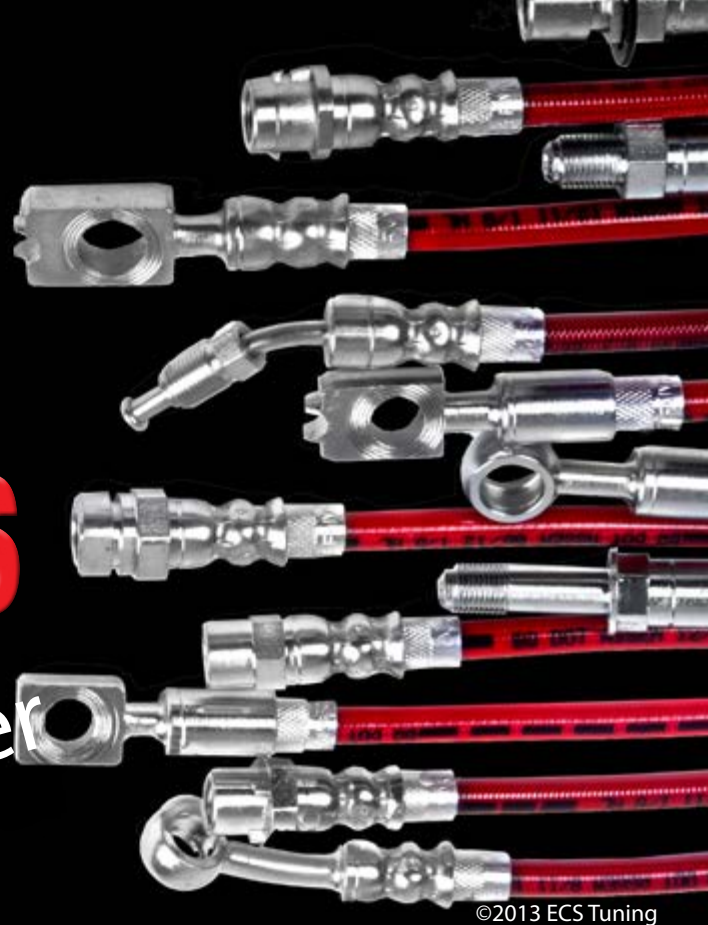




Exact-Fit Brake Lines

an **ECS Tuning®**
white paper



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Brake Lines

The Heart of a Complete Brake Job

Automotive brake fluid hoses are often ignored during a vehicle brake service. Brake pads and rotors are commonly accepted replacement items, but many motorists mistakenly assume that their brake hoses should last the life of the vehicle.

That assumption is incorrect and dangerous.

Stock brake hoses are made of a synthetic rubber inner core, surrounded by one or more layers of fabric mesh reinforcement, which is then encased in another layer of rubber. Brake hoses connect chassis-mounted rigid steel brake lines to calipers and wheel cylinders mounted on moving suspension components. Suspension travel continually flexes and twists them as the vehicle is driven, weakening hoses over time.

Brake hoses are also heat cycled, splashed with road salt and abrasives, and degraded by ozone, airborne contamination, and UV rays. Exposure to chemicals, especially petroleum-based fluids, can also degrade hose rubber. The combination of physical stress and chemical attack eventually leads to hose failure.

Failure usually presents itself as leaks caused by hose cracks and fissures, or mechanical separation of the hose from its crimped fittings. Since brake system operating pressures are very high, small leaks grow quickly, and hoses may split open without prior warning, causing an immediate and highly dangerous loss of hydraulic pressure.

In this white paper, we will explain how brake hoses are made, and show you how to inspect old hoses. We will also explain why ECS Tuning Exact-Fit lines should be included in a professional-grade brake system service.

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Brake Hose Construction - Stock Hoses

- The inner core of a stock brake hose is commonly made of a synthetic rubber compound. EPDM (ethylene propylene diene monomer) and CR (chloroprene rubber, also called neoprene) are often used, since they are cost effective and fairly strong. Both are flexible, and expand slightly when exposed to brake fluid line pressures, a characteristic that can give a slightly soft feel to the brake pedal as it is initially depressed.
- The hose is wrapped in a fiber mesh that reinforces the core and limits expansion under pressure. Multiple mesh layers may be used.
- The layered hose is encased in a seamless rubber coating for protection. EPDM is a common material for the outer coating, although it is less resistant to oils, grease, and gasoline than it is to ozone and UV rays.
- Metal fittings are inserted into the hose and may have barbed nipples to better grip the hose inside diameter. Fittings may have male or female threads or banjo ends attached by a hollow bolt and washers to the brake actuator.

The fitting is then crimped around the hose with great force. The crimping die compresses and deforms the collar to create a strong physical bond that seals the hose and fitting to prevent fluid loss under pressures that normally range between 800 and 2000 psi.



This stock brake hose is made from a reinforced rubber hose to which fittings are attached. The mechanical bond between hose and crimped fittings creates a leak-free physical union capable of withstanding brake system line pressures. This example has both a banjo and threaded fitting.

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Exact-Fit Hose Construction

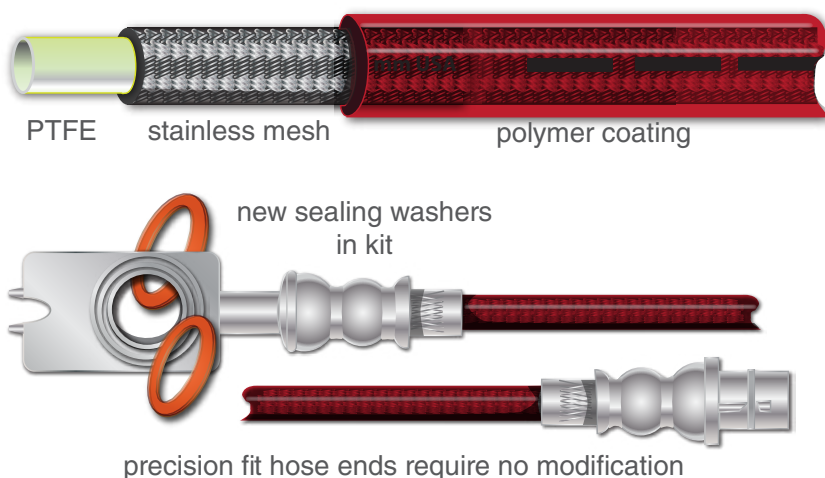
Premium Exact-Fit lines from ECS Tuning, are made of special materials.

The core of an ECS Tuning Exact-Fit line is made of extruded PTFE (trade name Teflon®). Stronger than rubber, PTFE swells less under pressure, is flexible and durable, and is unaffected by chemicals that can damage EPDM, including petroleum-based fluids.

The inner core of an Exact-Fit line is surrounded by a stainless steel mesh that is stronger than fabric mesh reinforcement used in stock hoses. As a result, the stainless mesh resists core expansion under pressure better than fabric mesh, and provides added shielding to protect the core from abrasion and impact damage. Less core expansion gives a harder initial pedal feel when the brakes are applied.

The outer coat of the Exact-Fit hose is made of a bright red, seamless polymer.

Attractive and more impact resistant than synthetic rubber, the Exact-Fit outer layer also provides added protection from chemical and UV attack.



Pedal Feel

Brake pedal feel is affected by several factors including, but not limited to, the physical characteristics of the brake hardware, wheel bearings, friction material coefficient of friction and condition, and brake hose expansion. In most instances, the addition of stainless reinforced lines can make a noticeable improvement in pedal firmness, other factors notwithstanding.

The brake pedal has a softer feel with stock hoses since they swell more initially under pressure. Since Exact-Fit hoses swell less, they need less fluid volume to exert the same pressure, making the pedal feel firmer.

Long term testing by original equipment vehicle manufacturers and reputable aftermarket brake suppliers indicates that the decreased pressure-volume ratio associated with stainless lines does not significantly affect the operation of computer-controlled brake systems used in ABS and traction control systems. This is an important concern, since many vehicle stability, traction, and antilock braking controls are now installed as standard equipment.

Exact-Fit lines do not affect the pressure-torque relationship of the braking system, since this factor is determined by the physical characteristics of the brake system components, including caliper and rotor size and condition, and brake friction material condition and coefficient of friction.

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Tested for Your Peace of Mind

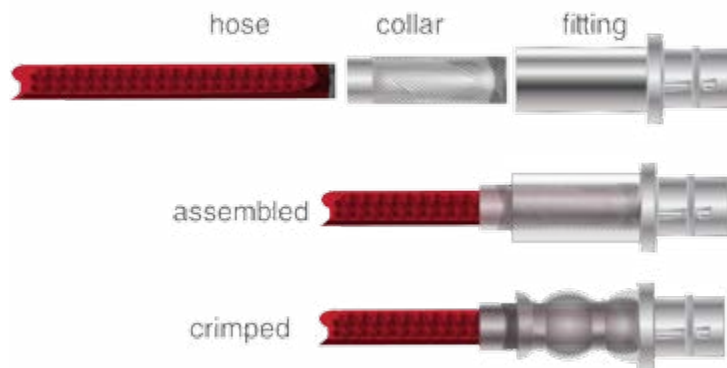
To ensure that our brake lines meet customer expectations for safety and performance, Exact-Fit lines are made to comply with DOT (U.S. Department of Transportation) standards listed in FMVSS (Federal Motor Vehicle Safety Standard) 106. (Title 49, Volume 5, Subpart N, Section 571.106 of the Code of Federal Regulations.)

All lines are made on dedicated, DOT-compliant brake equipment. Our material and equipment supplier submitted stainless lines assembled using the same process used to make Exact-Fit hoses to an independent lab for rigorous testing.

Test samples complied with the following DOT test categories:

- Construction
- Constriction
- Labeling
- Volumetric Expansion
- Burst Strength
- Whip Resistance
- Tensile Strength
- Low Temperature Resistance
- End Fitting Corrosion Resistance
- Ozone Resistance
- Brake Fluid Compatibility
- Hot Impulse
- Dynamic Ozone Resistance

Exact-Fit hoses use a two-piece fitting design. An aluminum crimp collar is slid over the hose end. Collar and hose are inserted into a zinc-coated, corrosion resistant fitting, then crimped by a shaped set of dies that compresses the fitting and collar tightly around the hose. The fitting collar changes shape when crimped to create multiple compression bands for added strength.



As a final quality control step, each Exact-Fit line is tested in-house at ECS Tuning to 3000 psi (21,000 kPa), a pressure greater than what it will normally experience in a vehicle braking system.

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Exact-Fit Means What It Says

Exact-Fit hoses get their name from their tailored fit. Cut to the exact length specified for each make and model, they require no further modification to ensure an original equipment fit. That includes Exact-Fit hose ends, threaded or banjo style, with copper sealing washers supplied for applications that need them.

Hoses that require stand-off support brackets are pre-fitted with transparent polymer sleeves and grommets for secure mounting.

Kits That Fit

ECS Tuning Exact-Fit hoses are available in axle sets for front or rear, or as complete vehicle kits.



This VW MKIV Exact-Fit rear brake line comes with support bracket, rubber grommet, and protective polymer tube.

Do You Need New Hoses?

While good looks are reason enough to install Exact-Fit Brake lines, the condition of your old hoses may already be a safety issue and a more compelling reason to upgrade. Careful inspection of existing hoses can reveal concrete evidence of impending hose failure. These steps will help identify potentially dangerous hoses.

- Look for cracks. Physically flex the brake hose. Hoses with a cracked outer rubber coating should be replaced, since breaks in the shield layer let water, abrasives, and harmful chemicals penetrate to the fabric mesh where they damage and weaken it.
- Look for leaks. Inspect the areas where the hose is crimped to the end fittings. Look for fluid leaks, and replace any hose that shows signs of dampness.
- Check for swelling. Have an assistant press the brake pedal as you inspect the hoses. This is especially important on vehicles that have a low, spongy brake pedal. Brake hose should never expand visibly or bloat. Replace any hose that does.
- Check the outer rubber for flaking. Run your hand over the outer rubber. Does a layer of black powder rub off onto your skin? If so, the rubber is already degraded, and probably brittle.
- Check for wear spots and abrasion. Replace hoses that show signs of chafing or abrasive wear. Replace missing or damaged support brackets that let the hose rub against the chassis, road wheels, or suspension components.

- Check your odometer. If your car has traveled 100,000 miles or more or is six years old or older, odds are the original brake hoses should be replaced as a preventive measure. Similarly, if one hose has already failed, it's wise to replace all remaining hoses, since they are also nearing the end of their service life.

Prevent Hose Damage

Repair professionals observe accepted practices carefully when performing any brake maintenance or repair. Here are a few important tips about brake hoses to add to your list:

- Never let the weight of a brake caliper hang by the brake hose. Always use a caliper hanger or bungee cord to support the caliper weight.
- Never use heat to separate corroded brake fittings. Heat from a torch will damage the hose and cause the brake fluid inside it to boil violently, sometimes causing the hose to separate from an end fitting, or even explode.
- Never reuse sealing washers. Whenever a brake line banjo fitting is installed, use fresh sealing washers of the correct size. Never reuse an old washer.
- Inspect lines on lowered cars while they are sitting at ride height. Lowering a car affects suspension geometry and component spacing. Hoses that were the correct length at factory ride height may be too long on a lowered car, allowing them to chafe against the chassis, steering links, or wheel and tire.
- Check for hose twist. When installing a caliper, do not twist the hose 360 degrees out of position. This is a common error that occurs when the caliper is removed during pad replacement. When it is reinstalled, the caliper is twisted one complete turn, placing constant stress on the hose, causing it to fail prematurely.
- Check hose length. The wrong length hose is always a problem. Too short, and the hose will be pulled and stressed at full suspension drop or when steering. If the hose is too long, it will chafe or get pinched between suspension arms and links.
- Make sure the inner hose is not blocked. If the brakes at a single wheel are always applied, the hose may be the problem. A material defect has allowed a small flap of rubber on the inner hose wall to act as a one-way valve. Open the brake bleeder and test again. If the road wheel turns freely now, the hose is trapping fluid pressure inside the caliper, and must be replaced.

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- Flush the system. Often overlooked, flushing and refilling the brake system with fresh fluid from a factory sealed container should be part of any major brake system service. Fluid is hygroscopic and absorbs moisture that affects fluid performance during braking. Water in the system can freeze, and boils at lower temperatures than brake fluid. It also contributes to internal corrosion and component failure.

Conclusion

ECS Tuning Exact-Fit Brake lines are a quality upgrade from stock brake hoses. Made from premium materials to exacting standards, they can be expected to deliver long and trouble-free service, whether they are installed for their looks, or as a service upgrade for stock hoses.

This White Paper is provided as a courtesy by ECS Tuning.

Proper service and repair procedures are vital to the safe, reliable operation of all motor vehicles as well as the personal safety of those performing the repairs. Standard safety procedures and precautions (including use of safety goggles and proper tools and equipment) should be followed at all times to eliminate the possibility of personal injury or improper service which could damage the vehicle or compromise its safety.

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