_vir...ed_180x164.jpg
~$140 depending on exact model

Fuel Filters
Rule of thumb with fuel filters...100 micron inlet, 10 micron out. This means put a 10 micron filter pre-fuel pump and a 100 micron filter post pump. The weak filter will save your filter, the good filter will save your injectors. This is handy because 100 micron filters and small and compact. 10 micron filters are large and bulky.

If you are running E-85 you need a SS mesh element...but it’s tricky. Look into the E-85 issues before going down this path.

* Jegs Billet (Long) In-Line Fuel Filter

Quote:

Originally Posted by jegs

CNC-machined from Billet aluminum and features a laser etched JEGS logo, 9” long x 2” diameter housing and built in AN fittings. No need to purchase adapters, just add your hose ends and go. Includes a 10-micron cellulose (gasoline only) element for applications up to 1000 HP. Available in blue or black anodized finish and -8AN or -10AN male fittings.

http://www.jegs.com/images/photos/50...5-150070_2.jpg
Jegs 555-150070 / $59

* Originally Posted by jegs

Replacement Element
10 Micron Cellulose (Paper) For Use With Gasoline Only
Fits JEGS 555-150070, 555-150071, 555-150072, 555-150073; Russell Profilter 799-649000 and BG Inline 132-171043 & 132-171044 filter housings

http://www.jegs.com/images/photos/50...555-150030.jpg
http://www.jegs.com/images/photos/50...5-150030_3.jpg
Jegs 555-150030 / $17
Surge Tanks
Surge tanks are for high performance use.

- With Submerged Bosch 044 Pump
  Outer Dimensions: 5.5" X 8" x 4.25"
  3 x O ring boss -6 AN inlet/ outlets
  Interior Volume 1.5L
  http://www.intengineering.net/images/044_surgeTank.jpg
  Integrated Engineering / $199

- With Submerged Dual Bosch 044 Pumps
  Outer Dimensions: 4.25" x 6" x 8" (HxWxD)
  http://intengineering.net/images/dua...tank_assem.jpg
  http://a763.g.akamai.net/7/763/1644/...15580/size/250
  http://a763.g.akamai.net/7/763/1644/...tra/1/size/250
  Integrated Engineering / $299

- Single 044 - For custom work
  http://a763.g.akamai.net/7/763/1644/...64100/size/250
  Integrated Engineering - $109

- Dual 044 - For custom work
  http://a763.g.akamai.net/7/763/1644/...15582/size/250
  Integrated Engineering - $149

Fuel Pressure Senders
For use with electronic gauges. Very useful if you want a fuel pressure gauge in the cabin. The gauges that take a fuel line should not be brought into the cabin for safety reasons. If you need to look at the fuel pressure while driving then make the gauge exposed through the windshield and look from there.

Tools
The stainless needs to be double annealed if you are doing double flares...or it will split. Use these when you decide to work with hardline

- Rigid 345 Flaring Tool
  For making 45 degree, SAE flares
  Spec'd for soft copper, brass, aluminum and mild steel (JIC and Bundy) tubing
  http://www.ridgid.com/assets/thumbna...-275566CDF8E5}

- Snap on Tube cutter + double flaring SAE set
  http://buy1.snapon.com/catalog/OBJECTS/47500/47496.JPG
  Snap On TF528D / $140

- Summit Racing 37 degree flaring tool
  Flare Tool, Single, 37 Degree Flare, Tube Sizes 3/16, 1/4, 5/16, 3/8, 1/2 in., Kit
  This tool won't hold up for stainless. Use it for mild steel, aluminum, etc etc
  http://static.summitracing.com/globa...sum-900311.jpg
  Summit Racing SUM-900311 / $30

- Imperial Eastman IMP 400-F , 37 degree flaring tool
  This tool will do everything you want. Stainless Steel, Titanium, Aluminum, whatever....Great tool.

  Quote:

  Originally Posted by Newman Tools  

  Forms 37o flares to Government Specifications in steel stainless steel (including MIL-T-6843), titanium and other metal tubing. Positive stopgauge assures correct size of flare. Special burnishing action polishes flare face. Three rollers in flaring cone rollout 37o above die block. Roller action cuts effort required; maintans original wall thickness-eliminates stress concentration. Extension on yoke for clamping in vise. Furnished in sturdy tool case.
  Conforms to Federal Specification GGG-F-451a. Type 1, Class 1, Style A.

  http://www.newmantools.com/imperial/400-F.gif
- **Drill Spot / $400**  
  - Jerry Bickel's Roto Flair Tool  
  - For 37 degree flares  
  
  *Originally Posted by* **Jerrybickel.com**  
  

- **http://www.jerrybickel.com/tools-and...s/jbrc4006.jpg**  
  - Jerry Bickel / $100

- **Mastercool 71480 , 37deg flaring and double flaring hydraulic kit**  
  - This will do all your 37 degree flares with ease  
  *http://www.mastercool.com/media/71480.gif*

- **Automotive tools online / $220**  
  - Mastercool 72029 Reduced Friction Ball Bearing Tube Cutter  
  *http://www.automotivetoolsonline.com...009_9_14_3.jpg*

- **Automotive Tools Online / $21**  
  - Mastercool 70069 , 4-in-1 tube bender  
  
  *Originally Posted by* **automotive tools online**  
  
  Open side design slips over tube at any point. Makes smooth short radius bends up to 90 Degree with minimal effort. Calibrated to show angle of bend.  
  *Easy 90 Degree start requires much less effort to make fast and accurate bends. All metal multi-purpose tube bender for 3/16", 1/4", 5/16" and 3/8" 4 mm, 6 mm and 8 mm O.D. tubing*

- **http://www.automotivetoolsonline.com...07_14_54_3.jpg**  
  - Automotive Tools Online / $20

- **AN Crimp Tools**  
  - Great list of AN tools by Earl

- **Earl AN Crimping Tool (requires below mentioned dies)**  
  - Earl 40-D031ERL  
  - Crimping tool and dies are used to crimp the aluminum collar on Auto Crimp hose ends. Designed to give a maximum pressure rating to Auto-Crimp hose ends when using Pro-Lite hose.  
  *http://www.mpsracing.com/images/prod...Earls/D031.jpg*

  - MPSRacing / $707

- **Early AN Crimping Dies for Earl 40-D031ERL Crimping Tool**  
  - 40-D03104ERL Earl's Crimping Die Size 4AN  
  - 40-D03106ERL Earl's Crimping Die Size 6AN  
  - 40-D03108ERL Earl's Crimping Die Size 8AN

  - Use the appropriate die for auto-crimp hose ends  
  *http://www.mpsracing.com/images/prod...rls/D03104.jpg*

  - MPSRacing / $96 per size

- **Earl Pressure Testing Kit**  
  - 40-D016ERL

  - Every hose assembly should be pressure tested prior to installation. Earl's pressure test kit makes it easy to test field-assembled kits with either compressed air or nitrogen. Consists of fitting with air valve in each size and matching plugs.

  - Covers sizes 3 through 16.

- **http://www.mpsracing.com/images/prod...Earls/D016.jpg**  
  - MPSRacing / $157

- **Aluminum Vice Jaws**  
  - These handy vise jaw liners help prevent scratching of anodized aluminum hose
ends during assembly. Internal magnets hold the extruded aluminum liners securely to most popular bench vises. The jaws are available in both of the standard jaw widths and are designed to hold almost any soft part without marking its surface. Earl's assembly department uses these jaws.

40-004ERL Earl's Aluminum Vice Jaws - 3" Jaw Width
40-005ERL Earl's Aluminum Vice Jaws - 5" Jaw Width
http://www.mpsracing.com/images/prod...rls/004ERL.jpg
MPS Racing / ~$15
- Rubber Tubing Assembly Lube
Earl's 40-184004ERL
Use this to get the rubber tubing onto the hose ends. Fuel tubing fits TIGHT
http://www.mpsracing.com/images/prod...84004ERL1.jpg
MPS Racing / $9

**Fuel Pressure Gauges**
These are for engine side use only. Do not bring these gauges into the cabin.

- Auto Meter #105-4363-M Sender + Gauge
  http://www.jegs.com/images/photos/100/105/105-2246.jpg
  http://www.jegs.com/images/photos/10...105-4363-M.jpg
  Jegs / $227
- 0-100 PSI Gauge
  1.5" face
  http://www.usrallyteam.com/images/PGAUGE.JPG
  USRT / $20
- 0-120 PSI Fuelab
  http://fuelab.com/components/com_vir...01_170x170.jpg
- VDO 0-60 PSI Gauge
  http://www.jegs.com/images/photos/90...918-153008.jpg
  Jegs 918-153008 / $22
- VDO 0-100 PSI Gauge
  http://www.jegs.com/images/photos/90...918-153003.jpg
  Jegs 918-153003 / $20

**Fuel Rails**

- Racecraft
- RMR
  7/12/10 - Note: This is a discontinued part. They are selling what they have and there are vendors here and there that carry it.

-6AN Inlet/Outlet

  Quote:

  Originally Posted by **RMR Racing**

  The 20v VW Fuel Rail is CNC machined from billet T6061 Aluminum stock and is made to replace your stock oem rail to provide you with more fuel flow for your high horsepower applications. This fuel rail is designed for the 1.8T engine and made to be used with either stock or Bosch Style Non-Stock Injectors (pictured). This is attainable due to the fact that we include machined spacers which allow you to space the rail in order to fit the bosch style injectors under the rail. Typical uses are for people doing programmable engine management where low impedance injectors are a must for idle quality.

  Note: Images of Fuel Rail mounted are on an RMR 1.8t Intake Manifold (also out of production)
USRT 1.8t fuel rail

Quote:

Originally Posted by USRT

Mounts to any stock or USRT short runner 1.8T intake manifold. Also fits USRT 16v short runner intake manifolds and USRT ITBs. Features a clear anodized finish to protect against the elements and alternative fuels. Kit includes rail, -6AN fittings with o-rings, stainless steel clamps, and stainless steel hardware. A smart choice for 300+ hp.

Fuel Injectors
This should be another thread entirely.
List of injectors. Compatible Fuels. Spray Patterns. Hi/Lo Impedance. Height. Known Compatible software tunes. etc

Common Configurations

- Adding a adjustable FPR + Electronic Fuel Pressure Gauge + Analog Fuel Pressure Gauge
  Photos courtesy of Richard_Cranium
  http://i663.photobucket.com/albums/u...530001654a.jpg

- Adding an RMR Fuel Rail + RMR FPR Adapter to an otherwise factory setup
  This is a common upgrade if you are changing your manifold. Most aftermarket manifolds won't accept the factory fuel rail. The SEM intake manifold is an exception to this, it will hold the factory fuel rail.

- Adding a fuel rail to a heavily modded setup
  Taken from Richard_Cranium's Setups...
  -8AN into rail, and -6AN into the FPR and -6AN return to fuel cell. no issues.
  or
  -10AN into rail, and -6AN from rail to FPR and -6AN from FPR to cell. no issues. (Big flowing E-85 build with 1680cc injectors) (Fed from dual 044’s)

Note: If you are going to run asymmetric fuel lines (intake vs. return) you need to be sure your return can handle the overflow from the FPR. If you don't take this into account you could potentially experience pressure surging on the fuel rail when the FPR can't dump the excess pressure enough. An example of this would be Richard's -10AN setup above. In my opinion, if he were running say 300cc injectors they wouldn't make a dent in that amount of fuel volume going into the fuel rail...thus, a lot of fuel would have to be returned via the return line. If the return line was largely undersized it would cause a pressure buildup in the fuel rail. Instead of say, 4BAR + 25 lbs of boost being sent to the injectors all the extra pressure would act as a base, so say 6BAR + 25 lbs of boost would hit the injectors causing you to run a very rich condition.

So in short, run asymmetric lines with care. If you don't know how to size, just run symmetric lines.

- Adding an inline fuel pump to an otherwise factory setup
  This is a common upgrade to sustain higher fuel pressures and larger flow rates.
  ...My question...If the stock pump flows x LPH and the inline pump flows y LPH, wouldn't you be limited to x LPH and you could only flow y LPH based on the amount of fuel sitting in the fuel line behind the inline pump?

- Adding a surge tank + Inline
  Low pressure in-tank pump feeds surge tank
In-line pump pulls fuel from surge tank
Return line from engine feeds main fuel tank

VR6t Setup

From Richard Cranium's new Audi Build

Getting ready for E85
It takes ~30% more E85 to reach the same power levels compared to unleaded gasoline. E85 runs like a high octane gas does, but it has a lower energy density so it takes more to do the same thing. It's like running a race fuel with the side benefit of making your MPG's go down the tubes (but far cheaper than race fuel).

Car Specific

Mk1 GTI

Quote:

Originally Posted by Richard_Cranium

rabbit MK1 GTI the lines run from pass side rear tire area under the car up to the engine bay.

the problem area is the steering rack.

i did this a long time ago on mine, with 1/2" SS tubing. and the rack was the issue. i changed it to Summit twist tite style, and the rack ate the line on a hard turn. i was in the garage luckily, but still the $16/gal fuel it spilled hurt my ego. LOL.

Custom fuel cell with dual 044 fuel pumps
This one is courtesy of newto20v

He plans on adding 90deg down bends from the interior filters to the bottom of the fuel cell. That way it'll have less chance of fuel starvation at lower fuel levels. He used the Integrated Engineering 044 tank plates and custom fab'd them into this fuel cell.
groggory  07-08-2010 11:47 PM

...post5...

schwartzmagic  07-09-2010 07:00 AM

Thank baby jesus someone is finally doing this.

gtimitch  07-09-2010 07:06 AM

Quote:

Originally Posted by schwartzmagic

Thank baby jesus someone is finally doing this.

Excellent information post...Thanks.

ejg3855  07-09-2010 07:25 AM

www.jayracing.com

makes some very nice Bosch 044 Check Valves $50/pc

I also have seen on some various sources that the Aluminum Hard line isn't compatible for the pressures of a fuel injection system.

groggory  07-09-2010 10:41 AM

moved...
Vegeta Gti

this should be a sticky and we should all work on gathering information to make it a solid resources for the forums as a whole.:beer::thumbup:

20thAEGti1009

The adapter to go from 5/16th's oem to -6AN will indeed fit the factory fuel line.

robingohtt

good reference!

Dub-Nub

Bosch 0 580 254 044 Inline Fuel Pump

Bosch 044 fuel pumps mount inline (out side of your gas tank), most commonly rear center under your car or truck. Each Bosch 044 inline fuel pump provides 300LPH of flow and operate at 72.5 PSI. Bosch 044 fuel pumps are comparable to the Walbro 255LPH high pressure inline fuel pumps which can both support vehicles for up to 600-700 horse power. Can be used in sequence with an intank Walbro or Bosch 040 fuel pump.

Bosch 044 Fuel Pump Specs:
Bosch Part Number: 0 580 254 044
Minimum Current: 12 Volts
Operating Pressure: 72.5 PSI (5 Bar)
Minimum Flow @ Outlet: 80 GPH (300 LPH)
Fuel Pump Location: In-Line
High Temperature Reduction: 8 GPH (30 LPH)
Weight: 1030 Grams (2.27 Pounds)

Fuel Pump Connections:
Inlet: M18 x 1.5
Outlet: M12 x 1.5
Electrical: Positive M6 / Negative M5

Sourced from www.boschfuelpumps.com

goggory

Quote:

Originally Posted by Dub-Nub

Bosch 0 580 254 044 Inline Fuel Pump

Bosch 044 fuel pumps mount inline (out side of your gas tank), most commonly rear center under your car or truck. Each Bosch 044 inline fuel pump provides 300LPH of flow and operate at 72.5 PSI. Bosch 044 fuel pumps are comparable to the Walbro 255LPH high pressure inline fuel pumps which can both support vehicles for up to 600-700 horse power. Can be used in sequence with an intank Walbro or Bosch 040 fuel pump.
Thanks. Added that in. Also, added some additional 044 info, info on the walbro's, and some bits here and there.

If anyone can chime in on any of the sections that very much need work please do. I'll edit your responses into the main posts.

Thanks.

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**Bosch 044 Fuel Pump Specs:**
- **Bosch Part Number:** 0 580 254 044
- **Minimum Current:** 12 Volts
- **Operating Pressure:** 72.5 PSI (5 Bar)
- **Minimum Flow @ Outlet:** 80 GPH (300 LPH)
- **Fuel Pump Location:** In-Line
- **High Temperature Reduction:** 8 GPH (30 LPH)
- **Weight:** 1030 Grams (2.27 Pounds)

**Fuel Pump Connections:**
- **Inlet:** M18 x 1.5
- **Outlet:** M12 x 1.5
- **Electrical:** Positive M6 / Negative M5

*Sourced from [www.boschfuelpumps.com](http://www.boschfuelpumps.com)*

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07-10-2010 12:46 PM

**groggory**

moved....

07-11-2010 02:11 PM

**groggory**

Bump. Added gauges, more fuel pump specific fittings, some adapters, more fuel pumps, adj FPRs, and fixed a few typos

Can anyone answer any of the questions in post # 15?

07-11-2010 03:43 PM

**Richard_Cranium**

*Quote:*

*Originally Posted by groggory* »

Questions:

Can aluminum tubing be used for the fueling inlet? **not usually as it does not have the pressure capabilities needed.**

What are the advantages to Stainless braided hose over twist-tite or Aeroquip AQP socketless hose? Conversely, are there situations where both shine? **Aeroquip/twist tite is one time use IIRC. you have to cut it off to get it off the fitting, thus shortening your line length.**

When using Aeroquip AQP socketless connections, do you have to use a hose clamp? **NO. have you ever tried to pull one off? better yet, have you ever tried to assemble these lines? Its a major PITA... i have alot of this i was going to use, and the PITA factor made me throw it on the shelf and use some Summit style hoses for the oil filter relocate/cooler setup. it is some burly ass hose for sure.**
that said, this was a very well thought out post.

i use the Jay Racing check valves.... good product.

this forum needs more of this type of stuff really.

the best price on 044's i have found, for REAL 044's, is LooseBoltsMotorsports.com. i run dual 044's with Jay Racing check valves into -10AN and on to the fuel rail.

a few more parts you can add is Racecraft fuel rails, and Fuelab FPR's.

you have to watch FPRs as the Aeromotive stuff is not super high pressure compatible. also, Weldon, MagnaFuel, Fuelab, Barry Grant, many other pumps available as well.

then there is filters, and material and sizing of the elements. rule of thumb is 100 micron in and 10 micron out. but when you get to E-85 where you need a SS mesh element, it gets tricky.

you also need to be aware of what pump can handle what fuel.

also the injectors, what fuels can they handle? but i guess injectors would be a WHOLE DIFFERENT thread, now, wouldnt they? LOL

one can also use SS hard line tubing for fueling needs. it has tremendous pressure handling capabilities, looks nice, and is not very expensive. much like what i run on my wastegate control lines. it takes some skill to be a good bender, but you can do alot with it with some practice.

a few other tips? get a set of the vice jaws if you plan to do any major amount of SS braided line assembling. worth the 35 bucks or whatever.

and when cutting the braided line, i wrap it a few times TIGHT with electrical tape, then cut it with a thin blade on a grinder. take some snips (i like green for this) and trim the little pokies off and it goes right in the fitting with no frays. you can believe me on this or not; i have assembled many many braided AN lines for these past two race cars of mine.

lastly, you MUST PAY ATTENTION to the instructions with certain fuel pumps. not all of them are "pull" type. the A-1000 is the first that comes to mind. it is a "pusher" type pump, and needs to be gravity fed or pumped to feed it. it "may" run for a bit pulling fuel, but it wont last for long. some are pull-type pumps that can pull fuel as well as push. then there is the low-pressure high flow versus high pressure pumps as well. if using inline pumps and a surge tank, it would be good for a low pressure high flow pump to feed the surge, and then high pressure out of the surge to the motor. this way the surge is always full.
Lots of updates.

Questions below still remain.

I've put a lot of time into this post so please give it a read-through to check for accuracy. Looks pretty good to me so far though.

Questions:

What path in a Corrado do the fuel lines run (In case of total replacement)? Any notes on install ?(estimated line lengths, problem areas, etc etc)

What path in a mk1 golf/ GTI do the fuel lines run (In case of total replacement)? Any notes on install ?(estimated line lengths, problem areas, etc etc)

What path in a mk2 golf/ GTI do the fuel lines run (In case of total replacement)? Any notes on install ?(estimated line lengths, problem areas, etc etc)

What path in a mk3 golf/ GTI do the fuel lines run (In case of total replacement)? Any notes on install ?(estimated line lengths, problem areas, etc etc)

What path in a mk4 golf/ GTI do the fuel lines run (In case of total replacement)? Any notes on install ?(estimated line lengths, problem areas, etc etc)

What path in a b5 Passat/ A4 do the fuel lines run (In case of total replacement)? Any notes on install ?(estimated line lengths, problem areas, etc etc)

Of the fuel pumps that I have listed, which pumps would you recommend for what applications?

How does the bosch 413 stack up to dual bosch 044's?

THANK YOU!!!! :thumbup:

Wow! I was over on fuelab's website looking at their fuel pumps (very nice, btw) and I never realized fuel pumps draw such huge amounts of current....Especially at high pressure levels.

I really like their feature that lets you tune the pressure level so you aren't pulling full current all the time (and so you aren't pushing tons of fuel through your return line hose).

Cool stuff.

Bump.
I'm still working on making this thread better. Been adding more products and information.

Could use some links to additional fuel rails for the 1.8t.

Could use some more pics of installed aftermarket fuel systems with mention of what car it is and any notes about the install. Parts, difficult situations, success, problems, etc.

Any notes on any of the parts I've mentioned. Have you had success with them? Failure with them? Etc?

If this is going to be a good reference post I need to make sure all of the information is sound so I don't send 'students' out into the world with incorrect facts.

Thanks for helping me to make this a better 1.8t forum!

---

**groggory** 07-12-2010 12:24 PM

On this picture..
[http://i395.photobucket.com/albums/p...ernator011.jpg](http://i395.photobucket.com/albums/p...ernator011.jpg)

Why do you have filters on both the inlet and the outlet of the pump? I assume the inlet is to protect the pump and the outlet is to protect the motor.

Also I assume that you can put a mediocre filter on the inlet and a very good filter on the outlet.

For instance, one of the little stubby 100 micron jegs filters on the inlets and one of the huge 6 micron filters on the outlet?

---

**gtimitch** 09-27-2010 03:54 PM

Why isn't this a sticky?

Now why isn't this a sticky by now? there is an enormous amount of information shared here and it is very valuable to the entire 1.8 community. Please consider it for a sticky. :)

This is very helpful as well...

> then there is filters, and material and sizing of the elements. rule of thumb is 100 micron in and 10 micron out. but when you get to E-85 where you need a SS mesh element, it gets tricky.

---

**schwartzmagic** 09-29-2010 12:31 PM

Quote:

*Originally Posted by *gtimitch* »

Now why isn't this a sticky by now? there is an enormous amount of information shared here and it is very valuable to the entire 1.8 community. Please consider it for a sticky. :)

X 2
Moderators, this is valuable, please place it as a sticky.

We have good moderators but we may need to get their attention.... hmmm - I think we have moderators????

and to update ya, Integrated Engineering also offers the 044 end plates separately as well, if you are doing custom work. here is my latest fuel cell, i sunk the two 044 pumps into the fuel cell. less fittings, more space, cool the pumps, quiet them down.

i will be putting 90 deg fittings on the inlets, so they pull from the lowest point. just progress pix....

another little tidbit of advice. when using pumps like the 044 and the A1000, its a good idea to make a plug setup like pictured here. this way you do not strip the bolts, or unloosen them. i had this happen once to an SX fuel pump. was disappointed, too. that setup is pictured up above under the rabbit.

and yeah, the Aeroquip socketless is a real pain in the ass to work with. i have a very expensive chunk of "tired of dealing with that stuff" on a shelf LOL.

http://i898.photobucket.com/albums/a...4/DSCN1990.jpg
http://i898.photobucket.com/albums/a...4/DSCN1996.jpg
Bump for a sticky........

**groggory**  
10-20-2010 06:55 AM

Cool. Thanks.

Also, updated the post with more setup pics and notes.

---

**ejg3855**  
10-20-2010 07:13 AM

Quote:

http://img413.imageshack.us/img413/6eldiagram2.jpg

I am not sure this is right?

I think the Bosch 044 should be between the rail and the surge tank. In this picture it would be pushing fuel into the Surge Tank.

FPR always goes on the return side doesn't it?

---

**newto20v**  
10-20-2010 07:24 AM

ya, that looks wrong to me, too.

i've always done it FPR after rail.

---

**groggory**  
10-20-2010 07:44 AM

Quote:

*Originally Posted by* newto20v

*ya, that looks wrong to me, too.*

*i've always done it FPR after rail.*

Good call.

The way that drawing was done it would leave the line pre fuel rail very nicely regulated...but the fuel rail itself would have no regulation. It would be freely dumping back into the gas tank return line.

I'll update that drawing.

Thanks.
newto20v

side inlet of the FPR after the rail.
cap the other side of the FPR.
return to surge from bottom of FPR.

---

goggory

Quote:

Originally Posted by newto20v

side inlet of the FPR after the rail.
cap the other side of the FPR.
return to surge from bottom of FPR.

Made the modifications.

Thanks.
REFERENCE: 1.8t Fuel Lines/ Fueling FAQ

1.8t Fueling FAQ

Note: I have some terminology that references brake systems. Brake systems are similar to fuel systems in that 1) they are critical and not allowed to fail for safety reasons and 2) they are high pressure lines filled with material that must be treated special (compared to water or similar). As such, brake line methodologies can be carried across to fuel line methodologies very nicely.

Terminology

- **AN vs. NPT:** Understanding port threads, adapter fittings and line sizes.
  - **What is AN?**
    The designation AN stands for Army/Navy and calls out mil/spec (military specifications) for dimensional standards of hydraulic lines, hose-end connectors and port adapter fittings. AN specifications are a popular standard met by all companies that manufacture AN style performance fuel hose and accessories. For many there has been much confusion about the subject of AN lines, NPT and ORB ports, and how all of this works together. Here are the answers for those wanting to know.

  - **Flare Angles**
    The flare angle used to seal AN connections is required to be SAE, 37 degree, as apposed to the 45 degree flare commonly found on household plumbing adapters. This angle can be found on the male point of the port adapter fitting and on the female inside the hose-end nut. AN port threads are not NPT or "pipe thread" but instead utilize straight threads (like any normal fastener) and SAE O-Ring Boss (ORB) technology for sealing. AN lines, ORB ports and the appropriate port adapter fittings are measured in inch/fractional sizes.

  - **AN 'dash' sizing**
    A dash (-) size in AN "speak" refers to the I.D. of a standard, thin wall, hard line as the basis to construct a comparable flexible hose that may be used in its place. A 1/2", thin wall, hard line measures .500" on the outside diameter (O.D.), has an inside diameter (I.D.) of 0.440", and a wall thickness of 0.030". An appropriate, flexible replacement line would be ~8 AN, with a minimum 0.440" I.D. Depending on line construction, rubber with stainless steel or nylon braid, or Teflon with stainless steel braid, the line’s wall thickness and O.D. may vary.

    AN line sizes will have a dash (-) preceding the line size. The number after the dash refers to the number of 1/16 of an inch O.D., thin wall, hard line to which the flexible line will compare. For example, calling for an ~8 AN line would mean the engineer or system designer requires a flexible line, made of certain materials suitable for the application, that would have the minimum I.D. of an 8/16" (1/2") O.D. hard line. The actual line construction is dictated by the application with regard to line flexibility, vacuum and pressure capability, abrasion resistance and chemical compatibility, etc. Regardless, the engineer knows a ~8 line of any construction will have a minimum I.D. equal to 1/2" hard line (.0440"), and be able to support similar flow rates.

- **Modern, Best Practices**
  Modern, high performance fuel systems are predominately fitted with safer, better sealing, higher flowing, AN-ORB ports. These ports require a straight thread adapter fitting, with a sealing O-Ring installed over the threads, up to the hex, that disappears into the port when properly installed. No additional thread sealer is required or recommended.

- **NPT, AN, and adapters**
  National Pipe Thread (NPT) ports, AN Ports and port adapter fittings:
  Over the years, in low-pressure hydraulics, NPT has been a popular thread for ports and adapter fittings. When NPT ports are used in a fuel system with AN line, an adapter fitting to convert from NPT to AN is required. NPT was designed for use with thick walled pipe, typically black pipe, used in fixed structures like buildings, to handle distribution of water and natural gas. Black pipe isn't particularly bendable, flexible or lightweight and hardly desirable for plumbing a high
performance fuel system. As a result, fittings that adapt NPT ports to AN lines are common to allow flexible AN lines to be utilized in performance automotive fuel systems.

Unlike AN thread, which is straight, NPT ports and fittings are both tapered. NPT male to female adapters start loose, threading easily but get tight and harder to turn well before the hex touches the port. When threaded together, the NPT design creates a wedging effect, binding the thread in order to seal. The use of a thread sealant is common and required with NPT, as it does not consistently create a positive seal on its own, like an O-Ring configuration. It's common to see a number of threads showing on the adapter fitting when NPT is sufficiently tight, making NPT assemblies bulkier and less clean appearing than a similar AN assembly.

NPT ports are commonly adapted to AN lines, but the NPT size designation is confusing, identifying the pipe I.D. rather than the O.D. Black pipe has a much thicker wall than hard line, so the pipe/port O.D. is much larger than the NPT size would seem to indicate. For example, a 3/8" NPT port will have an outside diameter of 5/8", allowing for a wall thickness of 1/8" (0.125"). As a result, NPT port sizes allow use of a one step larger AN line than their indicated size would seem to support. As long as the wall of the adapter fitting is not overly thick, the following NPT Port to AN adapters will provide a common I.D. through-hole:

### AN -> NPT port sizing

<table>
<thead>
<tr>
<th>Maximum AN line for NPT port size:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4&quot; NPT is compatible with up to -6 AN (3/8&quot; hard line)</td>
</tr>
<tr>
<td>3/8&quot; NPT is compatible with up to -8 AN (1/2&quot; hard line)</td>
</tr>
<tr>
<td>1/2&quot; NPT is compatible with up to -10 AN (5/8&quot; hard line)</td>
</tr>
<tr>
<td>3/4&quot; NPT is compatible with up to -16 AN (1&quot; hard line)</td>
</tr>
</tbody>
</table>

### Connecting large AN fittings to smaller NPT fittings

**WARNINGS**

Adapter fittings are available for connecting larger than recommended AN lines to the above NPT ports. Beware, the inside diameter of the adapter fitting will necessarily be smaller on the NPT side, creating a flow restriction that many racers and hotrod enthusiasts overlook. This is a poor practice and should be avoided, but when no alternative is available, consider sourcing a steel NPT to AN adapter from a good hydraulic supplier. Steel adapters will have a thinner wall than aluminum, due to the increase in material strength, leaving a larger I.D. to support higher flow on the too small, NPT side of the adapter.

- **Common army/navy (AN) line and thread specifications**
  
  **AN | Metal Tube (Hard Line) OD | Port & Fitting (Diameter-TPI)**
  
  | 2  | 1/8" | 5/16-24 SAE |
  | 3  | 3/16" | 3/8-24 SAE |
  | 4  | 1/4" | 7/16-20 SAE |
  | 5  | 5/32" | 1/2-20 SAE |
  | 6  | 3/8" | 9/16-18 SAE |
  | 8  | 1/2" | 3/4-16 SAE |
  | 10 | 5/8" | 7/8-14 SAE |
  | 12 | 3/4" | 1-1/16-12 SAE |
  | 16 | 1" | 1-5/16-12 SAE |
  | 20 | 1-1/4" | 1-9/16-12 SAE |
  | 24 | 1-1/2" | 1-11/16-12 SAE |
  | 28 | 1-3/4" | 2-1/4-12 SAE |
  | 32 | 2" | 2-1/2-12 SAE |

- **A note about AN Flares versus SAE Flares:**

  Automotive flares and flare tools are 45-degree flares. “AN” flares are 37 degrees. It is not “technically correct” to use a 45-degree flared tube with the 37 degree AN fittings, and for military and aviation use, this is not allowed. The 37-degree flares are designed to operate safely in systems up through 3,000 psi, so a flared angle mismatch is not allowed under these conditions. We never see such pressures in auto fuel systems. In actual testing that I have done, I have found that the 45/37 combination works safely and reliably in pressure systems up to 250 psi. In applications above 250 psi, the line-interface created by the angle mismatch can start to leak if the fittings are not re-torqued. In automotive fuel systems operating at 4 to 8 psi, the 45/37 interface works reliably and flawlessly, without the need to re-torque. Much more reliably than a rubber fuel line with a clamp. However, if you want to create a "perfect" flare interface, 37-degree flare tools are available from aviation supply houses.

  You will not notice any difference in system reliability between the two flare angles in this automotive fuel system application.
Where are the different flares used on our cars?

There are four (more or less) flaring styles in common use for brake systems. British cars have a bubble flare (aka Girling flare) backed up with a male swivel nut or a 45 degree double flare backed up with a female swivel nut. Metric cars have ISO bubble flares, where the pipes and threads are metric sizes rather than inch. Detroit iron has a 45 degree double flare backed up by a male threaded nut. Most (non-British) race cars are plumbed with AN (aka JIC) type single flares - a 37 degree single flare with a backup sleeve and inch threaded swivel nut (some people make a double flare here, which is useless overkill and may lead to failure; see below). Lastly, some brake fittings use tapered pipe fittings.

Take the easy one first: tapered pipe fittings are not really a positive seal under adverse conditions. They may do the job for a street car, but they certainly have no place on a race car.

The bubble flare is used with a male swivel nut, and seats at the bottom of a drilled and tapped hole, with a nice angled bottom. While it can usually be resealed, it has a limited lifetime - there's no good way to get back the deformation that was crushed out for the first seal, short of remaking the flare from scratch.

Making such a flare is easy: if you are in possession of a standard 45 degree double flaring tool, the bubble flare is what results after the first half of the operation. Simply stop there, and you have the bubble flare which will seat nicely at the bottom of the hole. If you continue, inverting the form tool and finishing the job, you then have the more familiar double flare used by Girling and the US automotive industry.

The SAE 45 degree double flare usually has a male-threaded tube nut that bears directly on the OD of the flared tube- so you need a double flare to help control galling that can result in stress cracking right at the flare. In short, you need "give" there. Problem is, the deformation that results is kind of irreversible, so the next cycle or two will result in your having to use astronomical torques to keep the flare from weeping. Worse is trying to use a single flare in an SAE flare nut and seat, and worse still if the seat is brass- the flared tube is squashed from both sides, even as it is deformed by the nut galling on it. The brass seat deforms and work hardens. It may seal once, with a ton of torque and some luck. It's not recommended practice - it's not even a good idea.

Racers (and aircraft, which is where the system originated as the "Army-Navy" or AN standard in WWII) use the single 37 degree flare. The AN single flare is still a concave flare, but its 37deg angle seals by stretching, not squashing. The tube is supported by a separate sleeve that the female-threaded tube nut bears upon. This isolates the flare from the torques imparted by the nut. So rather than trying to get a seal despite the presence of rotating torques and the resulting galling, you press the flare between precisely-machined (steel!) seat and precisely-machined support sleeve. The sealing area under compression is at least double that of the SAE flare. An additional bonus is that the OD of the nut is a lot larger than the 3/8" of an SAE nut, which means you won't kill as many trying to get the proper sealing torque. (Even so, you should always use a proper flare nut wrench on any tube nut.)

The SAE stuff was designed to go together once on the assembly line, and then be "immortal", as defined by Detroit. It's pretty good at it, too! The AN stuff is designed for field serviceability, long fatigue life, and a level of bulletproofness the SAE never considered. A further, Very Strong, recommendation is that single flared AN fittings are the only thing that Carroll Smith will suffer to put on his race cars.

The reason for harping on repeatability and multiple mate-demate cycles is that, to the best of my knowledge, I have never once put something on the car, and had it stay put on. I always forgot something, or broke something during the season, or needed to swap out something because it was at the end of its service life. While the double flare has that nice "squish" feeling as you tighten the flare nut the first time, the AN fitting has the same torque requirement for the second mating cycle as the first. That's where the reliability across multiple cycles comes from.
Never use compression fittings for brake plumbing.

I know racers that have gone so far as to purge all the SAE double flare fittings out of the plumbing of their track cars, except possibly the fittings at the master cylinder. The rationale is two-fold: first, the above-mentioned repeatability, and second, the fact that the AN parts are universally available at every race shop in every backwater in the country.

I have not gone quite so far on my British cars, which are plumbed with Girling flares. It is a happy coincidence (at least, it seems like a coincidence, perhaps it is by design) that the female Girling flare hardware will mate comfortably with a male AN-3 fitting; I have thus replaced the fancy fittings on the rubber hoses with the appropriate AN-3 male-to-male bulkhead fittings, and the hoses themselves with -3 female fittings on Teflon -3 line. My master cylinders all have machined flat surfaces, so the outlets are easy to adapt to -3 hoses as well (-4 for the clutch, typically).

A few words about Teflon lines: they may not have a place on your street car. For starters, the Teflon lines you make up at home don’t have DOT approval, because they haven’t been through the DOT approval process and you’re not a certified manufacturer. Even the Teflon lines you can buy pre-built are probably not DOT approved (though there are a few coming onto the market) for the same certification reasons. The main reason for this lack of approval is that manufacturers of racing gear don’t care to spend the money - they’re building the hoses for racers. The next reason is that the DOT expected lifetime for such brake hoses is five years, and the prudent racer will replace his or her brake hoses every other season, just to be sure. (This is a good reason to make your own - then you can reuse the fittings and just buy new olives and hose.) There are some concerns about using Teflon line in cold environments, though Aircraft Spruce is willing to sell you lines custom made from Aeroquip Teflon hose and rate them to -40 degF, so I’m not so sure that’s a concern. It may well be that the intended application for those lines is not subject to as much repeated deflection as the flex line snaking through your front suspension out to the caliper.

Other Sealing Methods

Other sealing methods

There is one other kind of sealing involved in braking systems, usually at caliper or cylinder entry and often when converting over from one kind of flaring system to another: a washer face at the top of a hole. This requires a crush washer of soft copper, aluminum, or in extreme cases, a Stat-O-Seal, which is a combination of O-ring and aluminum crush washer. To make this an effective seal, a precision machined surface is required around the drilling, exactly perpendicular to the axis of the threaded hole. If this is not there, you must use a bottom sealing fitting. Conversely, if the hole does not have a nicely formed drill point form at its bottom or the fitting will not reach the bottom, you must use a sealing washer (and, of course, provide the machined washer face for it to seal against).

A neat trick I learned a while back is that copper crush washers can be reused - IF you anneal them. Place the washer in question on a brick and play your propane torch across it until it glows orange. Let it cool. It’s now as soft as it was originally and will re-crush and seal perfectly.

DIY Links

- Make your own Fuel Line
- Make your own fuel line
- Make your own fuel line
- Common Fueling Mistakes by Barry Grant
- How to choose a fitting type

A good read on many types of flares with applications and uses

Pricing Summary

Fuel Line Price Summary ($/ft prices based off 10ft length), in increasing order
Aluminum Tubing - $0.80/ft
Stainless Tubing - $2.40/ft
Summit Racing Twist Tite - $2.50/ft
Aeroquip AQP Socketless - $3.60/ft
Summit Racing Stainless Braided - $4.00/ft
Aeroquip AQP Stainless Braided - $5.00/ft
Aeroquip Startlite - $6.90/ft

Fitting Price Summary
Tube Sleeves + Tube Nuts - ~$7
AN -> Twist-Tite - ~$3
AN -> AN Hose - ~$7
AN -> AQP Socketless
Add a bend to any of those fittings - ~+$7
AN -> AQP/ Startlite Crimp - ~$17
Add a bend to any of these fittings - ~+$15
AN -> Factory Fuel Line - ~$17 aluminum, ~$35 stainless

**Fuel Line Choices**

- **Aluminum Tubing**
  Soft material. Can be bent by hand or with an inexpensive tube bender. Smaller than flex tube for the same inner diameter. Compatible with hard line fittings.

  Use this for return line only. Does not have the pressure handling capabilities to be used for high pressure intake line.

- **Stainless Steel Tubing**
  Similar to aluminum tubing but requires higher quality flaring and bending tools to work with it. It can be polished much nicer than aluminum can and can be found without a seam weld line like aluminum. Compatible with hard line fittings.

  Pretty much this is the bee's knees of tubing. If you have the patience, tools, and ...patience to work with this stuff you can upgrade most every piece of your car. It can handle super high pressures, can withstand most every type of fluid (gas, E85, brake, hydraulic, A/C, jet fuel, whatever) and looks AWESOME when all set up right. Times where you should use a flexible line instead should be mating to a moving part. For instance, going from hardline in the body to the engine, you should couple the two pieces with some flex hose.

Summit Racing SUM-G2516 - 5/16" Alum, 25ft - $20

These photos show these beautiful line kits installed on the Holley and also the Demon carbs. Both of the photos show the lines with the polished stainless fittings. The item title indicates the line kit and the style of fittings.
Summit Racing SUM-220256 / 5/16", 20ft / $48

Twist-Tite (Reinforced Rubber Hose)

Think of this as an inexpensive version of the braided steel hose. It can withstand high pressures, is flexible, and is inexpensive. The rated pressures are only good if you get the matching fittings. And remember, not all rubber tubing is created equal! You have to get the stuff that is built to carry high pressure fuel! This can be used in twist-tite connectors only. A note on the flexibility. Although this hose can flex it is burly stuff! Figure on a generous bend radius when using this hose. Although it is rubber, it is thick and doesn't like sharp bends. Those sharp bend situations are a place hard lines shine.

Once you put this on the connector it cannot be just taken off. You will need to cut the tube off the connector, thus shortening the line length. This is good line, but when you connect it be 100% sure that it is where you want it because it's not coming off without you cutting it off.

Furthermore, the connection this hose has on the connectors is substantial. No hose clamps are necessary to aid keeping the hose on the connector.

Summit Racing Twist-Tite Hose - 6AN, 20ft - $45

Aeroquip AQP Socketless Hose (Reinforced rubber hose)

This is similar to the twist-tie hose above but is compatible with the AQP socketless hose connectors. More expensive probably because it's a brand name. This can be used in AQP socketless hose connectors only. Per user Richard_Cranium, he considers this stuff a PITA. He purchased a bunch of this and was so frustrated with the assembly of it that he moved to braided stainless steel instead.
Summit Racing FCV0615 / Aeroquip AQP Socketless hose 6AN, 15ft - $53
- Aeroquip Startlite Racing Hose
  Similar to AQP socketless hose but it is sanctioned by many racing bodies and has a Nomex and kevlar cover for increased heat and abrasion resistance. Plus it’s 45 percent lighter than a similar hose from other brands. Handles similar pressure to the AQP socketless (200 PSI). Compatible with AQP fittings.

Summit Racing FCU0610 / 6AN, 10ft - $69
- Aeroquip AQP Stainless Steel Braided Hose
  This is similar to regular stainless braided hose, but it allows you to reuse your fittings if you’d like. Making a connection is as simple as pushing the AQP hose into the AQP fitting.

  NOT SURE --- I think this is cross compatible with generic stainless steel braided hose (aka Summit Racing house brand Stainless steel braided hose)

Summit Racing FCA0610 - 6AN, 10ft - $50
- Stainless Steel Flex Hose
  This is a generic product that is less expensive than the brand name Aeroquip or similar. Flexible, durable. Good stuff.
Fittings

Obviously, this list can’t be comprehensive and my intention is not to make this comprehensive. This is just to give you a rough idea of what’s out there to help you plan. If you’re running a different hose size then go source something that fits your plan. Also, I’m listing prices so you can pick fittings that keep you in your budget. Some fittings cost far more than others. Also, there are many other companies than summit racing that make this stuff, they just have a nice website that allows me to link images off it.

Also, I’m only going to post up one example of each fitting. You can get almost any of these fittings in straight (0 degree), 45 degree, 90 degree, and 180 degree variants.

Color. The hot rod gods deemed blue and red to be the color of speed (I think)...so most every fitting seems to come in a combination of blue and red. In the last couple years companies started producing straight black fittings too. Of course, there is always the raw metal look (metal or nickel plated) So now’a’days you have some options

- Here’s what the angles look like...
- 45 degrees
- 90 degrees
- 120 degrees
150 degrees

180 degrees

- Aluminum Tubing -> AN Hose
  Summit Racing SUM-2200075 - 6AN hose -> 3/8" Alum tubing - $6
Hard Line -> AN Hose (Tube Sleeves)
These work in conjunction with a tube nut. It goes like this...

Put the tube nut on the hard line.
Put the tube sleeve (smaller diameter side first) on the hard line.
Prep, cut, and flare the hard line.
Walla! You have a hard line with an AN female connection on it, ready to be mated to a male AN connection.

Summit Racing FBM3679 / 5AN / $4
AN Tube Nuts
The compliment to the tube sleeve

Summit Racing FBM3591 / 3AN / $3
AN Crimp
I don't know what this crimps on to? Stainless braided? Rubber? Aeroquip specific?
Summit Racing FC3443-05S / 6AN hose end crimp / $2
- Male AN -> Twist Tite

Summit Racing SUM-220756 - 6AN male -> 6 AN barb - $3
- Female AN -> Twist Tite

Summit Racing SUM-220706 - $10
- Female AN -> AN Hose
Summit Racing SUM-220687 - $14
- Male AN -> AN Hose
- Female AN -> AN Hose
- Female AN -> Aeroquip AQP

Summit Racing FBM1012 / 6AN -> AQP / $7
- Male AN -> Aeroquip AQP
- Male AN -> Aeroquip AQP Socketless
- Female AN -> Aeroquip AQP Socketless (Crimp)

Summit Racing FBM4274 / 10AN -> 10AN / $31
- Female AN -> Aeroquip AQP Socketless

Summit Racing FBM1512 / AQP Socketless -> 6AN / $6
- Male AN -> Male NPT
Summit Racing FBM2037 / AN -> NPT / $10
- Male AN -> Female NPT

Summit Racing FBM2719 / 3AN -> 1/8" NPT / $10
- Male AN Flare -> Metric

Summit Racing FBM2608 / 6AN -> 16mmx1.5 / $14
- Female AN -> Female AN

Summit Racing FBM2916 / 8AN->8AN / $8
- NPT Plug
This will allow you to convert factory tubing to -AN. The stainless fitting costs about twice as much as the aluminum fitting. I don't know why most people would need the expensive stainless over the aluminum.
Summit Racing 15103 / 6AN -> 5/16" OEM line / $35
- Male AN -> AN O-Ring

Summit Racing 15607 / 8AN -> 8AN O-ring / $13
- Female 6AN -> Male 3/8" Barb Fittings

USRT / $30
- Male M18x1.5 -> Male 6AN , Male M12x1.5 -> Male 6AN
  This fitting is pretty much perfect for the Bosch 044 pump.

USRT / $25
- 10mmx1.0 -> 6AN
  This fitting is perfect for the Walbro fuel pump

USRT / $20
- O-Rings for AN-O-ring connections
  ...list some compatible Viton and Buna-N o-rings

Bulkhead Adapters
- Use these when you need to get a line through a firewall, panel, or anything else for that matter. Much more secure than just drilling a hole and pulling lines through.
- 6AN -> 6AN

Summit Racing FBM2072 / 6AN ->6AN / $5

- Bulkhead Nut

Summit Racing FBM2103 / 8AN / $3

Reducers
- 8AN -> 6AN

Summit Racing FBM2410 / 8AN -> 6AN / $8

Splitters
- 8AN -> 8AN -> 8AN

Summit Racing FBM2283
- 10AN -> 8AN -> 8AN

Summit Racing 15620 / $78

Summit Racing 15675 / $50

**Gauge Adapters**
- Flare -> Flare (w/ NPT Gauge Port)

USRT / $9
- AN -> NPT (w/ NPT Gauge Port)
Summit Racing FBM2277, $7
- AN -> AN (w/ NPT Gauge Port)

Summit Racing FBM2183, AN6->AN6, $7

Links
- Twist-Tite Parts @ Summit Racing

Last edited by goggory; 07-11-2010 at 08:29 PM.

Check Valves
- Aeromotive High Flow One Way Check Valves
Fuel Pumps
You need more fueling when you are using bigger injectors and can no longer flow enough fuel into your engine. In other words, if under high boost you are loosing fuel pressure your pumps can not keep up with the flow. The pumps we put on these cars rarely have a problem keeping up with the pressure...it's the flow numbers that are the problems.

Normally a standard in-tank fuel pump will feed the in-line fuel pump. The in-line fuel pump will feed the engine during high demand periods but can not sustain that high demand. The in-tank fuel pump can not feed enough fuel to the in-line fuel pump and you will have fuel starvation under sustained WOT driving. If you fall under this category then a surge-tank is for you.

Also, before choosing a fuel pump double check that it handles your fuel type. If you add for instance, E-85 to the mix, not all fuel pumps can handle this. You've been warned. Read the datasheets.

Originally Posted by Richard_Cranium
you MUST PAY ATTENTION to the instructions with certain fuel pumps. not all of them are "pull" type. the A-1000 is the first that comes to mind. it is a "pusher" type pump, and needs to be gravity fed or pumped to feed it. it "may" run for a bit pulling fuel, but it wont last for long. some are pull-type pumps that can pull fuel as well as push, then there is the low-pressure high flow versus high pressure pumps as well. if using inline pumps and a surge tank, it would be good for a low pressure high flow pump to feed the surge, and then high pressure out of the surge to the motor. this way the surge is always full.

...I need to insert graphs into these

- Walbro 255LPH - High Pressure Pump
  Mfg Part # GSL392
  Capable of supporting ~400WHP cars
  Free Flow Rate: 255 LPH @ 3BAR
  Inlet: 10mm x 1.0 (Female)
  Outlet: 10mm x 1.0 (Female)
  Inlet/Outlet fittings can be sourced from www.fuel-pumps.net or ATP Turbo
Install Kit @ USRT
ATP Turbo / Walbro 255LPH / $129
• Bosch 0 580 254 044 Inline Fuel Pump aka. Bosch '044' fuel pump

Bosch 044 fuel pumps mount inline (out side of your gas tank), most commonly rear center under your car or truck. Each Bosch 044 inline fuel pump provides 300LPH of flow and operate at 72.5 PSI. Bosch 044 fuel pumps are comparable to the Walbro 255LPH high pressure inline fuel pumps which can both support vehicles for up to 600-700 horse power. Can be used in sequence with an intank Walbro or Bosch 040 fuel pump.

Bosch 044 Fuel Pump Specs:
Bosch Part Number: 0 580 254 044
Minimum Current: 12 Volts
Operating Pressure: 72.5 PSI (5 Bar)
Minimum Flow @ Outlet: 80 GPH (300 LPH)
Fuel Pump Location: In-Line
High Temperature Reduction: 8 GPH (30 LPH)
Weight: 1030 Grams (2.27 Pounds)

Fuel Pump Connections:
Inlet: M18 x 1.5
Outlet: M12 x 1.5
Electrical: Positive M6 / Negative M5

Integrated Engineering / $225
Loose Bolts Motorsports / $180
Bosch 0 580 254 040 In Tank Fuel Pump

Bosch 040 fuel pumps are universal style in tank fuel pump replacements recommended for vehicles exceeding OE specifications. The Bosch 0-580-254-040 fuel pump is one of the only in tank fuel pump that can be compared with the Walbro 255LPH High Pressure series fuel pumps for use in vehicles with up to 700 horsepower.

Bosch 040 Fuel Pump Specs:
- Bosch Part Number: 0580254040
- Minimum Current: 12 Volts
- Operating Pressure: 94 PSI (6.5 Bar)
- Minimum Flow @ Outlet: 80 GPH (300 LPH)
- Fuel Pump Location: In Tank
- High Temperature Reduction: 8 GPH (30 LPH)
- Weight: 930 Grams (2.05 Pounds)

Fuel Pump Connections:
- Inlet: Open Base
- Outlet: M10 x 1.0
- Electrical: Positive M6 / Negative M5

---

Bosch Fuel Pumps / $200

- APR in-tank
  - Fits into the factory A4 platform (A4, TT, GTI, Jetta) and perhaps others (people fill me in here) stock fuel pump pickup. This is by far the EASIEST fueling upgrade as you don't have to do anything else. Just pull the stock fuel pump and drop this in for an instant fueling upgrade to fuel your project.

  Supposedly link the APR in-tank fuel pump finds its origins in the Audi TT225 model. For the TT225 APR stg3 GT2871r kit APR supplies an additional inline fuel pump which hints at the horsepower cap capable by this fuel pump alone. This makes me believe that this fuel pump is capable of supplying fuel for ~350HP. The TT225 is an AWD model and has a different gas tank and thus you can't just buy a TT225 fuel pump instead. APR modified the pickup to fit the FWD fuel tank.
  - Flows xxx liters/hour
  - Can sustain 44 PSI (3bar) fuel pressure (unconfirmed...)

---

MJM Autohaus / $200

- Bosch Motorsports 413

Originally Posted by USRT

An elite-level part from Bosch Motorsports, flow is
The reason for the fuel cell/res tank note is because this is a push-type pump. Not a push/pull pump. It needs to be either fed, or gravity fed. It will not pull. It would also work well if you put a low pressure, high volume pump behind it. A good example of this is Richard_Cranium’s new build where he has a fuel cell and an A1000 under it at his front driver’s side corner.
USRT / $315

**Walbro In-Tank**

This pump has the same specs as the Walbro 255LPH listed above, but has the right casing to fit in the stock fuel tank. It's a drop in replacement for the OEM pump. The downside to it is it will have fuel starvation under high g loads. As per USRT,

---

**Originally Posted by USRT**

This single stage pump is only recommend for use in conjunction with a surge tank to eliminate fuel starvation problems at less than 1/4 tank. Fully-compatible with stock fuel lines.

---

USRT / $140

- Weldon
- MagnaFuel
- Fuelab 40401

Billet, comes with mounting bracket, designed to be quieter than most of the competition

Internal Speed Controller that is controllable via external PWM signal


Amazon / $384

- Barry Grant

**Fuel Pump Mounting Kits**

- Bosch 044 Bracket w/ Isolation Rubber

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Tweakit Performance / $44

- Bosch 044 Bracket - Stainless

Jay Racing / $35

- Bosch 044 Bracket - Aluminum

Jay Racing / $50

- Generic 2.13" to 2.44" Mounting Bracket
Shown with a water pump instead...

Frozen Boost.com / $7
- Universal Relay’d Fuel Pump Wiring Harness
- Integrated Engineering / $65

Fuel Pressure Regulators
- RMR FPR Adapter
  - Allows Stock Bosch style FPR to convert to -6AN inlet/outlet.
  - Very nice for hanging off the end of an aftermarket fuel rail

Integrated Engineering / $75
- Stock

Integrated Engineering / $80
- Aeromotive
  - Pressure Range (BAR): 2.85 - 6.65
  - Pressure (PSI): 30 - 70

USRT / $139
- Not sure who makes this???
  - Drops into stock Bosch FPR socket
  - Pressure Range (BAR): 3 - 5
  - Pressure Range (PSI): 43.5 - 72.5
USRT / $99

Fuelab 53501 / 53502 / 54501 / 54502

xxx01 is adjustable up to 125 PSI
xxx02 is custom pressure requirements
535xx is return line on bottom
545xx is return line on opposite side of feed line

You can also get a 515/525 regulator...but they do the same thing, weigh 50% more, and are larger

Fuel Filters

Rule of thumb with fuel filters...100 micron inlet, 10 micron out. This means put a 10 micron filter pre-fuel pump and a 100 micron filter post pump. The weak filter will save your filter, the good filter will save your injectors. This is handy because 100 micron filters and small and compact. 10 micron filters are large and bulky.

If you are running E-85 you need a SS mesh element...but it's tricky. Look into the E-85 issues before going down this path.

Jegs Billet (Long) In-Line Fuel Filter

CNC-machined from Billet aluminum and features a laser etched JEGS logo, 9” long x 2” diameter housing and built in AN fittings. No need to purchase adapters, just add your hose ends and go. Includes a 10-micron cellulose (gasoline only)
Surge Tanks
Surge tanks are for high performance use.

- With Submerged Bosch 044 Pump
  Outer Dimensions: 5.5" x 8" x 4.25"
  3 x O ring boss -6AN inlet/ outlets
  Interior Volume 1.5L

Integrated Engineering / $199
- With Submerged Dual Bosch 044 Pumps
  Outer Dimensions: 4.25" x 6" x 8" (HxWxD)
Fuel Pressure Senders
For use with electronic gauges. Very useful if you want a fuel pressure gauge in the cabin. The gauges that take a fuel line should not be brought into the cabin for safety reasons. If you need to look at the fuel pressure while driving then make the gauge exposed through the windshield and look from there.

Tools
The stainless needs to be double annealed if you are doing double flares...or it will split.
Use these when you decide to work with hardline

- **Rigid 345 Flaring Tool**
  - For making 45 degree, SAE flares
  - Spec’ed for soft copper, brass, aluminum and mild steel (JIC and Bundy) tubing
Snap on Tube cutter + double flaring SAE set

Snap On TF528D / $140

Summit Racing 37 degree flaring tool
Flare Tool, Single, 37 Degree Flare, Tube Sizes 3/16, 1/4, 5/16, 3/8, 1/2 in., Kit
This tool won't hold up for stainless. Use it for mild steel, aluminum, etc etc

Summit Racing SUM-900311 / $30

Imperial Eastman IMP 400-F , 37 degree flaring tool
This tool will do everything you want. Stainless Steel, Titanium, Aluminum, whatever...Great tool.

Originally Posted by Newman Tools
Drill Spot / $400
- Jerry Bickels Roto Flair Tool
  For 37 degree flares

Originally Posted by Jerrybickel.com

Jerry Bickel / $100
- Mastercool 71480 , 37deg flaring and double flaring hydraulic kit
  This will do all your 37 degree flares with ease

Automotive tools online / $220
- Mastercool 72029 Reduced Friction Ball Bearing Tube Cutter

Automotive Tools Online / $21
- Mastercool 70069 , 4-in-1 tube bender

Originally Posted by automotive tools online
Open side design slips over tube at any point. Makes smooth short radius bends up to 90 Degree with minimal effort. Calibrated to show angle of bend. Easy 90 Degree start requires much less effort to make fast and accurate bends. All metal multi-purpose tube bender for 3/16", 1/4", 5/16" and 3/8"-4 mm, 6 mm and 8 mm O.D. tubing.
AN Crimp Tools

Great list of AN tools by Earl

Earl AN Crimping Tool (requires below mentioned dies)

Earl 40-D031ERL

Crimping tool and dies are used to crimp the aluminum collar on Auto Crimp hose ends. Designed to give a maximum pressure rating to Auto-Crimp hose ends when using Pro-Lite hose.

Earl AN Crimping Dies for Earl 40-D031ERL Crimping Tool

- 40-D03104ERL Earl's Crimping Die Size 4AN
- 40-D03106ERL Earl's Crimping Die Size 6AN
- 40-D03108ERL Earl's Crimping Die Size 8AN

Use the appropriate die for auto-crimp hose ends

Earl Pressure Testing Kit

40-D016ERL

Every hose assembly should be pressure tested prior to installation. Earl's pressure test kit makes it easy to test field-assembled kits with either compressed air or nitrogen. Consists of fitting with air valve in each size and matching plugs.

Covers sizes 3 through 16.
MPSRacing / $157
- Aluminum Vice Jaws
  These handy vise jaw liners help prevent scratching of anodized aluminum hose ends during assembly. Internal magnets hold the extruded aluminum liners securely to most popular bench vises. The jaws are available in both of the standard jaw widths and are designed to hold almost any soft part without marking its surface. Earl's assembly department uses these jaws.

40-004ERL Earl's Aluminum Vice Jaws - 3" Jaw Width
40-005ERL Earl's Aluminum Vice Jaws - 5" Jaw Width

MPS Racing / ~$15
- Rubber Tubing Assembly Lube
  Earl's 40-184004ERL
  Use this to get the rubber tubing onto the hose ends. Fuel tubing fits TIGHT

MPS Racing / $9

Fuel Pressure Gauges
These are for engine side use only. Do not bring these gauges into the cabin.
- Auto Meter #105-4363-M Sender + Gauge
Jegs / $227
0-100 PSI Gauge
1.5" face

USRT / $20
0-120 PSI
Fuelab

VDO 0-60 PSI Gauge

Jegs 918-153008 / $22
VDO 0-100 PSI Gauge
Fuel Rails

- Racecraft
- RMR

7/12/10 - Note: This is a discontinued part. They are selling what they have and there are vendors here and there that carry it.

-6AN Inlet/Outlet

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Originally Posted by RMR Racing

The 20v VW Fuel Rail is CNC machined from billet T6061 Aluminum stock and is made to replace your stock oem rail to provide you with more fuel flow for your high horsepower applications. This fuel rail is designed for the 1.8T engine and made to be used with either stock or Bosch Style Non-Stock Injectors (pictured). This is attainable due to the fact that we include machined spacers which allow you to space the rail in order to fit the bosch style injectors under the rail. Typical uses are for people doing programmable engine management where low impedance injectors are a must for idle quality.

Note: Images of Fuel Rail mounted are on an RMR 1.8t Intake Manifold (also out of production).
Mounts to any stock or USRT short runner 1.8T intake manifold. Also fits USRT 16v short runner intake manifolds and USRT ITBs. Features a clear anodized finish to protect against the elements and alternative fuels. Kit includes rail, -6AN fittings with o-rings, stainless steel clamps, and stainless steel hardware. A smart choice for 300+ hp.

$125 / USRT
Fuel Injectors
This should be another thread entirely.
Height. Known Compatible software tunes. etc.

Common Configurations
- Adding a adjustable FPR + Electronic Fuel Pressure Gauge +
  Analog Fuel Pressure Gauge
  Photos courtesy of Richard_Cranium

- Adding an RMR Fuel Rail + RMR FPR Adapter to an otherwise factory setup
  This is a common upgrade if you are changing your manifold.
  Most aftermarket manifolds won't accept the factory fuel rail.
  The SEM intake manifold is an exception to this, it will hold the factory fuel rail.
- Adding a fuel rail to a heavily modded setup
  Taken from Richard_Cranium's Setups...
  -8AN into rail, and -6AN into the FPR and -6AN return to fuel cell.
  no issues.
  or
  -10AN into rail, and -6AN from rail to FPR and -6AN from FPR to cell. no issues.
  (Big flowing E-85 build with 1680cc injectors)
  (Fed from dual 044's)

Note: If you are going to run asymmetric fuel lines (intake vs. return) you need to be sure your return can handle the overflow from the FPR. If you don't take this into account you could potentially experience pressure surging on the fuel rail when the FPR can't dump the excess pressure enough. An example of this would be Richard's -10AN setup above. In my opinion, if he were running say 300cc injectors they wouldn't make a dent in that amount of fuel volume going into the fuel rail...thus, a lot of fuel would have to be returned via the return line. If the return line was largely undersized it would cause a pressure buildup in the fuel rail. Instead of say, 4BAR + 25 lbs of boost being sent to the injectors all the extra pressure would act as a base, so say 6BAR + 25 lbs of boost would hit the injectors causing you to run a very rich condition.

So in short, run asymmetric lines with care. If you don't know how to size, just run symmetric lines.
- Adding an inline fuel pump to an otherwise factory setup
  This is a common upgrade to sustain higher fuel pressures and larger flow rates.
  ...My question...If the stock pump flows x LPH and the inline pump flows y LPH, wouldn't you be limited to x LPH and you could only flow y LPH based on the amount of fuel sitting in the fuel line behind the inline pump?
- Adding a surge tank + Inline
  Low pressure in-tank pump feeds surge tank
  In-line pump pulls fuel from surge tank
  Return line from engine feeds main fuel tank
  Courtesy of K20017
- Adding a surge tank + dual Inline
  - Low pressure in-tank pump feeds surge tank
  - Surge tank feeds each of the inline pumps
  - One way check valves come off each pump
  - Check valves go into a y-splitter
  - y-splitter feeds engine
  - Return line from engine feeds main fuel tank

From Richard Cranium's new Audi Build
Getting ready for E85
It takes ~30% more E85 to reach the same power levels compared to unleaded gasoline. E85 runs like a high octane gas does, but it has a lower energy density so it takes more to do the same thing. It's like running a race fuel with the side benefit of making your MPG's go down the tubes (but far cheaper than race fuel).

Getting ready for a very powerful E85 build (>500 WHP)

Car Specific

Mk1 GTI

Originally Posted by Richard_Cranium
rabbit MK1 GTI the lines run from pass side rear tire area under the car up to the engine bay.
the problem area is the steering rack.

i did this a long time ago on mine, with 1/2" SS tubing, and the rack was the issue. i changed it to Summit twist style, and the rack ate the line on a hard turn. i was in the garage luckily, but still the $16/gal fuel it spilled hurt my ego LOL.
Custom fuel cell with dual 044 fuel pumps

This one is courtesy of newto20v

He plans on adding 90deg down bends from the interior filters to the bottom of the fuel cell. That way it'll have less chance of fuel starvation at lower fuel levels. He used the Integrated Engineering 044 tank plates and custom fab'd them into this fuel cell.

I sunk the two 044 pumps into the fuel cell. Less fittings, more space, cool the pumps, quiet them down.
groggory  
Member  

Join Date: Apr 21st, 2003  
Posts: 2,110  

07-09-2010 07:41 AM  
#9  
moved...  

schwartzmagic  
Member  

Join Date: Apr 29th, 2007  
Location: MIA  
Posts: 5,094  
Vehicles: 2005 VW Jetta GLI  

07-09-2010 07:00 AM  
#6  
Thank baby jesus someone is finally doing this.  

FS- 2005 1.8T K03s set-up (turbo, TIP, 3" DP, OEM injectors, oil/water lines, Autotech CAI & APR DV)  

gtimitch  
Member  

Join Date: Nov 19th, 2006  
Location: Aiken SC  
Posts: 1,098  
Vehicles: 02 Golf GTI 1.8T  

07-09-2010 07:06 AM  
#7  
Originally Posted by schwartzmagic  

Thank baby jesus someone is finally doing this.  

Excellent information post...Thanks.  

isaam @ http://www.inaengineering.com/, ED @ http://www.forcefedengineering.com/, Bob @ http://www.qedpower.com/, Arnold @ http://www.pagparts.com/, DonR@Unitronic.ca and, for some fun: , http://www.elitedubs.com/  

ejg3855  
Member  

Join Date: Sep 22nd, 2004  
Location: Rochester, NY  
Posts: 3,355  
Vehicles: 1991 90CQ, 2002 TT, 2001 TT  

07-09-2010 07:25 AM  
#8  
www.jayracing.com makes some very nice Bosch 044 Check Valves $50/pc  

I also have seen on some various sources that the Aluminum Hard line isn't compatible for the pressures of a fuel injection system.  

RocDubs, Rochester NY's European Auto Group  
Project Audi TT S362  

Last edited by groggory; 07-10-2010 at 12:58 PM.
Vegeta G6

Join Date: Feb 12th, 2003
Location: konoha village
Posts: 7,332
Vehicles: 1984 GLi 20v

07-09-2010 10:48 AM #10

this should be a sticky and we should all work on gathering information to make it a solid resources for the forums as a whole.

:HOMEGROWNMOTORSPORTS:: power to weight ratio of 1:5.2
CarpeDiem #13 Dead Rabbits #13

Originally Posted by just-jean

this is what a bentley looks like....get your own, and then RTFM....put it in your hatch along with zip ties, duct tape, a BFH, a spare oil pan, and a cell phone.

20thAEGU1009

Join Date: Jan 27th, 2005
Posts: 810

07-09-2010 03:45 PM #11

The adapter to go from 5/16th's oem to -6AN will indeed fit the factory fuel line.

Force Fed Engineering
Best Turbo Kits around.
565whp 60-1'ed 2.0 20v
Billet 67mm SFWD Build in Progress

robingohtl

Join Date: Nov 6th, 2005
Posts: 721

07-10-2010 12:20 AM #12

good reference!

Dub-Nub

Join Date: Sep 27th, 2005
Posts: 2,693

07-10-2010 07:28 AM #13

Bosch 0 580 254 044 Inline Fuel Pump

Bosch 044 fuel pumps mount inline (out side of your gas tank), most commonly rear center under your car or truck. Each Bosch 044 inline fuel pump provides 300LPH of flow and operate at 72.5 PSI. Bosch 044 fuel pumps are comparable to the Walbro 255LPH high pressure inline fuel pumps which can both support vehicles for up to 600-700 horse power. Can be used in sequence with an intank Walbro or Bosch 040 fuel pump.

Bosch 044 Fuel Pump Specs:
Bosch Part Number: 0 580 254 044
Minimum Current: 12 Volts
Operating Pressure: 72.5 PSI (5 Bar)
Minimum Flow @ Outlet: 80 GPH (300 LPH)
Fuel Pump Location: In-Line
High Temperature Reduction: 8 GPH (30 LPH)
Weight: 1030 Grams (2.27 Pounds)

Fuel Pump Connections:
Inlet: M18 x 1.5
Outlet: M12 x 1.5
Electrical: Positive M6 / Negative M5

Sourced from www.boschfuelpumps.com
Bosch 0 580 254 044 Inline Fuel Pump

Bosch 044 fuel pumps mount inline (out side of your gas tank), most commonly rear center under your car or truck. Each Bosch 044 inline fuel pump provides 300LPH of flow and operate at 72.5 PSI. Bosch 044 fuel pumps are comparable to the Walbro 255LPH high pressure inline fuel pumps which can both support vehicles for up to 600-700 horse power. Can be used in sequence with an intank Walbro or Bosch 040 fuel pump.

Bosch 044 Fuel Pump Specs:
- Bosch Part Number: 0 580 254 044
- Minimum Current: 12 Volts
- Operating Pressure: 72.5 PSI (5 Bar)
- Minimum Flow @ Outlet: 80 GPH (300 LPH)
- Fuel Pump Location: In-Line
- High Temperature Reduction: 8 GPH (30 LPH)
- Weight: 1030 Grams (2.27 Pounds)

Fuel Pump Connections:
- Inlet: M18 x 1.5
- Outlet: M12 x 1.5
- Electrical: Positive M6 / Negative M5

Sourced from www.boschfuelpumps.com

Thanks. Added that in. Also, added some additional 044 info, info on the walbro's, and some bits here and there.

If anyone can chime in on any of the sections that very much need work please do. I'll edit your responses into the main posts.

Thanks.

Richard_Cranium
Member

07-11-2010 01:43 AM

Questions:

Can aluminum tubing be used for the fueling inlet? not usually as it does not have the pressure capabilities needed.

What are the advantages to Stainless braided hose over twist-tite or Aeroquip AQP socketless hose? Conversely, are there situations where both shine? Aeroquip/twist
that said, this was a very well thought out post.

i use the Jay Racing check valves.... good product.

this forum needs more of this type of stuff really.

the best price on 044's i have found, for REAL 044's, is LooseBoltsMotorsports.com. i run dual 044's with Jay Racing check valves into -10AN and on to the fuel rail.

a few more parts you can add is Racecraft fuel rails, and Fuelab FPR's.

you have to watch FPRs as the Aeromotive stuff is not super high pressure compatible. also, Weldon, MagnaFuel, Fuelab, Barry Grant, many other pumps available as well.

then there is filters, and material and sizing of the elements. rule of thumb is 100 micron in and 10 micron out. but when you get to E-85 where you need a SS mesh element, it gets tricky.

you also need to be aware of what pump can handle what fuel.

also the injectors, what fuels can they handle? but i guess injectors would be a WHOLE DIFFERENT thread, now, wouldnt they? LOL

one can also use SS hard line tubing for fueling needs. it has tremendous pressure handling capabilities, looks nice, and is not very expensive. much like what i run on my TPI'd 4x4 truck. it takes some skill to be a good bender, but you can do alot with it with some practice.

a few other tips? get a set of the vice jaws if you plan to do any major amount of SS braided line assembling. worth the 35 bucks or whatever.

and when cutting the braided line, i wrap it a few times TIGHT with electrical tape, then cut it with a thin blade on a grinder. take some snips (i like green for this) and trim the little pokies off and it goes right in the fitting with no frays. you can believe me on this or not; i have assembled many many braided AN lines for these past two race cars of mine.

lastly, you MUST PAY ATTENTION to the instructions with certain fuel pumps. not all of them are "pull" type. the A-1000 is the first that comes to mind. it is a "pusher" type pump, and needs to be gravity fed or pumped to feed it. it "may" run for a bit pulling fuel, but it wont last for long. some are pull-type pumps that can pull fuel as well as push. then there is the low-pressure high flow versus high pressure pumps as well. if using inline pumps and a surge tank, it would be good for a low pressure high flow pump to feed the surge, and then high pressure out of the surge to the motor. this way the surge is always full.
on my way to being banned once again, because i know a lil somethin somethin and stand by MY KNOWLEDGE!

keep on keepin on, Poortex 😛

Lots of updates.

Questions below still remain.

Questions:

What path in a Corrado do the fuel lines run (In case of total replacement)? Any notes on install? (estimated line lengths, problem areas, etc etc)

What path in a mk1 golf/ GTI do the fuel lines run (In case of total replacement)? Any notes on install? (estimated line lengths, problem areas, etc etc)

What path in a mk2 golf/ GTI do the fuel lines run (In case of total replacement)? Any notes on install? (estimated line lengths, problem areas, etc etc)

What path in a mk3 golf/ GTI do the fuel lines run (In case of total replacement)? Any notes on install? (estimated line lengths, problem areas, etc etc)

What path in a mk4 golf/ GTI do the fuel lines run (In case of total replacement)? Any notes on install? (estimated line lengths, problem areas, etc etc)

What path in a b5 Passat/ A4 do the fuel lines run (In case of total replacement)? Any notes on install? (estimated line lengths, problem areas, etc etc)

Of the fuel pumps that I have listed, which pumps would you recommend for what applications?

How does the bosch 413 stack up to dual bosch 044’s?

THANK YOU!!!!

Wow! I was over on fuelab's website looking at their fuel pumps (very nice, btw) and I never realized fuel pumps draw such huge amounts of current....Especially at high pressure levels.

I really like their feature that lets you tune the pressure level so you aren't pulling full current all the time (and so you aren't pushing tons of fuel through your return line hose).

Cool stuff.
Bump.

I’m still working on making this thread better. Been adding more products and information.

Could use some links to additional fuel rails for the 1.8t.

Could use some more pics of installed aftermarket fuel systems with mention of what car it is and any notes about the install. Parts, difficult situations, success, problems, etc.

Any notes on any of the parts I’ve mentioned. Have you had success with them? Failure with them? Etc?

If this is going to be a good reference post I need to make sure all of the information is sound so I don’t send ‘students’ out into the world with incorrect facts.

Thanks for helping me to make this a better 1.8t forum!

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On this picture...

Why do you have filters on both the inlet and the outlet of the pump? I assume the inlet is to protect the pump and the outlet is to protect the motor.

Also I assume that you can put a mediocre filter on the inlet and a very good filter on the outlet.

For instance, one of the little stubby 100 micron jegs filters on the inlets and one of the huge 6 micron filters on the outlet?

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Why isn’t this a sticky?

Now why isn’t this a sticky by now? There is an enormous amount of information shared here and it is very valuable to the entire 1.8 community. Please consider it for a sticky.

This is very helpful as well...

then there is filters, and material and sizing of the elements. rule of thumb is 100 micron in and 10 micron out. but when you get to E-85 where you need a SS mesh element, it gets tricky.
Now why isn't this a sticky by now? there is an enormous amount of information shared here and it is very valuable to the entire 1.8 community. Please consider it for a sticky.

FS - 2005 1.8T K03s set-up (turbo, TIP, 3” DP, OEM injectors, oil/water lines, Autotech CAI & APR DV)

Moderators, this is valuable, please place it as a sticky. We have good moderators but we may need to get their attention.... hnnnnn... I think we have moderators??

Why do you have filters on both the inlet and the outlet of the pump? I assume the inlet is to protect the pump and the outlet is to protect the motor. Correct, this is per the fuel pump instructions. This was, BTW, the new-old build, the last iteration of the drag rabbit.

Also I assume that you can put a mediocre filter on the inlet and a very good filter on the outlet. again, true. the 100 micron in is to get the big stuff.... the 10 micron out is to get the rest. and then, Methanol and Ethanol take a different filter element.

For instance, one of the little stubby 100 micron jegs filters on the inlets and one of the huge 6 micron filters on the outlet?

and to update ya, Integrated Engineering also offers the 044 end plates separately as well, if you are doing custom work. here is my latest fuel cell, i sunk the two 044 pumps into the fuel cell. less fittings, more space, cool the pumps, quiet them down.

i will be putting 90 deg fittings on the inlets, so they pull from the lowest point. just progress pix....

another little tidbit of advice. when using pumps like the 044 and the A1000, its a good idea to make a plug setup like pictured here. this way you do not strip the bolts, or unloosen them. i had this happen once to an SX fuel pump. was disappointed, too. that setup is pictured up above under the rabbit.

and yeah, the Aeroquip socketless is a real pain in the ass to work with. i have a very expensive chunk of "ired of dealing with that stuff" on a shelf LOL.
known and hated throughout the 1.8T forum.
INTEGRATED ENGINEERING, DJM, LUGTronic, A1-CVTech, NUBWORKS, INA, 034
Bump for a sticky.......  

Cool. Thanks. 

Also, updated the post with more setup pics and notes.

I am not sure this is right? 

I think the Bosch 044 should be between the rail and the surge tank. In this picture it would be pushing fuel into the Surge Tank. 

FPR always goes on the return side doesn't it?

ya, that looks wrong to me, too. 

i've always done it FPR after rail.
Good call.

The way that drawing was done it would leave the line pre fuel rail very nicely regulated...but the fuel rail itself would have no regulation. It would be freely dumping back into the gas tank return line.

I'll update that drawing.

Thanks.

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Side inlet of the FPR after the rail.
Cap the other side of the FPR. Return to surge from bottom of FPR.

Made the modifications.

Thanks.