

BUILDING A REPLACEMENT MUFFLER

MUFFLER FABRICATION

As an owner of a BMW 600, most people have already run into the fact that years of neglect have taken their toll on the exhaust system. If your muffler is not completely rusted away, it will be soon. There are a couple of options. The first is to purchase a unit that is design for the BMW 700 or later BMW 600 models that came with an air preheat system. This muffler looks very close to the original. Their one drawback is they lack the 12mm connections for the intake manifold pre-heat tubes. If you are interested in keeping your car as close as possible to original, live in a very warm climate and have about \$375.00 (2004 prices) to spare, this is a reasonably good solution. On the other hand, if your car was not equipped with the air pre-heat system or you don't have \$375.00 extra dollars to spend on a muffler, you can install a stock muffler and pre-heat system on your car for a much smaller price tag.

I used a stock muffler with body measurements of 12" x 8" x 3-1/2". The inlet and outlet pipes should be located in opposite sides of the muffler and 1- 1/2" OD. The flange you need will probably not be found at most muffler shops. You will either have to make your own flange, or if you have access to some old VW exhaust system, you can steal one from there. The exhaust flange that bolts to the head of a 1600cc VW engine from the 1968 – 1972 models works perfectly. The gaskets for these same cars are also a perfect match for this application. Next you will need a tail pipe from a type III Volkswagen (Fastback or Squareback model) from 1968 through 1972. The VW part number is 311.251.185. The last time I purchased one if these tail pipes was in the early 1980's at a cost of \$2.50. Today I found one on the internet for about \$12.00.

This document will give you some basic information on how to construct the muffler and manifold pre-heater tubes. The actual fit of the preheater tubes to the muffler is a "field fit" and is best accomplished when the engine is out of the car. This is not to say it can't be done with the engine installed, but it is much easier to accomplish with the engine removed.



The above picture shows the muffler with inlet and outlet ports at opposite sides of the muffler. This picture was taken after the muffler had been modified with a curved inlet and a reducer installed on the outlet. Also, on the bottom left of the muffler a mounting bracket has been attached.



The Type III (Fastback or Squareback) VW tail pipe used in the late 60's to early 70's works well as pre-fabricated parts for making the tight bend and reducer pipe for the transitions pieces. If you cut the pipe in the places shown by the black lines you can use the curve piece and the reducer to lessen the work required to fit your stock muffler to your 600. Again, the VW part number for this item is 311.251.185.

BUILDING A REPLACEMENT MUFFLER



Cut the VW tail pipe at the two black lines. The “2” section will form the tight bend between the exhaust pipe on the engine and the muffler. The end closest to the “1” section will be inserted into the muffler inlet pipe.



Once you have cut the VW tail pipe, you will now need to slot the inlet pipe of the muffler. Taking a hack-saw and cut two slits vertically in the inlet pipe. This should be done in such a way that you can peel the part in the lower section of the photograph downwards. This will also allow the upper section to be formed around the upper part of the tail pipe. When complete the center of the tail pipe should be 3 1/2” from the edge of the muffler. Weld or braze the pipe in position and fill any gaps with weld material.



Using the section of the tail pipe marked “1”, remove the mounting flange with a side grinder or chisel. Cut one or more additional slits in the larger end of the tail pipe piece similar to the factor slit. This will allow you to close the gap between the tail pipe and the muffler outlet pipe. Weld up the connection.

BUILDING A REPLACEMENT MUFFLER

Bill Rogers

www.isettaofsc.homestead.com



Fabricate and install a hanger for the rear of the muffler. This is done best by aligning the muffler to the engine to make the final decision on its exact location and length. In general, the bracket should be about 1" wide and a total length of approximately 3 1/2". One inch of the bracket should be bent at 90 degrees to provide a surface to attach the bracket to the muffler.

On the picture shown to the left, the bolt is 2 1/8" above the surface of the muffler, 1 1/8" back from the edge and 2 1/2" in from the right edge (as shown in the photo). Yours may differ and should be determined by positioning the muffler under the engine.



The picture to the left shows the muffler blocked up under the engine for measuring the distance of the rear hanger.



This photograph shows the hanger after being installed. Make sure that you have sufficient clearance between the muffler / tail pipe and the paper heater tube that connects from the air duct opening shown just behind the hanger to the exhaust heat exchanger. In my engine, the muffler slants slightly downwards in the rear of the engine for proper clearance.

BUILDING A REPLACEMENT MUFFLER



After the rear hanger has been installed, it is time to install the front flange on the inlet pipe. Using a fabricated flange or one taken from an old VW exhaust system, install the flange on the pipe and bolt it to the engine outlet pipe. Once everything is aligned, tack-weld the flange to the pipe and then complete the welding on the bench.



Using a 1 3/8" tail pipe (or the remaining section of the VW tail pipe) weld an extension onto the outlet of the muffler. The overall length of the outlet pipe should be approximately 8".

MUFFLER TUBES FABRICATION

The original pre-heater tubes were made from 12mm OD steel tubing. While you can use steel 1/2" OD tubing to replace these, I have found that using 1/2" OD copper tubing and fittings is much easier. In either case, the material used should be 1/2" outside diameter.

You will need about 4 feet of tubing (more if you make a mistake) and five 90 degree elbows. A tubing flaring tool, tubing cutter and tubing bender are also required. Most people who have ever had to repair copper water piping in their home will have a tubing cutter in their tool box. The flaring tool and tubing bender may be items that you have to purchase. I had the flaring tool, but purchased a tubing bender at a discount tool store for about \$12.00.

BUILDING A REPLACEMENT MUFFLER

Bill Rogers

www.isettaofsc.homestead.com



On the outlet side of the muffler, measure the distance from the edge of the muffler to the middle of the outlet pipe.



Repeat this measurement for the other direction (vertical and horizontal).



Transpose these measurements to the opposite side of the muffler. The “cross” should be in line with the outlet pipe but on the opposite end of the muffler.

BUILDING A REPLACEMENT MUFFLER



At this location, drill a ½” diameter hole.



Cut a 13” long piece of ½” OD tubing. Clean each end and insert the tubing into the hole drilled in the previous step. The tubing should be inserted until only about 1” of the pipe is exposed at the insertion end.

I inserted a screwdriver in the outlet pipe to brace the copper tubing up so that it was centered in the muffler and then brazed the pipe in position at the insertion point.

By having this pipe extended almost to the outlet pipe of the muffler, the back pressure on this pipe will be at a minimum. This will allow for enough differential pressure between the supply and outlet of this system to push exhaust gasses through the intake manifold.



This is a close-up of the brazing of the tube inserted in the muffler (hope you do a better job than I did on brazing this connection!!).

The 90 degree elbow should be installed with the outlet pointing slightly upwards and towards the inlet pipe of the muffler. The copper to copper joints may be soldered instead of brazed if you desire.

BUILDING A REPLACEMENT MUFFLER



Drill a 1/2" hole in the tight radius elbow that was installed on the inlet pipe of the muffler. This hole should be drilled in such a manner as to allow a nipple to be installed from the flange-end of the muffler pipe.



Cut a 2-1/2" long piece of 1/2" copper tubing and flare one end.



Insert the nipple into the hole drilled into the elbow from the flange end with the flared end exposed to the exhaust gasses that will be flowing in the pipe. Braze the copper tubing at the connection between the steel elbow and the copper tubing.

The flared end of the tubing should remain within about 1/4" of the muffler flange.

BUILDING A REPLACEMENT MUFFLER



Now fabricate the 2 sets of pipes as shown in the photo to the left. The two 90 degree elbows shown in the far left should be positioned just below the opening in the cooling shroud. The joints for these pipes may be soldered instead of brazed if you so desire. The upper joints for the two elbows shown in the far left should not be soldered or brazed – they should be left as a slip fit on the two tubes coming down from the manifold.



This is a close-up photo of the two elbows in the far left of the picture above. Note that the upper connections are not soldered or brazed – they are to be a slip fit. This will allow the muffler to be removed and re-installed without having to solder the connections.



The completed muffler should be cleaned and made ready for paint.



Paint the muffler with a heat resistance paint to match the original design and camouflage the fact that it is not an original!

BUILDING A REPLACEMENT MUFFLER

Bill Rogers

www.isettaofsc.homestead.com

MANIFOLD TUBING

The two tubes that run from the front of the intake manifold to the exhaust system were originally made from 12mm OD steel tubing. Most of the cars you find have had these tubes removed or they are rusted very badly. You will need the two tubing nuts and hopefully those are still with your manifold. Take special care in removing these nuts as it is very easy to break the aluminum housing they are screwed into. Use plenty of penetrating oil and some heat. Work the nuts back and forth until they break free. A lot of oil, some heat and much patience will free up these nuts without damaging either the housing or the nuts. Once you manage to free up the nuts, the housings should be thoroughly cleaned. You will also find a seal ring in the housing at the base of the threads. These sealing rings should be removed and can be discarded since you will be installing copper pipes which will be self sealing.

The tubes are made from the same material that was used on the muffler. Cut a length of tubing 15" long and flare one end.



Place about 1/8" of material beyond the flaring clamp and flare the end. After the end has been flared, use a small hammer to flatten the flared end against the clamp.



The flatten end of the tube must fit freely into the housing. Check the fit and using a grinder, remove the amount of material necessary from the end of the tube to allow for proper fit.

BUILDING A REPLACEMENT MUFFLER

Bill Rogers

www.isettaofsc.homestead.com



Grind the edge of the flared and flattened tube to allow it to fit freely into the housing.

Each tube is bent slightly differently. If you have the old tubes to go by, then you should use them as a pattern. If you don't have a set of old tubes, use the information below and verify your fit at each step in the process. I have designated the tubes as follows - Upper Front and Lower Rear. This refers to their respective location as they attach to the intake manifold. The upper front is connected to the upper location and towards the front of the car. The lower rear is naturally in the lower position of the manifold and towards the rear of the car. I recommend fabricating the lower rear tube first.

I found that when bending the tubing it is very helpful if you apply some oil (like WD-40) to both the tubing and the bender shoes. Also, do not attempt to bend the tubing in one continuous movement, bend the tubing slowly with short strokes.

LOWER REAR TUBE

After you have cut your tube, flared and fitted it to the manifold you are ready to bend the tube. You will need a tubing bender designed for 1/2" tubing.



Measure in 1- 7/8" from the flared end; this point should be at the 0 degree mark on your bender. Bend the tubing slowly in short strokes until the end is at a 50 degree angle from the centerline of the flared end.

BUILDING A REPLACEMENT MUFFLER

Bill Rogers

www.isettaofsc.homestead.com



The next bend is made at an 80 degree angle to the first. Note the position of the flared end in the bender. It is mounted so that it is angled at 10 degree from vertical.



The tube is also mounted so that the center of the previous bend is 4-1/2" from the new bend. The tube should now be bent to a 50 degree angle.



Now slide the tubing nut over the bends and install the tube in the lower rear position. Check the distance to the 90 degree fitting on the muffler pipes (not shown in this picture) and cut off the excess tubing so that it will fit into the muffler's fittings.

BUILDING A REPLACEMENT MUFFLER

Bill Rogers

www.isettaofsc.homestead.com

The process is repeated for the upper front tube with the measurements shown in the next pictures and paragraphs.



Measure in 1- 3/4" from the flared end; this point should be at the 0 degree mark on your bender. Bend the tubing slowly in short strokes until the end is at a 50 degree angle.



The next bend is made at an 80 degree angle to the first. Note the position of the flared end in the bender. It is mounted so that it is angled at 10 degree from vertical.



The tube is also mounted so that the center of the previous bend is 4-3/4" from the new bend. The tube should again be bent to a 50 degree angle.

BUILDING A REPLACEMENT MUFFLER

Bill Rogers

www.isettaofsc.homestead.com



Again, slide the tubing nut over the bends and install the tube in the upper front position. Check the distance to the 90 degree fitting on the muffler pipes (not shown in this picture) and cut off the excess tubing so that it will fit into the muffler's fittings.



When complete you will now have a system which will provide pre-heat to the manifold. The exhaust gasses are supplied by the higher pressure located in the exhaust pipe entering into the muffler. The gasses will pass through the manifold and will exit at the lower pressure pipe located near the outlet of the muffler.

The tubes and the muffler should be painted with a heat resistant black paint to match the original.