

2002 HEATER BOX REFURBISHMENT

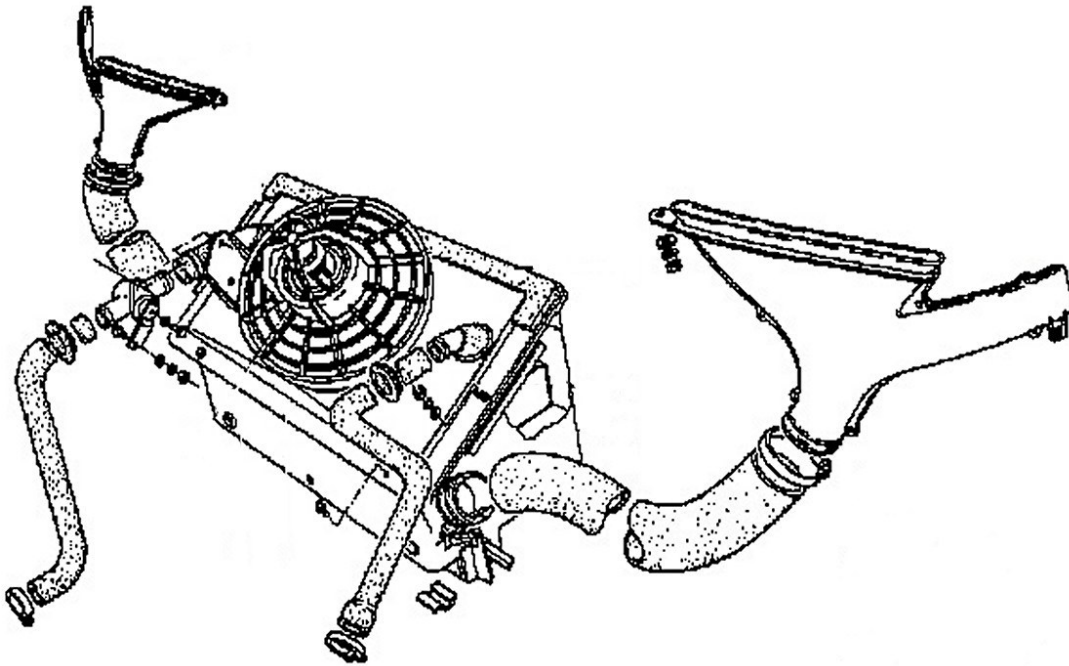


Figure 1: 02 heater system viewed from left front (driver's side) of car

A. INTRODUCTION

The task of refurbishing the 2002 heater box may be intimidating for the newbie, but is well within reach of almost anyone willing to put the effort into the job. Because this refurbishment procedure includes work with potentially dangerous materials, parts, and tools, many of which could cause personal injury to you or a helper, as a prereq to doing this job you should be familiar with basic car repair and use of tools and workshop equipment. If you have any doubt about the meaning of, or your ability to perform, any part of this procedure, please get help from someone more experienced, or have this work done by a qualified mechanic familiar with the 02s.

This article covers the procedure for refurbishing the newer (>1972 model year) 02 heater box. I have noted certain differences in the controls and boxes in the different model years, but this is not intended to be an exhaustive treatment of the subject- I may have missed a few of the differences in the earlier cars in this description.

B. HOW THE 02 HEATER BOX WORKS

1. **General.** The purpose of the heater box is to provide ventilation to the passenger compartment. The air can be heated and directed to the windshield and/or the passenger compartment footwells. [*Figure 1*](#) above shows an external view of the 02 heater box with the defroster air hoses/vents and coolant hoses. The footwell vents are at the lower corners of the back of the box (not shown above, but see [*Figure 11*](#) below for a good view of the vents).

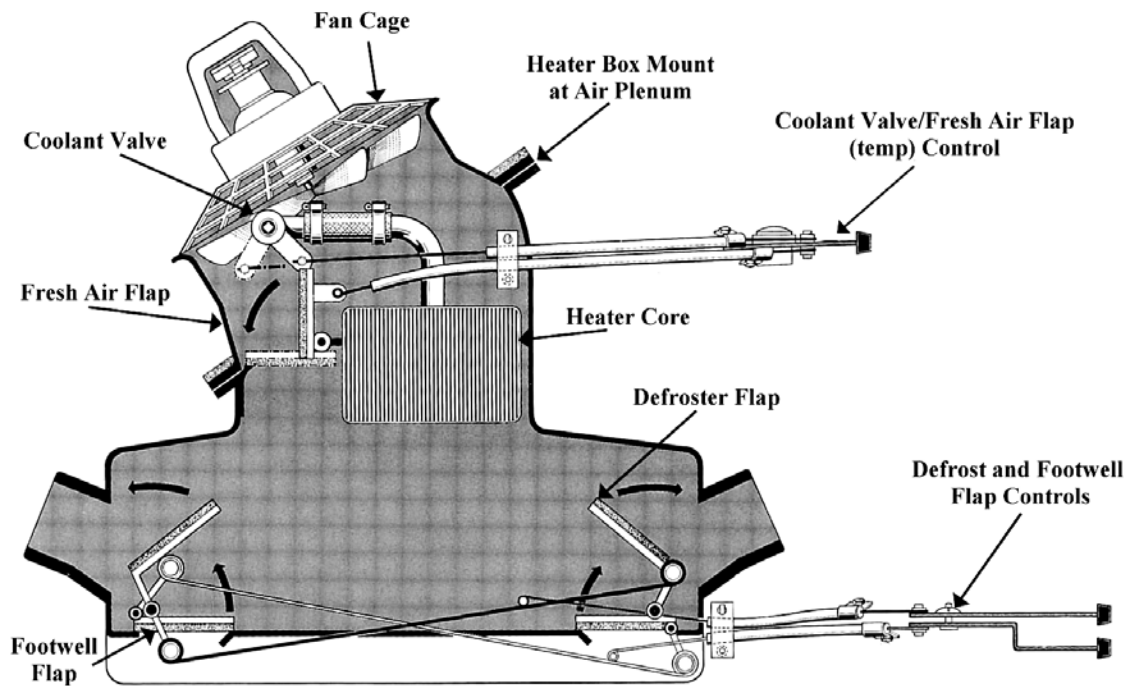


Figure 2: Illustration showing cutaway schematic of 02 heater box and major components

2. **Box and Air Plenum Description.** The heater box is roughly rectangular in shape and approximately 13" (330 mm) wide, 8" (203 mm) high, and 7" (178 mm) deep. The box is mounted from inside the car behind the console. The top of the box, including the fan cage and coolant hose hook-ups, protrudes into the air "plenum." This plenum is a chamber that runs the width of the car between the top of the firewall (back of the engine compartment) and the base of the windshield. There are slot-shaped openings across the rear of the hood over the plenum area. When the car is moving, air is forced through these slots into the plenum and into the heater box through the fan cage opening. The multi-speed fan (AKA, blower) at the top of the box may also be used to move air into the box when the car is not moving and/or the flow is otherwise insufficient for defrosting, heating or ventilation needs. Suffice to say, when the car isn't moving, very little air will enter the box unless the fan is on. See [Figure 2](#) above for an illustration of the box, and [Figure 3](#) below for photos of this area in the car.

Note: The plenum is intended to be sealed from the engine compartment, so that only fresh air from outside the car enters through the box. There are seals on the body at each side of the plenum, on the underside of the hood, and at three drain locations at the base of the plenum. Note that many 02s need maintenance on these seals. You should check the condition of your seals and replace if necessary. This is critical to keeping fumes out of the passenger compartment.

3. **Heater Core.** The heater box contains a heater "core," which is a mini-radiator through which engine coolant flows when the valve on top of the box is open. Thus, the core is the source of heat in the box-when the coolant is at operating temperature ($\sim 180^{\circ}\text{F}$) and the valve is in the open position (see description of controls in paragraph B(5) below), any air moving through the core is heated.
4. **Air Flow Through the Box.**
 - a. **Air Pathway.** Air enters the box through the fan cage at the top of the box and flows through the heater core and the fresh air bypass, and out of the box through the defroster and footwell openings (if the respective flaps are open- see flap description below). The air pathway through the core is always open; however, because of the small size of the air passages in the core, air moving through the core encounters more resistance than air moving through the fresh air bypass. (See [Figure 2](#) above for an illustration of the core and the fresh air flap.) This is why the heater controls cause the fresh air flap to open as the coolant valve is closed and vice versa- when the fresh air flap is closed, all air

moving through the box is forced through the core so that it may be heated (see description of controls in paragraph B(5) below).

- b. Flaps. Air flow through the box is controlled by three sets of flaps inside the box: (i) the “fresh air” flap is at the top of the box just under the fan, and when open provides a route for air moving through the box to partially bypass the heater core; (ii) the defrost flaps in the front (middle) chamber of the box control air moving out of the box into the defroster hoses to the vents at the top of the dashboard; and (iii) the footwell flaps control air movement out of the box to the footwells, on each side at the rear of the console under the dash.

- 5. **Heating and Ventilation Controls.** The coolant valve and flaps are controlled by levers on the right and left side of the steering wheel (see *Figure 8* below). The temp control lever on the right side operates two cables; one operates the coolant valve and the other the fresh air flap. When the heater temp control is in the “cold” position, the coolant valve is closed, preventing coolant from entering the core, and the fresh air flap is open, allowing air to bypass the core and move more freely through the box for ambient temp (unheated outside air) ventilation. Thus, the heater system can be used for ambient temp ventilation without heat, when the defrost and/or footwell controls are in the open position, and the temp control is in the closed (cold) position. The individual levers on the left side operate the defrost and footwell flaps, which can be opened and closed independently. The fan (blower) is controlled by a lever on the right side (newer cars) or a pull switch on the dash (earlier cars).



Figure 3: Heater hoses and valve locations

C. RECOMMENDED TOOLS AND MATERIALS

Materials

- BMW factory coolant (antifreeze)
- Caulking, for sealing heater box to sheet metal at body mounting point. I recommend 3M Strip Caulk
- Epoxy, JB Weld, part no. 8265-S
- Grease, synthetic rubber/plastic safe; I recommend Permatex Ultra Disc Brake Caliper Lube P/N: 24110
- Grommets, 6 ea. rubber, 7/16" outside diameter, 5/16" groove diameter, 3/16" bore, 1/32" groove width; note that grommets are available in different materials. Harder materials are better for this application [flap hardware pivot bushings]
- Grommet, 1 ea. rubber, 9/16" outside diameter, 7/16" groove diameter, 1/4" bore, 1/16" groove width, for heater valve cable where it exits box at valve]
- Foam, firm closed cell, self-adhesive, 1.25" x 3/16" [for flap seals]
- Foam, firm closed cell, self-adhesive, 1/4" x 3/8" [for heater core seal]
- POR-15, clear, 1/2 pint
- Rivets, 6 ea. aluminum, 3/16" diameter, 1/4" grip range (e.g., Stanley # PAA64) [for securing top of box to bottom sections]
- Solvent, 3M Adhesive Remover or equiv.
- Vinyl cleaner; Lexol Vinylex or equivalent rubber/vinyl cleaner/conditioner
- Washers, 6 ea. #10 brass (3/16" bore, 1/2" outside diameter) for use under rivets

Tools

- 7mm combination wrench or socket
- 8mm combination wrench or socket
- 10mm socket
- ¼" ratchet driver with 6" extension
- Battery filler bulb
- Drill bit (3/16" recommended) and drill motor
- Pliers, bent, needlenose, such as Stanley "84-008 - 7-7/8" Insulated Bent Long Nose Pliers"
- Pliers, standard, such as Stanley "84-000 - 6-1/2" Insulated Combination Pliers"
- Pliers, Vice Grip-style, such as the 6", bent-nose model Vice Grips "6BN"
- Rivet Gun (available from many sources, from \$10); I recommend the Stanley MR100CG- readily available, lower-midrange price (~\$25)
- Screwdriver, flat blade .5" blade width
- Screwdriver, Phillips, #2 size
- Safety glasses/goggles

D. REMOVAL OF HEATER BOX FROM CAR

1. **Safety first!** Disconnect your battery by removing the ground cable and securing it out of the way so it won't accidentally make contact with the negative terminal on your battery while you are performing this procedure.

2. **Drain coolant.** With the motor cold, open the coolant control valve (set the heater to the "warm" position inside the car) and drain a pint or so of coolant from your cooling system. You can do this by using a large syringe or battery filler bulb (available for a couple of bucks at your local auto parts store...). Alternately, you can remove the drain plug or lower hose from your radiator. If you do this, I suggest you let the coolant drain out completely out of the radiator. This is an excellent time to flush your cooling system- the procedure for which is outside of the scope of this article. If your coolant has recently been changed, you can save the coolant for re-use if you drain it into a clean container. If not, then collect and recycle or otherwise dispose of the coolant properly- if your system contains ethylene glycol antifreeze, the coolant is poisonous and particularly dangerous to pets or kids because of its sweet taste.
3. **Disconnect heater hoses.** Disconnect the coolant hoses that run from the motor through the firewall, to the heater core inside the air plenum (see [Figure 3](#) above for pictures of this area). You may want to put a cork or wadded-up paper towel into the heater core outlet to keep coolant from spilling when you remove the heater box from the car.

Note that the heater valve may be left in place and removed with the box. Simply disconnect the inlet hose where it attaches to the valve on the right side of the box. If you return the heater temp control to the "cold" position, you won't need to cork the inlet. Use care when removing the hose from the heater valve, because the plastic mounting bracket for the valve (part of the box top) tends to become very brittle with age. Note that this mounting is not strictly necessary- the short length of hose connecting the valve to the core is generally strong and stiff enough to keep the valve in position; alternately, you can either fabricate or buy (I believe 2002 Haus may have them...) a sheet metal support bracket that can be attached to the stub of the broken, original plastic mount.
4. **Remove under-dash panels.** Put on your safety glasses and remove the under-dash panels with your Phillips screwdriver. I recommend that you keep your hardware organized by putting the screws in a container like a coffee can or margarine tub. This will make reassembly infinitely easier when the time comes.



Figure 4: Under dash panels

5. **Take out the glove box.** Remove the three small (8mm head) bolts that attach the glove box hinge to the firewall. Note that the heater box can be removed without first removing the glove box, but you will have better visibility and clearance if you do so. You will be able to see these bolts if you lie in the passenger footwell with your head as far toward the front of the car as possible. Look up at the back of the glove box and you will see the hinge. You may have to move the right defrost vent hose slightly to have a clearer view. Access is somewhat difficult because the hinge is at the top of the rear part of the glove box, but a 1/4" socket driver with a 6" extension will do the job. After you remove the hinge bolts, support it at the back, open and drop it into the passenger footwell and remove it to a safe storage location.

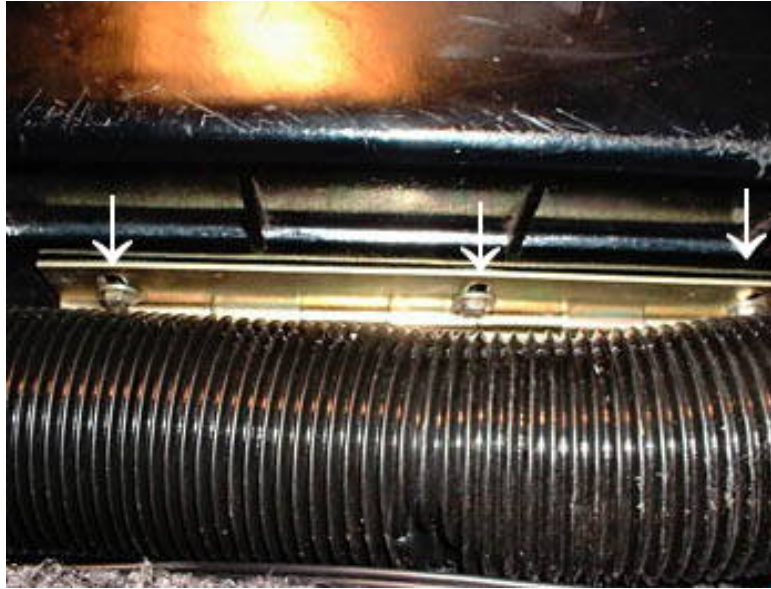


Figure 5: Glove box hinge bolts locations

6. **Remove console.** Remove the center console as a unit. It is held in place by only 2 screws- one in an angle bracket that attaches and locates the upper right side to a sheet metal finger at the bottom of the dash, and another that is hidden beneath the inner console base panel, which is a flat piece that fits inside, and forms the bottom of, the console.

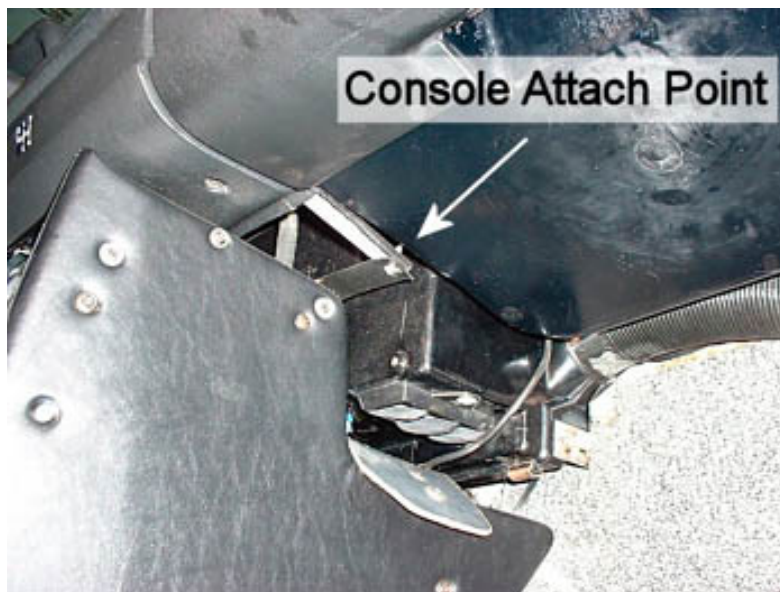


Figure 6: Upper console attachment

This deck sits in the bottom of the console, held in place by a tight fit with the sides (no screws). After you remove the locating screw from the top of the console, you should be able to move the console to one side a bit and insert your fingers or some flat object between the transmission tunnel and the side of the console, pushing the base panel up several inches at the end toward the shifter. Then, you will be able to see where the shifter surround is attached by a single screw to the sheet metal of the transmission tunnel. Remove this screw.



Figure 7: The hidden console screw

After you remove these 2 screws, you can pull the console back a bit from the dashboard and you will have clearance to reach over the top of the console and use your flat-bladed screwdriver to pry off the connector from the back of the emergency flasher button. Note that in early cars the hazard switch is not mounted in the console, so this step does not apply. If you have gauges, a radio/head unit or other devices mounted in your console, you will need to disconnect such devices at this point. Remove the shift knob by unscrewing it (counterclockwise), and pull the console back, up and over the shifter. Remove the console from the car and put it in a safe place.

7. **Remove control panels/cable control levers.** Pull the knobs off of the control levers, straight out and toward you as you sit in the driver's seat. Remove the bezels (face plates). This is the least intuitive part of the job- the face plates snap into the opening in the dash by the friction fit of nubs on each side of the plate. Use a wide, flat blade screwdriver, ruler or similar tool and gently pry them out toward you at the right or left edge. You should place a thin, flat piece of wood, plastic or metal at least 1" wide between the edge of the vinyl dash material around the opening and your pry tool, in order to avoid damaging the dash board when you pry. When you pop out each bezel, remove the light bulb attached to the back side and put the bezels in your safe storage location. After you have removed the bezels, you will see a screw on each side of the opening; these hold the control cable assemblies to the under-dash sheet metal. Remove these screws, and push the control assemblies back into the dash a bit. See [Figure 8](#) below for pictures of illustrating this process.

You should now be able to reach under and pull the assemblies out and down under the dash. These assemblies will remain connected to the heater box by the control cables, and will ultimately be removed with it when you pull the box. Just make sure that they do not hang up on the under dash wiring as you pull the assembly out from under the dash.



Figure 8: Control panel disassembly on later cars

For later cars, the right heater control includes the fan speed switch, which must be unplugged from the wiring harness at the switch before the right control assembly can be removed from the dash area. *Note: in earlier cars, the fan speed control is mounted in the dash near the instrument panel.* Disconnect the other end of this harness where it plugs into the lower, left side of the heater box. Note the position of the wires carefully for reinstallation. The ground wire is obvious (brown, per BMW standard) and the connector only allows correct reinstallation; however, the other wires (individual wires for the different fan speeds) each have the same kind of connector, so you may want to draw a diagram of the connector, using the wire colors as a guide. If your digital camera has a macro mode, take a picture of the wires before removing them.



Figure 9: The left (defrost and footwell air) control assembly

8. **Remove the heater box.** Put some old towels under the heater box area on the transmission tunnel, and in the footwell. Unless you have plugged the heater core inlet/outlet completely, you are likely to spill some coolant when you wrestle the box out of the car. The heater box is held in place by a 10MM nut on a stud on each side of the box. These nuts are accessible from under the dash. Shine a light up under the dash where the box is mounted behind the console area, and you will see them. Remove the two 10mm nuts and pull the box down toward you. You may have to push it through from the top, but be careful not to damage the plastic cage around the fan; it will probably be brittle. If your box has not been removed for a long time (or ever), it will be pretty well stuck to the sheet metal opening by the remnants of the seal around the top of the box. Just keep gently pulling/pushing until the box starts to drop down from its mounting point on the underside of the air plenum. Then maneuver the top of the fan cage out of the opening in the firewall. Remove the box, with control units and cables connected, from the car.

E. DISASSEMBLING THE HEATER BOX.

1. **Box sections.** The box is comprised of three sections: the top (which includes the fan and motor), the front lower section (which includes the fresh air flap that controls air flow through the heater core, and the flaps that control air flow to the windshield [defroster] vents), and the larger, rear lower section (which holds the heater core and includes the flaps that control air flow to footwells). In the remainder of this article, the three box sections are referred to as the “top,” “front” and “rear” sections.

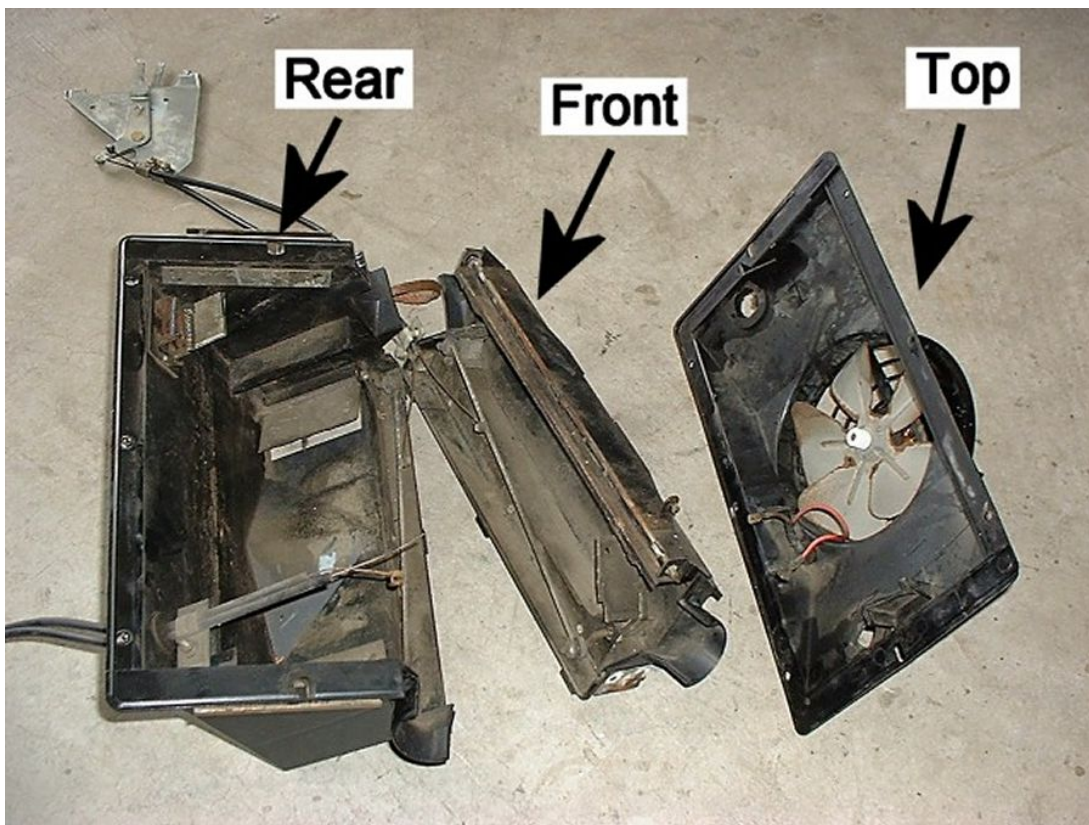


Figure 10: The three pieces of the heater box shell

2. **Remove heater control valve.** Take the valve and short rubber hose off of the heater core inlet on the right side of the box by (if your valve mounting bracket is intact) removing the two bolts with 8mm heads holding the valve to the plastic mounting bracket, and loosening the hose clamps. Be very careful, because the mounting bracket may be brittle and will likely break with any lateral pressure. Remove the control cable from the valve lever arm by loosening the 7mm nut on the bolt that secures the cable to the end of the arm.

3. **Remove top.** Remove the top section by drilling out the rivets fastening the top to the front and rear sections. Use a drill bit that is about 75% of the diameter of the rivet head. Drill straight into the center of the rivet head until the head separates from the body of the rivet. Sometimes the rivet will begin to spin as you drill into it, so you will need to immobilize it by grabbing the bottom of it with a pair of pliers. A small pair of Vice Grips-type pliers works best. After you have drilled off the head of the rivet, the bottom piece of the rivet should fall out. If the bottom piece does not fall out, use a small punch to gently tap it out of the hole. *Note: use care and only gentle pressure when drilling out rivets; the object is to remove only the head of the rivet- if you slip with the drill or push it through the hole in the heater box after the rivet, it will enlarge the hole and/or crack the box, making it more difficult to fasten the top of the box to the front and rear sections on reassembly.* I suggest that you brace/support the edge of the box with a piece of wood, such as a short length of 2x4, so that the wood backstops the plastic of the box when you drill the rivets or use a punch to knock out a rivet.

After you have removed the rivets or other fasteners, remove the top by grasping the edges carefully and gently pulling it up and forward to move it off the heater core inlet/outlet, which are curved toward the front of the box. When you have pulled the top up enough to clear the heater core inlet/outlet, reach in and remove the two fan wires from the resistor assembly at the left of the rear section by pulling the wires carefully off the spade connectors. Also, as you pull the top off the box, the heater valve control cable must be pulled through the grommet in and separated from the top. After you have separated the top from the lower sections, put it out of the way in your safe location.

4. **Remove clips.** You will find three spring steel clips around the lip at the back of the box where the front and rear sections of the box are joined. These can be slid sideways off the mounting tabs of the front and rear sections by gently tapping the clips to the left or right with a small hammer or a large punch and hammer. This works much better than prying the clips off over the lip of the box sections, which is likely to crack the case and bend the clips.

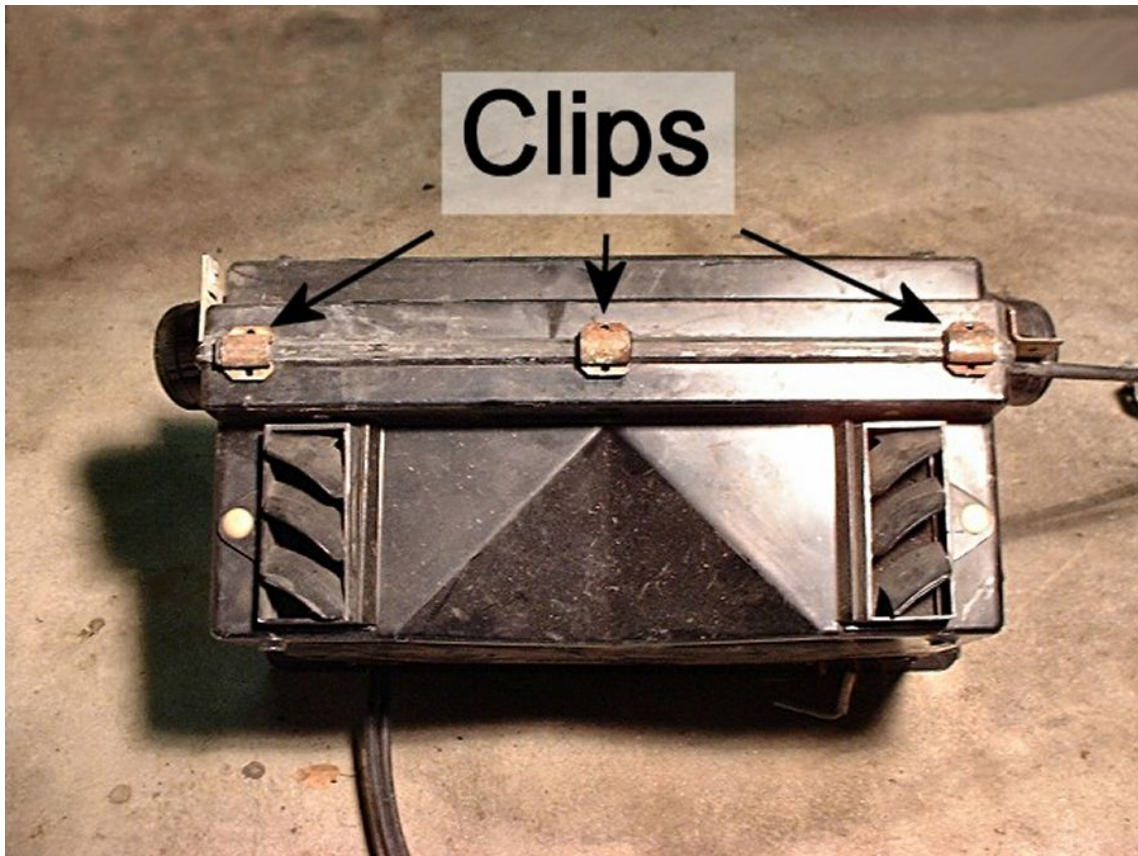


Figure 11: Lower section/rear of the box showing the clips and footwell vents.

5. **Preliminary separation of front and rear sections.** After you have removed the clips, you can separate the front section from the rear section by pulling the two sections apart, removing the cable clamp from the left side of the front section (this is the anchor point for the two cables that control the defroster flaps in the front section and the heater flaps in the rear section), and the control cables from the fresh air flap and the defroster flap control rod in the front section.



Figure 12: Front and rear sections of the heater box separated, exposing the core and lower control/mixture flaps.

6. **Remove control cables.** Look closely at the end of the control cables where they connect to the flap and flap control rods, respectively, and you will see that each cable end is attached with a small coil spring-like structure that fits over a nub on the flap or control rod. This coil is attached only by friction fit on the nub and can be removed by pulling it off the nub. I suggest using a pair of standard pliers or needle nose Vice Grips, and grasping the cable end from a 90 degree angle (i.e., perpendicular); rock it back and forth toward the end of the "nub" while exerting pressure vertically, and it will come off.
7. **Complete separation of box sections.** After removing the attachment points on all cables, you can remove the front section and put it in the safe place. If you are not very familiar with the control cable routing, now is a good time to label each control cable, indicating its attachment point. The cable for the heater control valve is obvious, because it does not have the coiled end piece. You will note that the cables for controlling the defroster and heater flaps enter the box on the left and are clamped to the front section, and the cables for the valve and fresh air flap enter the box through a large, double hole grommet at the top right of the rear section, where the cables are clamped just inside the section.
8. **Remove heater core.** Lift the core out of its mounting slot. The core will likely still contain coolant, so be prepared to drain the coolant and either re-use or dispose of it properly. Note the aluminum heat shield at the lower left of the core mounting slot; this shield protects the plastic from heat gen-

erated by the nearby resistor assembly. Make sure that it goes back in place when you are reassembling the box.



Figure 13: View of resistor heat shield, showing core and fresh air flap (closed) at top

F. CLEANING AND REFURBISHING INTERNAL PARTS

1. **Service heater core.** Take your heater core to your favorite local radiator shop and have it pressure tested, boiled out, and repaired (if necessary). If you have a leak in your core, repair can be quite expensive. You may want to try to source a good donor core from someone who has a spare heater box, or from one of the many '02 parts sources/recyclers. Note that, although all '02 heater boxes are basically the same, there are 2 different-style heater cores. The primary difference is the size of the inlet/outlet pipes on the core (and therefore, in the valve and hoses)- 15mm OD for the earlier and 18mm for the later. The cutoff for the transition is roughly in the '71-'72 timeframe. It is possible to convert from the early, smaller pipe core to the later, larger pipe core, but if your core does not leak, there is no compelling reason to do so.
2. **Inspect top section.** When tackling this phase of the operation, start by inspecting the top section of the box. There are several items in the that may need attention. There should be large, soft rubber grommets mounted in the holes for the heater core inlet and outlet. The purpose of these grommets is to seal around the heater core pipes, and they should be intact and pliable. Mild deterioration can be treated by removing the grommets from the top, cleaning them with a strong cleaner and then applying a liberal coat of Vinylux. If either grommet is too deteriorated to provide a good seal, order a new set from your favorite OEM parts supplier. Note also the small grommet through which the heater valve control cable passes. If this grommet is deteriorated, replacement grommets are readily available at your local hardware store (see materials list above).
3. **Inspection, cleaning and replacement of fan.**
 - a. **Testing fan motor.** Bench test the fan motor mounted in the top with a +12V DC power supply, capable of providing at least 5 amps. Note that if you use your car battery as a power source, **great caution** is necessary. Lead-acid batteries give off hydrogen gas, which can explode if ignited. Only use a battery as a power source in a well ventilated area; use jumper wire assemblies with shielded clips on both ends to avoid shorts/sparks. Attach the leads to the battery first and then to the fan wires. This will keep any sparks that may be generated at the fan end and away from your battery.

Place the top of the box on a flat surface or on its side, so that the fan blades will not hit anything when they spin up. Polarity is unimportant for this test, because the purpose of the test is to determine whether the fan spins freely, quietly and without vibration. Note, however, that reversing the connection of the wires will cause the fan motor to spin in the opposite direction. One specific test you should perform is to rotate the top of the box quickly through a 180 degree range of motion (e.g., turn the top on its side) while the fan is spinning, being careful of the spinning blades. This will simulate lateral G forces on the fan and may help identify a problem with the bushings in the motor, if any noise or vibration becomes evident. If your fan motor is slow or won't run at all, lubricate the bushings at each ends of the motor with a small amount of machine oil or other light lubricant, and spin the fan in both directions to loosen up the bushings.

- b. Inspect Brushes. You also should inspect the brushes in the fan motor, visible in the motor through the top of the fan cage, where the wires connect to the motor. The brushes are sufficient for continued service if you can they are at least 1/3" (~8.5mm) long.
- c. Removal of fan from case. If your brushes are OK and your fan motor spins quietly and without significant vibration, you can use it with confidence in your refurbished box. If it doesn't, now is the time to replace it with a new motor/fan or a good used assembly. If you need to remove your fan motor, or just want to clean and lubricate it, remove the four spring-steel clips around its periphery. These clips are accessible from the outside of the top.



Figure 14: Clips that hold the fan motor in the fan cage

Remove the motor by disconnecting the two wires attached to the motor, then popping off the clips with a screwdriver, (make sure to observe the position and orientation of these clips carefully before removing- the bottom of the clip is "u" shaped and hooks over the bottom of the motor case), and moving the motor down and out of the cage formed by the top section of the box. *Caution: do not pull on the fan blades during this process! The fan is attached to the motor shaft with a plastic bushing and it will come off the shaft if excessive pressure is applied. Also, the fan blades are balanced specifically for each fan/motor assembly. Your fan may have little clips on the blades. These are balance weights- do not remove them from the blades.*

- d. Cleaning and lubricating fan motor. Vacuum the dust off/out of the motor, and, if you haven't already, lubricate the bushings at the top and bottom of the motor with some light machine oil (e.g., 3-in-1 or sewing machine oil), applied on the shaft at the outside of the bushings. Also, you may find that your fan blades are rusty. This rust will probably not affect the operation of your fan, but you can remove it by using some light sandpaper or a wire wheel mounted in a bench grinder. If you do this, I suggest sealing the motor with plastic food wrap or masking tape beforehand, to keep the dirt and metal particles out.

When you are cleaning the fan blades, you need to use a great deal of care to not bend them, particularly if you are using a bench grinder. Each blade must be at the same angle and level- otherwise, fan imbalance will result. After you have removed the rust, put a light coating of sealant on the blades to prevent a reoccurrence of the rust. I suggest POR-15 clear. Do not allow any drips to form or you may destroy the balance of the blades. Before replacing the motor, clean the top section in accordance with the "Clean the Box" section below.

- e. Reinstallation of motor. Reinstall the fan/motor assembly by inserting the motor back into the "cage" of the top section. When you put the motor back in the cage, be sure to orient the top of the motor so that the power terminals are facing in the correct direction so you can hook the wires back up. Reinstall the clips and reattach the wires to the spade connectors on the motor.

3. **Inspection and Cleaning of Front and Rear Sections.**

- a. Inspection of flap hardware. Inspect the flap hardware in the front and rear sections carefully, including the flap mounting brackets, flap control rods, flaps and bushings.



Figure 15: Footwell flaps and control rod

Unless your heater box has been rebuilt recently, the odds are that all of the hardware in your heater box will be well oxidized and rusted, your flap foam will be history, and your flap pivot bushings will be in fragments or dust.

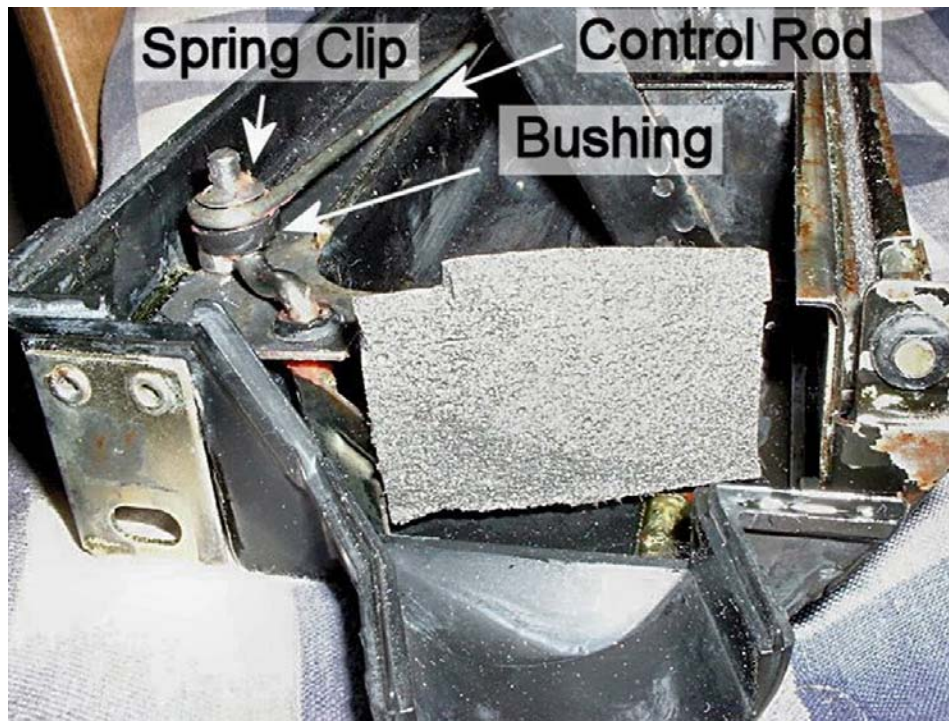


Figure 16: Closeup of defrost flap hardware

- b. Control rod structure and components. The defrost and footwell flap control cables are attached to control rods, which are used to move each set of flaps. Each control rod is attached to a flap at each end by an eyelet formed by the end of the rod. Each eyelet is held on the end of the flap shaft by a round spring clip. Underneath the spring clip is a round, hard-plastic spacer that acts as a pivot point/bushing, and keeps the control rod oriented and positioned correctly at its attachment point on the end of the flap shaft. Fortunately, these hard spacers are almost indestructible and can be reused.

Remove the round spring clips by using a pair of pliers, grasping the clip at a 90 degree angle and rocking it back and forth until it comes off the end of the flap shaft. It may be necessary to pry the spring clip up off of the hard spacer a bit by using a flat-blade screwdriver. After you have removed the clip, you can lift the control rod off of the flap shaft and remove the hard plastic spacer. Put the each spacer and all other hardware in your designated hardware container.

- c. Flap removal. Use your needle-nose pliers to bend the tabs holding each end of the shaft of the fresh air flap slightly to the right and left. These tabs are pretty flexible, and it doesn't take much right or left deflection in order to clear the ends of the shaft for removal from the remains of the bushings.

Remove the defroster flaps, which are mounted in the bottom of the front section. You will need to remove the three rivets that attach the flap bracket to the box. Use a small (3/16" works well) drill bit and drill the back of the rivet off from the inside of the box. If the rivet spins while you are drilling, grip the head with a Vice-Grips or similar pliers. When you have drilled the rivet material down to the bracket, push the remainder of the rivet through the bracket and out of the box. After you have removed all three rivets, you can lift the bracket and the flaps out of the box. Note the presence of the flat washers on the flap shaft, under the bushing/flap bracket.

Remove the footwell flaps in the rear section, using same procedure as above for the defroster flaps: drill out the three rivets and remove the bracket and flaps from the box. Again, note the position of the flat washers on the flap shaft, under the bracket.

- d. Cleaning box case. After you have removed everything from the plastic heater box case sections, clean them with some mild detergent and a soft bristle brush or cloth. The resistor assembly in the rear box section may be submerged in water- just make sure to rinse off any soap. To clean the top, use a damp, soft cloth, or remove the fan motor before putting the top into water. Most heavy dirt can be removed with Simple Green or Castrol "Super Clean" cleaner, but some rigorous scrubbing may be required. Use cause- the plastic in most old boxes is brittle and may crack if handled roughly. After washing the soap from and drying the box, apply Vinyltex over all surfaces, except the resistor assembly; remove excess with a towel.
- e. Cleaning and protecting flap hardware. Inspect and clean each flap, control rod and flap mounting bracket. If is likely that all of the original seals that were on the flaps will be mostly deteriorated or gone entirely. Clean the flap surfaces with 3M adhesive remover or a similar solvent to remove all traces of the original foam and adhesive.

Your flap hardware will likely be in various stages of oxidization/rust and will need cleanup before application of the new foam and reinstallation. By far and away, the easiest way to remove the rust is to use a bench grinder with a stainless steel wire brush. The next best alternative is to clamp the hardware in a vise and use a drill motor with a wire brush or other abrasive wheel, like a 3M flap or bristle brush, to grind off the rust. These are available in various sizes and abrasive qualities. If you do not have access to power tools, then use a wire brush, sandpaper or steel wool to remove the rust. After you have removed the rust, I highly recommend sealing the surface of the hardware to prevent a reoccurrence of the rust. My favorite product for this purpose is POR-15. POR-15, like many paints and similar products, is a potentially dangerous chemical. Please follow the instructions for use included with the product.



Figure 17: Clear POR-15 on cleaned-up hardware

- f. Installing foam on flaps. Each flap needs a soft seal around the edges to close off air flow at the opening covered by the flap. The original foam provided by the factory was an open cell, fairly light-density foam. I suggest using a higher density, closed cell foam as a replacement. Self-adhesive foam makes installation simple, and it is readily available from your local hardware store for home insulation (sealing doors, windows and the like). Cut the foam to the size and shape of the flaps. Foam wide enough to cover the flaps with one strip is hard to find. However, narrower strips are easy to apply so that the result is almost seamless.



Figure 18: a footwell flap with new foam installed

- g. Replace flap bushings. Replace the pivot bushing for each flap. In the case of the fresh air flap, there is a bushing on each end, seated in the tabs at the flap opening on the front box section. See the materials list above for the correct size rubber grommets to use as bushings. The bushings mount in the flap brackets. You will need to lubricate each bushing with rubber lubricant before reinstalling the flap in the bushing, and you will have to insert and install each flap shaft into each bushing before you re-install the flap mounting hardware in the box. I suggest using synthetic brake caliper grease for this purpose. See Figures 15, 16 and 17 above for pictures showing flap pivot bushings installed (and greased up with red synthetic grease...) in the box.
- h. Repair case cracks. Check for cracks in your heater box case. Most cracks in the plastic heater box case can be repaired with a good epoxy like JB Weld. Rough up the plastic on the edges of the crack with a medium grit sandpaper. Work the epoxy into the crack and thoroughly cover both sides of the crack with the epoxy, to a distance of at least .25" on each side of the crack. Let the epoxy dry before you do any more work with the box.



Figure 19: JB Weld applied to case crack

- i. Heater control assemblies. Your heater controls may be dry and oxidized/rusty. The control assemblies originally had an anodized surface, but in older cars/cars more exposed to the elements, the anodization may deteriorate, allowing rust to set in. The oxidization and rust can be removed with steel wool or fine sandpaper, but I like to use the stainless steel brush/bench grinder combo. After rust removal, clean and lubricate the entire assembly, especially the control lever pivots, with a light oil or dry spray lubricant. Then, lubricate the end of each cable- move the cable out to the extent of its travel and lightly coat each end with grease. Move the cable in and out to make sure that there is no excess grease at the end and that the cable moves freely. For cables that remain stiff and hard to move after this procedure, try dripping some solvent into the end of the cable between the cable and cable housing, letting it run down into the cable housing, to remove dirt build-up. Then, do the same with your spray lubricant. If the cable is still difficult to move after this process, you may need to replace the cable. The cables, referred to as “Bowden” cables, remain available from 02 parts suppliers.
- j. Coolant control valve: Inspect your valve; check for easy movement of the valve mechanism inside by the body by moving the lever arm back and forth. If the valve movement is excessively difficult, the valve can be disassembled by removing the C-clip (see [Figure 20](#) below) and cleaned. Clean the O ring seal with solvent and then with Vynlex. Use a bit of synthetic grease when reassembling. If the O ring appears to be flattened or worn, you can find a replacement at your local hardware store by taking the O ring in and matching the size. The valve is made of brass, so if you are interested in cosmetics, the valve may be polished up nicely by the ol’ wire brush/bench grinder setup. After polishing, coat the valve with clear protectorant like POR-15.



Figure 20: disassembled coolant valve

4. **Reassembling the Heater Box.** Reinstallation is more or less the reverse of removal. If you have any problems, read the instructions for removal again, and note the comments about the position of washers and hardware.
 - a. Flap reinstallation. The fresh air flap can be reinstalled after installation of the pivot bushings (grommet) on each side by placing the flap shaft into the grommets and bending the side pieces back in place with a 90-degree angle to the shaft. For the defrost and footwell flaps, reassemble each flap set as a unit outside of the box (flap pivot bushings installed in bracket, with top flap shaft inserted through brackets- remember to install a flat washer on each flap), and then set each of them into the box to attach the flap-set bracket to the box. The brackets can either be re-riveted into the box or attached to the box using small pan-head screws the diameter of the original rivets. I recommend using rivets for a clean, original appearing installation, but if you do use

screws, make sure you use all stainless hardware, with self-locking nuts and flat washers on the outside of the case. Make sure to lube the bushings *and* the pivot holes in the case where the lower flap shafts insert well with synthetic grease.

- b. Reinstall control rods and cables. Reinstall the flap control rods by first placing a hard plastic spacer/bushing on the end of each flap shaft, lubricating the bushing with grease, installing the control rod over the bushings, and securing the control rod by pushing a spring clip onto the end of each flap shaft. Then, install the appropriate control cable by pushing the end of the cable onto the respective cable attachment point on each rod. In the case of the fresh air flap, attach the cable directly to the flap as per original setup. Temporarily rejoin the front and rear box sections, hold them together and work the cables to make sure that cable movement is smooth, the flaps seal properly and the new foam fits well and does not bind on the edges of the flap openings. Now is the time to make sure that the control cables are properly adjusted, so that the flaps open and close all of the way, with the control levers correctly positioned at the control heads that mount in the dash. Adjustment is performed by positioning the cable housing clamps properly at the mounting point on the box and at the control head. If everything works OK, you are ready to complete the reassembly of your box.
- c. Reinstall heater core. Place a thin strip of closed cell foam around the bottom and sides of the heater core (put it where the original foam was located... you should be able to see the mark on the core from the original foam) and slide the core into the mounting slots on the sides of the rear section. Make sure to reinstall the aluminum heat shield over the plastic slot nearest to the resistor assembly (see [Figure 13](#) above).
- d. Reassemble box sections. Join the front and rear box sections and reinstall the spring clips in their original locations on the lip on the rear of the sections by sliding them on from the side. If any of the clips seems loose after installation, you can remove the clip and bend it together a bit with a pliers. Position the top of the box and reconnect the two wires from the fan motor to the connectors at the resistor assembly in the lower part of the box. These connectors are polarized and so can only be reattached correctly. However, just for grins, you may want to spin up the fan with your +12V power source connected to the outside of the box at the resistor pack. This will also allow you to check each resistor/fan speed. Make sure that air is moved into the box by the fan. Test fit the top by operating the fresh air flap to make sure it does not impact the fan blades. Rivet the top to the front and rear box sections. I recommend using stainless or brass washers under the rivets, which distribute the load around the rivets better (preventing case cracks) and help compensate for enlarged holes.
- e. Coolant valve. Replace the short hose piece between the core inlet and the coolant valve, unless your original hose is in pristine condition, and install the valve. If your case mounting bracket is intact or you are using a metal bracket reinforcement (as described in paragraph D(3) above). Connect the lever arm from the valve to the control cable. Move the control cable back and forth to make sure that the lever arm is correctly installed. The valve should be closed when the cable is pulled in (lever at control assembly pushed fully to the left, and open when the cable is pushed out (cable moves out of cable end at valve; lever at control assembly moved to the right)).

G. REINSTALLING THE REFURBISHED HEATER BOX INTO THE CAR

Reinstallation of the box is the reverse of removal. Be careful to seal the box against the opening in the plenum with some 3M Strip-Calk, silicone caulk or thin, closed cell foam. Leaks around heater boxes are a common cause of rust in the firewall and floor area, so extra attention to this area is worthwhile.

Reinstall the hoses, and tighten down the clamps. Open the heater valve and re-fill the cooling system with a 50/50 mix of distilled water and BMW coolant. Start the motor and add any additional coolant needed to top off the system. Warm up the car and make sure nothing is leaking. Enjoy!