

## Super Insulating and Cooling My 1963 BJ7

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### Research and Results

I did a few tests. I taped a thermometer to the driver side windshield wiper arm and placed two additional thermometers in the driver's foot well. One thermometer was resting on the trans tunnel with the tip near the gas pedal. The second one was taped to the underside of the steering wheel column, near the pedals.

I drove for about an hour and a half and checked the readings. The car temp was 200 F. The thermometer on the windshield read 90E F, the thermometer on the steering column read 110 F and the trans read 115 F! About 45 minutes later, the car temp showed 205 F, the windshield read 92 F, the steering column read 120 F and the trans read 125 F. Now you understand why you feel so hot in the car. Do your own temperature tests to get a base line.

I purchased a roll of the insulation and did a couple of tests. I took a coffee can and punched a hole in the plastic top, inserting a thermometer through the hole. The tip was suspended away from the sides of the can. With the car fully warmed up, I placed the coffee can on the intake manifold and closed the hood. After 20 minutes, I opened the hood and checked the temperature. The reading was 145 F! This was an unscientific test for sure but I could get a base line. Next, I wrapped the foil insulation around the entire can. I reinserted the thermometer through the insulation and into the can. I placed the can back on the intake manifold, closed the hood and waited 20 minutes. Now the reading was 115 F, a 30 F reduction! I had hopes that I could get a 30 F drop in the interior temp.

After the insulation process, engine cooling and new fans, I drove the car for an hour to compare the temps. The temp gauge read 190 F, the windshield thermometer read 70 F, the transmission tunnel read 78 F - and the column read 77 F. I turned on the fresh air duct fan and drove for about 10 minutes. With the new 4" fresh air duct fan running, on high, the trans tunnel temp was 71 F and the steering column temp was 70 F. I would say the insulation was a success!

### Insulation Materials

I used an insulation product I purchased at Lowes. The product is a very fine bubble wrap looking material, faced on both sides with shiny foil. The manufacturer states a "R" value of 4 when used on metal duct work. The manufacturer states that the foil reflects 97% of all radiant heat, back to the source. I reasoned that the foil would reflect the heat and basically prevent it from entering the interior of the car (see **Research and Results**). The material is available in several sizes. Each roll is 24' in length and is available in 48" width (\$46.87), 24" width (\$24.87) and 16" width (\$16.85). The material is about 3/16" thick. I found it easier to use the 16" and the 24" width and I used about 4 rolls of the 16" and 2 rolls of the 24".

I purchased a roll of aluminum foil tape to seal all of the seams. Do not use "duct tape" over time it will deteriorate and come apart. I purchased 6 cans of the 3M spray adhesive at \$9.99 per can. There is a "Super" adhesive for \$12.99 a can. I tried it and the other works just as well, in my opinion. I purchased a tube of black rubberized caulk. It is flexible and paintable.

I found a closed cell foam mat that is used as insulation, under a sleeping bag, at Wal-Mart, in the sporting goods section. The mat is 1/2" thick and is a very dense blue foam. I purchased 2 mats, about 24" wide and 78" long, about \$6.99 or \$9.99 per roll.

I ordered a complete set of firewall grommets. I discovered I had a slight header to down pipe leak, more heat into the engine compartment, so, new exhaust gaskets. I ordered an additional piece of heat shielding for under the driver's seat. Finally, a carpet set and an interior panel set.

### Hot Air Blocking

I found everything easier to reach when I put the car up on 4 jack stands. Start by completely stripping out the interior. That means everything must go, carpet, all panels, heater box, seats, seat runners, wooden spacers, trans tunnel, parcel shelf, thresholds, trim, everything! I removed the top and the bows as well. I removed the tar paper and discarded it. There is a thicker tar paper like material on the firewall where all the wires pass thru the bulkhead. Remove these 2 pieces very carefully and save them as patterns. Remove the muffler and heat shield and remove the seat rails and shims.

Remove each grommet on the firewall, one at a time, and replace it with a new one. Some are replaced from the engine side, others are easier to replace from the interior side. There is a grommet around the steering wheel column, as it passes thru the firewall. I chose not to pull the column to replace it so I caulked it with the black rubberized stuff.

I placed a drop light in the engine bay, turned off the lights in my garage and looked inside the car for light leaks. I found a lot! Either replace the grommets you missed or use the caulk. I placed the light inside the car and repeated the process from underneath and found more. I fashioned "booties" of foil insulation and placed the booties over the interior hood hinge pockets. Check the floor boards and foot well panels. Most of these panel seams are only spot welded in place, leaving the seams open. Either weld the seams or use seam filler or the rubberized caulk. Every hole, crack, seam, joint, etc must be sealed up. If not, heat leaks into the interior!

### **InsulatingProcess**

I started with the firewall. I used the 2 pieces of thicker tar like material I removed from the firewall as a pattern. I used the spray adhesive on both mating surfaces, per the directions, and glued 2 pieces of the foil insulation together. Place the tar firewall patterns on the foil insulation, draw around them with a marker, mark the holes and cut everything out with scissors or a sharp utility knife. Place a slit from a wire hole to the edge of the insulation to ease reinstallation. Paint the outward facing side of the insulation to match your interior bulkhead color. Spray the bulkhead with the adhesive and then the bulkhead side of the insulation. When the adhesive is almost dry, install the insulation.

I did the foot wells next. The foil insulation can be dry fitted, molded into position and marked. Remove the foil insulation, cut to your lines, refit and trim as necessary. You want to cover absolutely everything, all the way up to the cold air/heater box. Spray the adhesive on the sheet metal and the backside of the insulation and very carefully install the insulation. Thoroughly press the insulation into place. I found it easier to place the insulation, apply the adhesive to a small area and then press the insulation into the small areas progressively. If you make a placement error, very slowly pull back on the insulation and it will release. Respray and install correctly. Press and smooth the insulation thoroughly and firmly to get good adhesion and to fit it into every nook and cranny. Seal all seams with the sealing tape. Repeat the process and apply a second layer of the insulation, placing the seams in a different area. Do both sides of the car.

The firewall and the foot wells suffer from direct heat from the engine and must be dealt with thoroughly. Cover the pedal side area from the foot well to the face of the tunnel area and then across the face, right to the edge of the transmission flange! Use 2 layers, seal the seams, etc. Put the foil insulation as far up as the outlets for the heater box air holes. Paint the upper 3" - 4", all the way around to the foot wells to match your interior color.

Use the same process and cover the kick panels and the rear seating area.

The next area is the drive shaft tunnel. Remove the 4 carpet snaps and use 2, 1/8" pop rivet washers between the base of the snaps and the tunnel to build the snaps up from the surface. Apply just 1 layer of the foil insulation, not 2! Cut a 1" diameter hole, out of the insulation, around each snap.

Apply degreaser to the underside of the transmission tunnel, let it sit, respray it and then power washed it to remove everything! I found a couple of small holes in the fiberglass and I repaired them with gel coat. I reinforced the enlarged holes for the hold down screws with fiberglass mesh. I removed the 4 snaps from each side of the tunnel and used 2, 1/8" pop rivet washers, under the snaps, to build them up from the surface of the tunnel.

I applied 2 layers of the insulation to the transmission (bottom/underneath) side of the tunnel. Do not apply the insulation to the mating surfaces of the forward bell housing flange, the floor flanges or the recessed area where the transmission tunnel meets with the drive shaft tunnel. Insulate into the shifter tower area. Seal all of the seams with the tape and stagger the seams. Seal the edges of the insulation to the edges of the tunnel using the tape. I applied 1 layer of foil insulation to the interior side to the tunnel. Be through here and mold the insulation properly to the tunnel. This molding process will allow the seats, carpet and the handbrake to fit and work properly. Cut the insulation back, around the base of the shifter tower by 1" and cut a 1" diameter hole around each snap. Once the insulation is complete, install 3/4" wide, foam weather stripping to the underside of the floor flanges, the bell house flange and the drive shaft tunnel flange.

Be sure to paint anything that might be exposed after the carpet and interior panels have been installed. Be sure that you keep the blue camper pad below the carpet line. Repeat the same installation steps outlined above, and install just one layer of the camper pad. Start with the foot wells, cut, fit and glue the camper pad material. Do not use the tape to seal these joints. Apply the camper pad material to the full length of the drive shaft tunnel and cut 2" diameter holes around the snaps. Cover to the front edge of the tunnel and under the handbrake lever. Do not install the camper pad on either side of the transmission tunnel.

The drive shaft tunnel and the transmission tunnel are more challenging because of special fitting, cutting and the snaps. Place the transmission tunnel in the car and position it as close as possible to a normal position. The tunnel has moved back from the bell housing by 3/4" - 1" and sits higher by 3/4" - 1". It also does not sit properly on the drive shaft tunnel. The foil is 3/16" thick (2 layers), the camper pad is 1/2" thick and the foam weather stripping is about 1/8" thick when compressed. Everything will be off by about 1". Take the marker and mark around the trans tunnel flange at the bell housing. Remove the trans tunnel. Using a razor knife, very carefully cut about 1" inside (toward the transmission) the marker line, and remove all of the insulation down to the metal. Put the trans tunnel back in place. Gently lift up the edge of the bell housing insulation and allow the bell housing flange of the trans tunnel to move forward, touching metal, and compressing the weather stripping. Align the rear of the trans tunnel with the hold down screw holes. I used 2 awls in hold down holes to get it positioned properly. With the tunnel as far forward as normal, and the awls in place, use the marker to mark the outlines of the floor flanges and the drive shaft flange. Remove the tunnel. Using the razor knife, cut thru the three layers of insulation, on the floor boards, down to metal and remove the excess insulation. I left the one layer of foil on the drive shaft tunnel to the very front edge of the tunnel, removing only the excess camper pad. Now install the trans tunnel and it should fit perfectly. There should be a smooth surface transition between the two tunnels, otherwise adjust accordingly.

As you install the carpets you will see that the holes cut in the insulation around the snaps will provide only a very slight depression. Cutting back of the insulation around the shifter tower will allow the carpet to lay flat onto the tunnel, up to the shifter tower. Continue carpeting the rest of the interior.

From under the car, insert an awl in the rearmost seat slide hole and then in the forward most hole. Lay the original seat shim onto the awls and on the carpet. Very carefully, cut away the carpet and the insulation, under the seat shims, all the way to the floor boards. You will see that the thickness of the seat shim must be increased, over the standard thickness. You can make the rear of the shims 1 1/4" thick, cut them from oak and simply reinstall them. The seat slides will sit just above the carpet, providing room for proper seat movement. However, the seats will now be about 1 1/4" higher than normal! Or, you can make the rear of the shim, 1 1/4" thick and the front, 1 3/4" thick. This will give a tilt to the seat that may be of interest to some. If you do this, the seat slides will have to be opened up and longer bolts welded into the forward and middle seat slide holes.

I used 2 heat shields and 2 layers of foil insulation. I took the original, old heat shield and placed the foil insulation on both sides of it. I placed the new heat shield under the newly wrapped old shield, closest to the muffler. I bolted the heat shield sandwich back in place. I installed the muffler, making sure there were no leaks at the joints. The bubble part of the foil insulation might melt! You should always place the heat shield between the muffler and the foil insulation. Otherwise, this might be a fire hazard, and never place the camper pad in this area!

### Transmission Shroud

I had seen a transmission shroud and I decided to make my own.

Before I started the insulation process, I went to a Tractor Supply store. There I purchased a 3' x 3' sheet of fairly stiff tin. I took a large piece of cardboard, placed it on the garage floor with the bell housing end of the trans tunnel on it. I marked the cardboard, around the outside edge of the transmission flange with the felt marker. I cut out the curve of the flange, on the cardboard, about 2" bigger than the flange line. I rough cut a much smaller arch, inside the flange marker line, to estimate the diameter of the transmission itself. I slipped the cardboard into place from inside the car. I placed the cardboard pattern on the engine side of the bulkhead and adjusted the cardboard so that it overlapped the bulkhead opening by about 2" and scribed reference points on the cardboard for repeated fittings. I continued to trim and adjust the size of the smaller arch so that the cardboard cleared the transmission case, all around, by about 1". I covered all the way from the driver's floorboard, up over the top of the trans to the passengers' floorboard. I put the pattern on the sheet of tin and marked the outline. I cut out the shroud with tin snips and painted both sides to match my body color. I measured the size of the small arch above the transmission and bought an inner tube, at Tractor Supply, about \$8. The outside diameter of the tube was a couple of inches larger than the tin arch for the trans and the center of the tube (the hole) was a couple of inches smaller than the trans case itself. Laid flat, the tube looks like a donut and what I wanted was a tube size with the inside diameter of the tube (the donut hole) smaller than the trans case. I think this was a tube for a fairly large riding mower. I placed the inner tube on the cut tin to overlap the air baffle by a couple of inches where the tin meets the bulkhead and marked the tube. Basically, I cut a very small amount of the tube away. The piece I cut out looks something like a very wide piece of pie but blunt at the tip of the pie instead of a sharp point. The remainder of the tube is whole. I bolted the tube to the shroud using fender washers, in about five places. I put the tube and the bolt heads on the engine side of the shroud. Slip the shroud and tube into place, from the interior, as it is still quite flexible. Secure the shroud to the bulkhead by driving screws from the interior side of the bulkhead, into the shroud. To accomplish this, you may have to fashion wood wedges and place them between the rear of the block and the shroud while you install the screws. As you install the screws, start at one floorboard and work up over the top and then down the other side. As you install the screws, the shroud becomes quite stiff and the tube now stretches tightly around the transmission case, leaving about 2" actually on the trans case. Carefully reposition the overdrive wire so that it is held firmly in place by the inner tube. I reasoned that the shroud would block very

hot engine air from directly entering the trans tunnel. Hot air would be forced downward, under the car and mix with the cooler air flowing under the car. The air I feel now at the shifter tower is only slightly warm where before it was quite hot and the carpet on the tunnel itself is now quite cool.

### **Ventilation Fans, Heating and Defrosting**

At a NAPA store I found two duct fans. The first is 4" in diameter and the second is 3" in diameter. The fans are in the boating section and are called "Turbo In-Line Blower." The 4" (#4000) moves 125CFM and the 3" (#3000) moves 102CFM. The fans are white plastic and I painted them to match my body color and they disappear into the background of my bodywork.

At an auto wrecking yard, I bought two, used, auto heater fan switches for \$1. You must use this type of switch, if you want to regulate the speed of the fans. Otherwise, simply use an off/on switch. I installed the 4" fan in the fresh air duct work, in the engine bay, about midway between the 2 carbs. I wired the fan switches in and mounted them on a bent piece of aluminum, about 5" long by 3" wide. I placed the piece under the dash, behind and above the heater control so I could reach them easily. With the 4" fan running on high, I was amazed at how much air movement there was. I placed duct tape over the driver's well grill, forcing the outside air through the heater vents. This provides air movement as deep as possible in the foot well. The fresh air duct provides outside air, but outside hot air, at very high volume, is cooler than my 135 F readings!

I placed the 3" fan in the intake duct of my heater box. I intend to circulate the interior heated air during the winter. I will block off the original heater duct work during the winter. For the summer heat, I left the heater duct connected for more outside air. When I turned on the new 3" heater fan, I discovered the air passing thru the heater duct was hot. I pulled my heater and discovered the water valve was letting in hot water. I placed a piece of heater hose from the hot water valve, on the block, directly to the brass return line, bypassing the heater entirely. I was surprised at how hot the bypass hose got. I am going to leave the bypass hose in place until I want heat from the heater. I wanted to use the heater for additional outside air. I disassembled the heater, cleaned out the debris and replaced the water valve. I used strips of foam and caulked around the core to seal things off. This forces all of the incoming air thru the core if and when the heater is used. With the 3" duct fan installed, I expect the defrosters to work much better as well.

### **Engine Cooling**

I purchased and installed a Texas Kooler and front radiator air deflectors. I painted both the correct colors and installed them. I installed the correct thermostat and radiator cap as well as a coolant recovery tank. The car now runs cooler, at the proper temperature and never dribbles or overheats. The archives document these items and steps.

This insulation and installation process worked for me. I do not represent that it will work for you or that it should be attempted by you, or anyone else. If you choose to use this insulation and installation outline, or any part of it, you assume any and all risks involved. If you do not wish to accept these risks or do not have the skills necessary to perform this process in a workman like manner, please do not undertake this insulation and installation process. Anyone you may have perform the insulation and installation process for you must also accept any and all risks associated with the insulation and installation process.