

# PLUMBING BASICS - SOLVING THE PLUMBING PUZZLE

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Automotive Plumbing is like a jigsaw puzzle, lots of bits and pieces all looking much the same and no real guide as to where they go.

The Earl's® catalog shows you the bits and pieces. The following notes will help novice plumbers to sort out which ones to use and hopefully provide a start to developing skills which will make more advanced plumbing a lot easier when you come to it.

## CATALOG TECHNICAL SECTION

Firstly, please note that the Earl's® catalog contains a technical section with details of what is meant by AN, NPT and various other esoteric names and numbers used in plumbing, plus outline drawings of common thread sizes. It also has instructions on assembling the various types of hose end to the hose. We recommend that you have a look at this before doing anything. You will refer back to it frequently!

## TOOLS YOU WILL NEED

Basic plumbing requires:

- **Vice with soft jaws** to avoid marking aluminum fittings - available from Earl's® (P/N 004ERL and 005ERL)
- **Fine bladed hacksaw, angle grinder or chop saw** - for cutting hose.
- **Set of wrenches.** **NOTE:** Aluminum wrenches which reduce marking of aluminum adapters and hose ends are available from Earl's.
- **Ruler** - or preferably Vernier gauge - for measuring hose and barb fitting diameters.
- **Tape measure**- minimum extended length 10ft (3m) for measuring hose and hose run lengths.
- **Length of string or thin wire** - to assist in measuring lengths of existing or planned hoses.
- **Screwdrivers** - flat blade type.
- **Good straight Tin Snips** - recommended for cutting and trimming TUBE-BRAID™ sleeves.
- **Duct Tape or similar to wrap hose** - prior to cutting. (ALWAYS wrap to prevent fraying).
- **Earl's® Assembly lube (P/N 18404ERL), Sewing machine oil or clean engine oil** - used on hose end threads before assembling ends to hose.

If you intend to assemble Speed-Flex™ brake lines in sizes 3 or 4 with reusable Speed-Seal™ hose ends you will need a Earl's® braid spreader (P/N 007ERL) and a utility knife.

## THE MOST IMPORTANT BASIC CONCEPTS

1. **Hose diameter.** The inside diameter of an original hose is most important - it is this which determines what sizes of stainless braided Hose you will use to replace it. The outer diameter is only of use when determining which size of Earl's® Tube-Braid™ Sleeve or Flame Guard or Econ-O-fit to apply if covering the old hose rather than replacing it.

2. **Hose sizes.** You will find each type in the Earl's® catalog has a size number - 4,5,6 etc. Nearly all the hose ends and adapters also have a size number. For each size, there is a whole family of parts whose part number usually ends in the size number to go with the size of hose. A hose end of 6 will fit the hose size 6.

**For example:** Auto-Flex™ hose 300006ERL works with Auto-Fit™ hose ends 300106ERL, 309106ERL, etc. and adapters 981666ERL, 982206ERL, etc. And such parts as in-line filter 230106ERL. Get the idea?

3. **Thread sizes.** The Earl's® catalog provides outlines of the most common NPT and AN threads. If in complete doubt, a thread gauge may be useful to you. Metric threaded adapters to convert from metric holes to AN hose end threads are shown in the Earl's® catalog as well.

## 4. NOW TO BUSINESS...

### SIMPLE STREET MACHINE PLUMBING

#### -REPLACING WHAT IS ALREADY THERE

You will be looking most often at the following product types: Auto-Flex™ hose, Tube-Braid™ stainless steel sleeving, Econ-O-Fit™ hose ends, Auto-Fit™ hose ends, fuel line kits, pipe thread to AN adapters and carburetor/power steering/fuel pump adapters.

1. **Radiator hoses.** Due to their often complex curvature and wide range of sizes pre-braided Auto-Flex™ or Perform-O-Flex™ hose usually cannot be used. Instead we recommend the use of Earl's® Tube-Braid™ sleeve or Form-A-Flex™ radiator hose.

#### SELECTION AND INSTALLATION NOTES FOR TUBE-BRAID™ SLEEVE:

A. In the size ranges up to 1 inch (25.4mm) it will be necessary to use up to 70% longer Tube-Braid™ sleeve than the length of hose to be covered if the outside diameter of the hose to be covered is close to the maximum ID of the Tube-Braid™. Consider using the next size up - it may be easier to fit and more economical as you may actually need less length than the hose to be covered.

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B. It may not be possible to work Tube-Braid™ over hose OD is close to the maximum ID size of the selected sleeve if there are sharp bends in the hose, and use of the next size up Tube-Braid™ may be necessary.

C. Cut stainless Tube-Braid™ with good tin snips we recommend Wiss type.

D. Work the sleeve along the hose being covered. Once arrived at the end, tape it tight. Pull it back along the hose to make a snug fit and tape the other end. Trim the ends with tin snips before fitting the appropriate size of Econ-O-Fit™ hose ends - ones that are a neat fit over your hose plus the sleeve and any tape you used.

**IMPORTANT NOTE 1:** Whenever using Tube-Braid™ we suggest most strongly that as it makes visual inspection of the hose underneath impossible. You will need to apply it to a NEW original equipment hose to ensure as long and trouble-free hose life as possible.

**IMPORTANT NOTE 2:** Each size of Tube-Braid™ sleeve covers a range of hose diameters. If your hose diameter is near the top of the Tube-Braid™ size range, you are likely to need MORE length of sleeve than the actual length of the hose you are intending to cover. So, make allowances when ordering!

2. **Heater hoses.** These may be covered with Tube-Braid™ sleeve, but should preferably be replaced with Auto-Flex™ hose as over a long length its regular covering looks much better! And the whole hose is covered by Earl's® Lifetime Guarantee! Usually size 10 or 12 is suitable. Measure either the inside diameter of the hose you are replacing or the outside diameter of the barb that the old hose pushed over and this will tell you what size of hose to use. Size 12 hose (11/16") will clamp down OK onto 5/8" barbs. Fix in place with Econ-O-Fit™ hose ends of the correct size for the hose or for the old hose + sleeve + tape. Usually sizes 10 or 12 for proper braided hose, size 14 if you used Tube-Braid™ sleeves.

3. **Fuel lines.** Normally you will do these using size 5,6,7 or 8 Auto-Flex™ hose to replace the original hose, and appropriate Econ-O-Fit™ hose ends.

4. If you have replaced your carburetor with, lets say, a Holley® carburetor, and a Holley® regulator, you will need to look at going a little more complicated.

Adapters such as 981666ERL, 981668ERL, 982266ERL or 982268ERL will screw in the regulator. You can then use Auto-Fit™ hose ends of the same size as the hose you are going to use to join your hose to these adapters and to the regulator. Then maybe a fuel line kit for your particular Holley® carburetor and hose size will complete the deal.

5. **Other hoses.** There may be other hoses, breathers, overflows, etc. that you want to replace with Earl's® stainless braided hose and fittings. Just measure internal diameter and length and select the Auto-Flex™ hose and Econ-O-Fit™ hose ends to suit.

6. **Oil coolers.** If you want to fit an engine cooler to your vehicle, first work out where you want to put it and determine the space available. Select a cooler from Earl's® extensive range of Temp-A-Cure™ coolers. Then the right sandwich adapter to enable you to plumb the cooler to the engine. Generally use size 10 Auto-Flex™ hose with size 10 Auto-Fit™ hose ends or Swivel-Seal™ hose ends and pipe thread (usually 3/8 or 1/2 NPT) to AN-10 adapters for the sandwich adapter.

7. A table with suggested engine oil cooler sizes follows. Note that climatic conditions, degree of engine tune and modifications etc. may mean the suggested cooler is not to be the exact one you need - consult your dealer or Earl's® tech line **1-310-609-1602**.

Engine size	Cooler No.
1000-1500 cc	<b>41310ERL</b>
1501-2500 cc	<b>41610ERL</b>
2501-4000 cc	<b>41910ERL</b>
4001-5000 cc	<b>42510ERL</b>
5001-6000 cc	<b>43410ERL</b>

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## **MOST IMPORTANT OF ALL...**

Don't despair if you don't get it all, or don't get it all right the first time around. If your dealer is conveniently close, don't buy everything at once. Get a little at a time until you gain confidence. And if you bought something that doesn't fit, the dealer may, although he is under no obligation to do so, take it back in part exchange for what you really needed all along, as long as you haven't damaged or marked the part you didn't want!

## **BRAKE HOSES**

These days road-going vehicles in most countries have to have flexible brake hoses complying with various rules and regulations. So if your vehicle is street registered, we suggest you use Earl's Hyperfirm™ street legal hoses.

If your vehicle does not have to comply with such regulations, Earl's® huge range of reusable Speed-Seal™ hose needs for Speed-Flex™ hose will let you do pretty much anything. For adapters to suit most brake system components, check out steel brake hydraulic adapters. We strongly suggest you use sizes 2 or 3 Speed-Flex™ for brakes and size 4 Speed-Flex™ for clutch hoses.

**ONLY use Earl's® Speed-Flex™ hose for brakes and clutches.** Other types of Earl's® hose are totally unsuited to the brake and clutch application and may cause accidents leading to injury or death.

## **RACE CAR AND SPEED BOAT PLUMBING**

Mechanics plumbing high performance competition vehicles and boats will usually have considerable experience in the use of stainless braided and other hoses, so here are only a few general notes too follow.

1. **Hose to use.** We suggest Earl's® Perform-O-Flex™ hose to provide the ultimate in reliability for almost all your needs.. If the chemicals in some modern fuels and lubricants cause a problem, sometimes shown by a smell of petrol, consider using Teflon® lined Speed-flex™ hose. Where ease of use, reduced weight and low pressure are a consideration, Earl's® Super Stock™ & Pro-Lite 350™ hose may be suitable.

2. **Hose ends to use.** With Perform-O-Flex™ hose use Swivel-Seal™ or Auto-Fit™ hose ends. Super Stock™ hose ends should be used with Super Stock™ hose. Speed-Seal™ hose ends must be used with Speed-Flex™ hose. Pro-Lite 350™ hoses uses Swivel-Seal™ or Auto-crimp™ hose ends.

3. **Adapters to use.** The Earl's® catalog list a range of adapters suited to all Earl's® hose ends. Where lack of space make life awkward, consider using the special Swivel-Seal™ hose ends which have adapters built into them. Dry sump pumps and similar pumps usually work best with Earl's® Port adapters in them. Note that when using NPT pipe thread adapters you should apply Teflon® tape, Loctite 567 or similar products to the tapered threads before wrenching them up.

## **HARLEY-DAVIDSON® OIL AND FUEL HOSES**

Harley-Davidson® motorcycle oil hoses may be replaced with Earl's® Auto-Flex™ size 7 (3/8") hose, with Earl's® Econ-O-Fit™ hose end size 7 - usually chrome P/N 900307ERL.

Fuel hoses are usually 1/4" or 5-16" internal diameter and are replaced with Auto-Flex™ hose sizes 5 or 6 and Econ-O-Fit™ hose ends size 5 or 6.

Some Harley-Davidson® oil line adapters may be replaced by Earl's® adapter P/Ns 981662ERL (straight), 982362ERL (45 degree) or 982262ERL (90 degree) with size 6 Auto-fit™ hose ends and size 6 Auto-Flex™ hose.

*So there you have it. Easy.....*



# ENGINE INSTALLATION



## INSTALLATION

While Earl's hose and hose ends make a pretty fool-proof combination, there are a few general rules to follow to make sure that you end up with a sanitary and trouble-free installation:

1. Make sure that there is adequate clearance between the hose ends and anything that they might be able to contact. While the hose is flexible, the hose ends are not!
2. Do not allow the hose to contact a sharp corner, nut, bolt, rivet stem or anything else that might cause damage. At any point where a hose passes through a panel, install a grommet for chafe protection.
3. Do not allow the hose to rub against anything—even if the surface on which it rubs is flat. The stainless steel braid is a very efficient low speed file and will abrade through anything that it moves against. In order to prevent chafing and to keep your hoses where you meant for them to be support the hoses every 18" or so with either a cushion clamp or a ti-wrap.
4. Do not force the hose into too tight a bend. Follow the minimum bend radius chart. Do not kink the hose, either by too tight a bend, by misalignment between the hose end and the part or adapter on short assemblies or by getting the whole assembly into a helix on long assemblies. Align the hose end with the adapters so that the hose is not placing strain on the hose end or on the adapter. The SWIVEL-SEAL design reduces these problems, but only care in installation will eliminate them. We manufacture enough hose end and adapter configurations to allow a sanitary and sound solution to just about any installation problem.
5. Keep the hoses as far away from extreme heat sources (like turbochargers and exhaust systems) as possible. If you must run close to such things, use an air gap insulating panel and/or fire resistant Flame Guard sheathing. Do not run fuel lines in proximity to hot fluid lines (or hot anything else) or you will end up with either hot fuel and low power or vapor lock. Do not run hot fluid lines near cool fluid lines or near to the driver.
6. Do not over-tighten the hose ends onto the adapter fittings or parts. The seal is achieved by the design of the mating surfaces—not by muscle. It helps a lot to use the wrenches made for the job.

## MAINTENANCE

Virtually no maintenance is required. Basically, maintaining Earl's high performance plumbing hose ends is a question of preventing abuse.

1. Inspect the plumbing installation frequently for signs of chafing, abrasion, kinking, crushing or seepage.
2. Take care not to crush, stretch, kink or otherwise damage the hose assemblies when changing engines etc.
3. Keep both hoses and fittings CLEAN.
  - (a) Before removing any hose end from its adapter or port, wash the assembly down with solvent—or even gasoline—and blow it clean and dry so that no grit can find its way into the threads or the sealing surfaces.
  - (b) As soon as the hose end has been removed, install a CLEAN protective plug into the hose end and a CLEAN cap onto the adapter. This will keep dirt out of the lines and the fittings and will keep the fluid off the floor, the machine and the mechanic.
  - (c) Always inspect both hose ends and adapters for dirt before reassembly.
  - (d) Correctly assembled Earl's hose ends will not leak if they, and the adapters are undamaged, clean and properly tightened. The only way to be certain that every hose end is properly tightened is to form the habit of NEVER leaving the adapter, a hose end (or anything else) loose, finger tight or partially tightened. Even when you know that you are going to take the thing right off again, correctly tighten it—every time.

## LEAKS

If it leaks, it has probably been assembled incorrectly or the sealing surfaces on the adapter and the nipple have been damaged—or just possibly someone has attempted to assemble an AN 37° seat hose end into a 45° SAE cone. Damage to the cone or the seat can be caused by a multitude of sins—dirt and over-tightening being the most common.

## RE-USE

All of Earl's removable hose ends are completely reusable as is the hose and as are most of the competing brands. As usual, Earl's have an edge. When disassembling a nipple and cutter type hose end, it is very common for the inner tube of the liner, which is captured between the nipple and cutter, to be torn off and to remain in place. If this happens, the rubber must be removed before the hose end can be reused—and it is a bear to get out. With SWIVEL-SEAL the chances of this happening are greatly diminished because the cutter can rotate with respect to the nipple so that the rubber is faced with only one moving surface. The procedure is as follows: Place the socket in a vise, and with a wrench on the nipple and another on the cutter, hold the nipple and turn the cutter until the socket is disengaged. Then pull the hose off the nipple. All parts of the SWIVEL-SEAL are ready for reuse as soon as they have been cleaned and relubricated.