

## **BODY-03, Sunroof Operation, Troubleshooting, and Repair**

### **Table of Contents**

- [System Description](#)
- [Normal Operation](#)
- [Removing the Sunroof](#)
- [Installing the Sunroof](#)
- [Sunroof Manual Operation](#)
- [Sunroof Motor Slip Clutch Adjustment](#)
- [Sunroof Troubleshooting and Repair Guide](#)

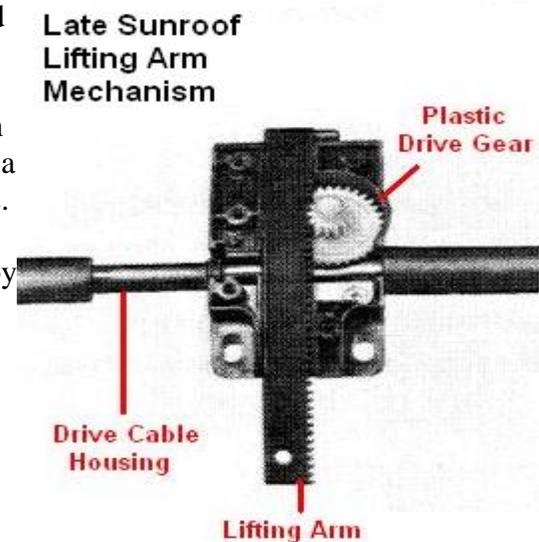
### **System Description**

The sunroofs on 944s are raised and lowered by two lifting arms at the rear edge of the roof. On cars made after February 1986, the lifting arms are operated by plastic gears (one for each lifting arm mechanism). The plastic gears have a small set of teeth which operate the lifting arms. They also have a large set of teeth which are driven by a flexible cable. The cable is driven by the sunroof motor.

For cars produced before February 1986, there is a [gear box](#) between the two lifting arm mechanisms. This gear box has a single gear which moves the lifting arms via two short lengths of drive cable. The guide tubes for the short sections of the flexible drive cable are routed such that the drive cables are directly engaged in the teeth on the lifting arms as opposed to using a plastic drive gear in each lifting arm housing.

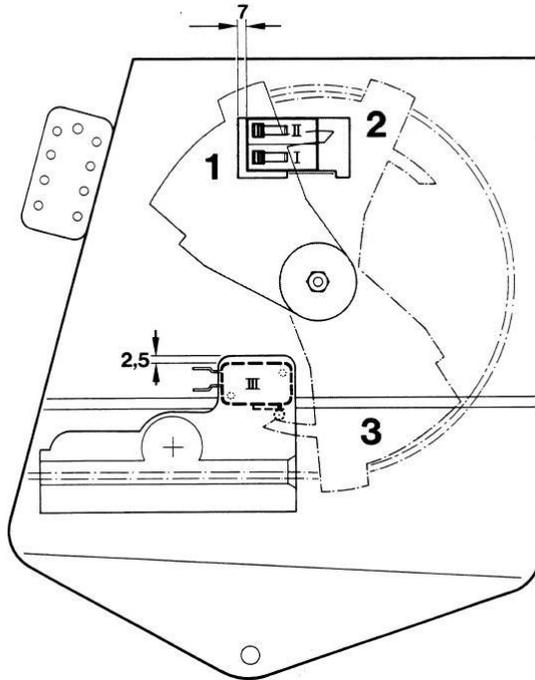
The sunroof drive motor assembly is located in the rear hatch area behind the vertical section of carpet on the driver's side of the car. On most cars the motor assembly will have a plastic cover over it which is held in place by six Phillips head screws.

The sunroof system on all 944s uses a series of micro-switches to stop the lifting arms in different positions. The functioning of the sunroof depends on the ignition switch position and the direction that the console switch is operated. The ignition switch on 1985.5 and newer cars is a three-position switch whereas the early ignition switch is a two-position switch (OFF-ON). On the later cars, it's a OFF (0) - ACCESSORY (1) - ON (2) switch. You'll frequently hear the ignition switch "ON" position referred to as ignition switch position 2. To operate the sunroof in the open or closed direction, the ignition switch is turned to the "ON" position. To release the sunroof the ignition switch must be in the "OFF" position for the early 944s or in the "ACCESSORY" position for the late



model 944s. Specifics on how to operate and remove the sunroof are discussed in another section of this procedure.

### Late Sunroof Cam Assembly



All sunroofs installed since February 1986 have three limit switches which are operated by a plastic cam attached to the sunroof drive cable. The cam assembly rotates as the drive motor moves the drive cable and as the cam rotates it operates the limit switches.

In cam position 1, the lifting arms are fully retracted back against the body of the sunroof so that the sunroof can be removed from the car. This is referred to as the "released" position. In this particular instance, both Limit Switches I and II are made. Limit Switches I and II are ganged together and can only be adjusted together. Limit Switch I is the bottom switch and Limit Switch II is the top switch. They function to stop the lifting arms in the "locked" position. If the lifting arms are in the released position and both limit

switches are not made or are not functioning properly, the lifting arms can not be moved to the "locked" position.

In cam position 2, the lifting arms are partially raised so that the sunroof is still closed but, it is locked in the closed position. As the lifting arms are moved toward the locked position, the cam rotates. When the cam reaches position 2, Limit Switch II drops out to stop the sunroof motor. As previously mentioned, the ignition switch must be in the ACCESSORY position to operate the sunroof between the retracted and locked positions (from cam position 1 to 2). When moving the lifting arm from the locked position to the released position, movement of the lifting arms is stopped by the slip clutch on the sunroof motor when the lifting arm tabs contact the body of the sunroof opening. This is a very common problem area. Over time, the motor slip clutch torque tends to increase. There really isn't a good explanation for why this occurs but, it does. Eventually, the torque will get high enough so that when the lifting arms are retracted and come in contact with the body, the sunroof motor have enough torque to cause the drive cable to strip the teeth on the plastic sunroof gears. The procedure for adjusting the slip clutch torque will be discussed later.

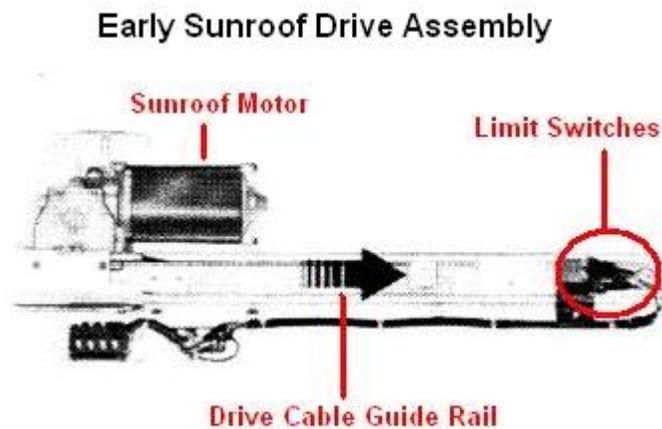
To raise the sunroof from the locked position, the ignition switch must be in the ON position. When the console switch is depressed (Up Arrow), the sunroof will start to raise and the cam rotates. As soon as the cam starts to rotate, Limit Switch I drops out. The sunroof will continue to raise as long as the console switch is depressed until the roof

reaches the fully open position (cam position 3). When the cam hits limit switch III, the sunroof stops in the fully open position.

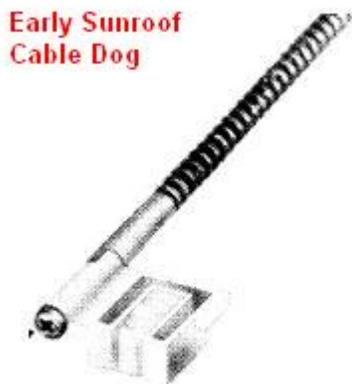
To lower the sunroof from the fully raised position, the ignition switch must be in the ON position. When the console switch is depressed (Down Arrow), the sunroof lowers until cam position 2 is reached. When the cam makes Limit Switch I, the sunroof stops in the locked position.

The operation of sunroofs on 944s produced from 1982 to February 1986 is essentially identical to that of later 944 sunroof systems. The primary differences are in the physical construction of the sunroof equipment.

One of the major differences is the set up of the drive motor and limit switches. The early sunroof assembly does not use a rotating cam to operate the limit switches. Instead, there is a guide rail attached to the sunroof motor which extends toward the rear of the car. At the very back of the guide rail is two limit switches. These are equivalent to Limit Switches I and II on the late model sunroof systems. They function together to stop the lifting arms in the locked position and are operated by a plastic dog that is attached to the end of the drive cable.



Like the late model sunroof, in the locked position, one limit switch is made and one is not. To open the sunroof, the ignition switch must be in the ON position. When the console switch is depressed the sunroof moves in the open direction and is stopped when the micro-switch mounted between the sunvisors drops out. The micro-switch is operated by a tab attached to the front edge of the sunroof hatch. As the back of the sunroof hatch raises during opening, the tab on the front of the hatch swings down. When it swings down it drops out (electrically opens) and the sunroof motor is used on the late model sunroofs but, merely functions as a backup to Limit Switch III.



From the locked position, to move the lifting arms to the released position (for sunroof removal), the ignition switch must be in the OFF position. As the lifting arms move to the released position, movement of the lifting arms is stopped by the motor's slip clutch when the lifting arm tabs contact the body of the sunroof opening.

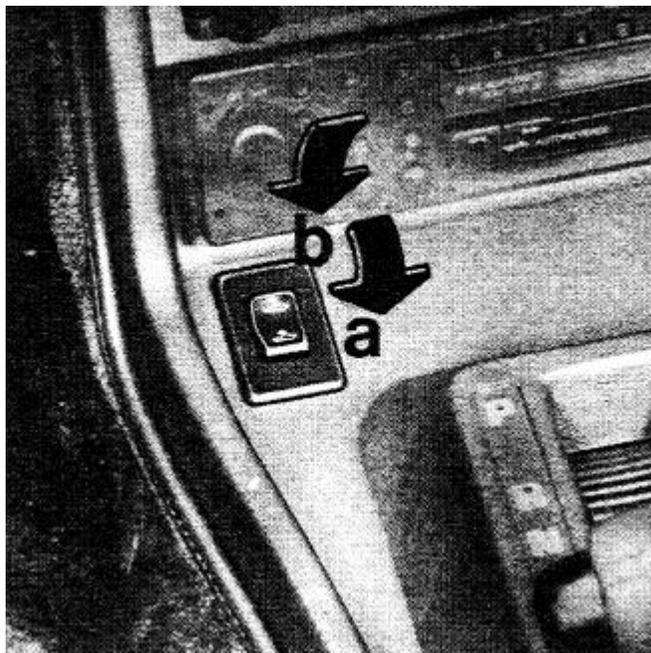
And, when moving the lifting arms from the released position to the locked position, the sunroof motor is stopped when one of the limit switches drops out.

The micro-switch between the sunvisors also performs an additional function on both early and late model sunroofs. It tells the system that the sunroof is installed. If the sunroof is installed but, the lifting arms are released, the system will automatically move the lifting arms to the locked position when the car starts moving.

If the sunroof fails electrically, it can be operated manually. However, operating an early sunroof manually is difficult at best and should only be done if absolutely necessary. Directions for sunroof manual operation are contained in another section of this procedure. To troubleshoot problems with the sunroof system, refer to the troubleshooting section of this procedure.

### **Normal Operation**

On pre-1985.5 cars, the sunroof is operated by turning the ignition switch to the "ON" position. The sunroof console switch is then pushed back ("A" direction) to open the sunroof and pushed forward ("B" direction) to close.



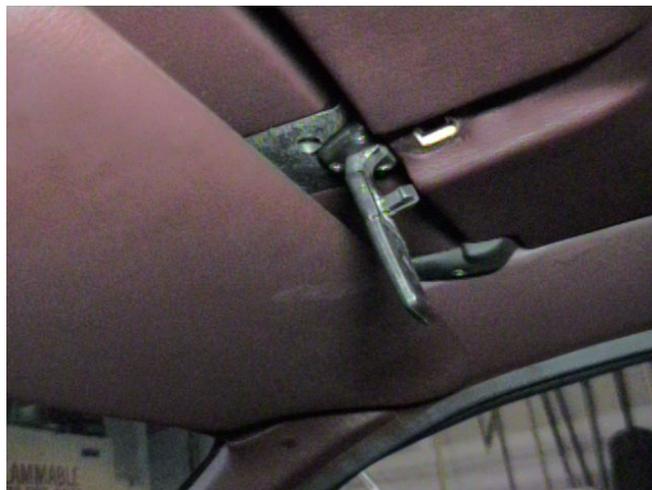
### **NOTE**

The ignition switch on 1985.5 and newer cars is a three-position switch whereas the early ignition switch is a two-position switch (OFF-ON). On the later cars, it's a OFF (0) - Accessory (1) - ON (2) switch. You'll frequently hear the ignition switch "ON" position referred to as ignition switch position 2. To operate the late model sunroof, turn the ignition switch to the "ON" position. The sunroof console switch is then pushed back (up arrow) to open the sunroof and pushed forward (down arrow) to close.



### **Removing the Sunroof**

1. Retract the sunroof lifting arms as follows:
  - a. On pre-1985.5 cars, turn the ignition switch to the "OFF" position. Depress the sunroof switch in the back direction ("A" in picture from previous section) to retract the sunroof lifting arms.
  - b. On 1985.5 and newer cars, turn the ignition switch to the "ACCESSORY" position (1). Depress the sunroof switch in the back direction (Up Arrow on Switch) to retract the sunroof lifting arms.
2. Release the two latches at the front of the sunroof.



3. From inside the car, push up on the back of the sunroof and slide it off of the wind deflector and front guides.



### **Installing the Sunroof**

1. Slide the sunroof hatch on to the wind deflector guides until it seats at the front of the sunroof opening.



2. Lower the back of the sunroof in to the sunroof opening. It should sit flush with the top of the roof.
3. Engage the latches at the front of the sunroof.

### **NOTE**

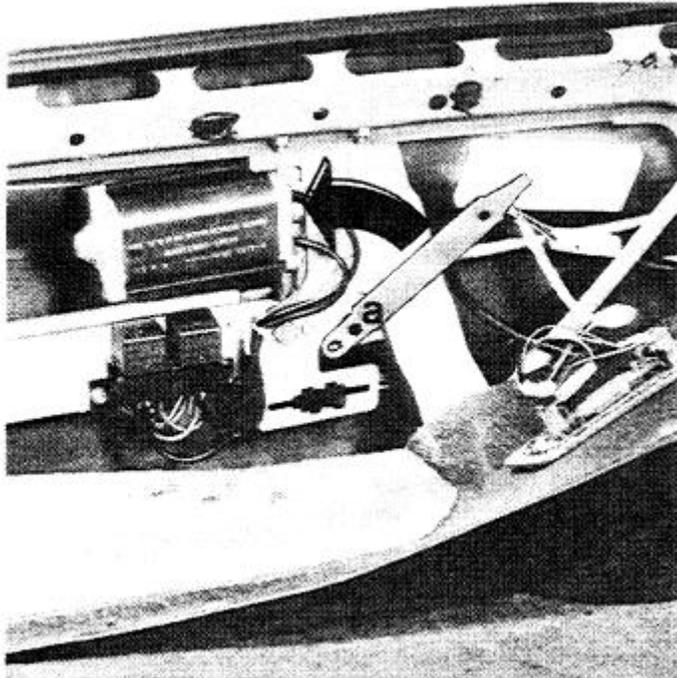
When raising the sunroof lifting arms from the retracted position (for removal), the lifting arms should automatically stop at the locked closed position.

4. Engage the sunroof lifting arms as follows:
  - a. On pre-1985.5 cars, turn the ignition switch to the "OFF" position. Depress the sunroof switch in the forward direction ("B" in picture from previous section) to raise the sunroof lifting arms.

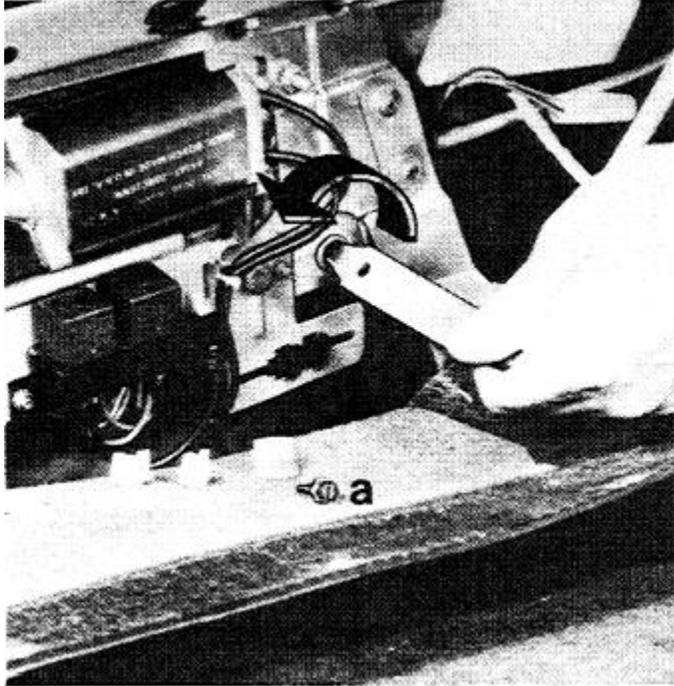
- b. On 1985.5 and newer cars, turn the ignition switch to the "ACCESSORY" position (1). Depress the sunroof switch in the forward direction (Down Arrow on Switch) to raise the sunroof lifting arms.

### **Sunroof Manual Operation**

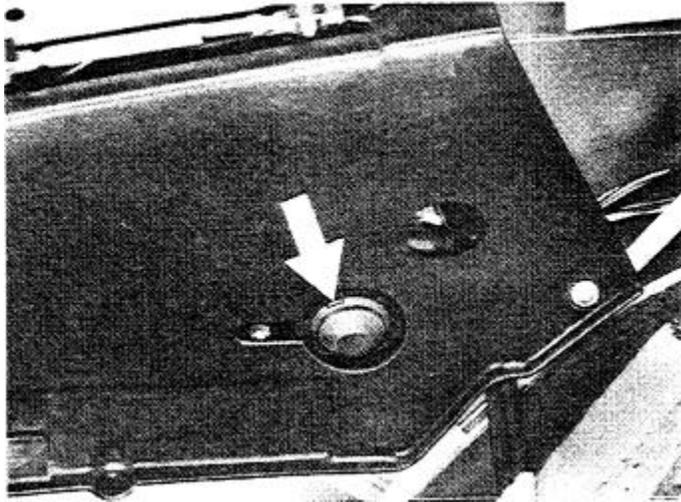
1. Operate the early 944 (1982 - February 1986) sunroof manually as follows:
  - a. Unclip the carpet on the driver's side (left-hand drive) of the hatch area. There you will find the sunroof motor and cable drive assembly.
  - b. Below and to the left of the sunroof motor you should find a manual operating tool attached to the cable guide by two wing nuts. Unscrew the wing nuts and remove the tool.
  - c. Below and to the right of the sunroof motor there is an adjusting screw for the motor slip clutch. There should be a cap over the adjusting screw. Remove the cap and, using the tool, remove the adjusting screw (a).



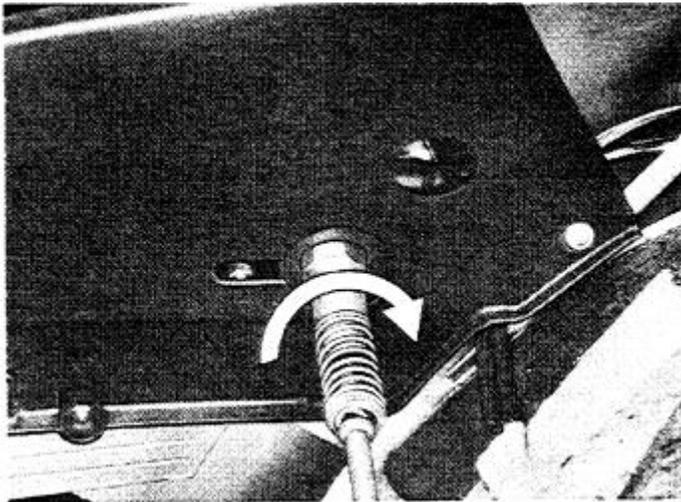
- d. Once the adjusting screw is removed, you'll find a threaded sleeve inside the opening for the screw. Insert the tapered end of the tool into the sleeve and turn the sleeve to operate the sunroof. Turning the sleeve counter-clockwise will close the sunroof and turning it clockwise will open the sunroof.



- e. When manual operation is complete, install the adjusting screw into the threaded sleeve. Adjust the slip clutch torque using the slip clutch adjustment procedure.
2. Operate the late 944 (February 1986 - On) sunroof manually as follows:
  - . Unclip the carpet on the driver's side (left-hand drive) of the hatch area. There you will find the sunroof motor and cable drive assembly. The assembly may have a plastic cover. Although on many of the late model cars, I've found that the cover has been removed.
    - a. Remove the slip clutch adjusting screw cap. You'll find the cap, below and to the right of the sunroof motor. If the sunroof motor assembly has the plastic cover discussed in the previous step, the adjusting screw cover will be visible in an opening in the motor assembly cover.



b. Behind the adjusting screw cap, you'll find a small lock nut which locks the slip clutch adjusting screw in position. Behind that, there is a larger nut which is used to manually operate the sunroof. Use a spark plug socket (13/16") or a 21 mm socket on the large nut to operate the sunroof. Turn the nut clockwise to close the sunroof and counter-clockwise to open.



**NOTE**

Since the position of the slip clutch adjustment screw has not been altered, it is not necessary to perform a slip clutch adjustment.

**Sunroof Motor Slip Clutch Adjustment**

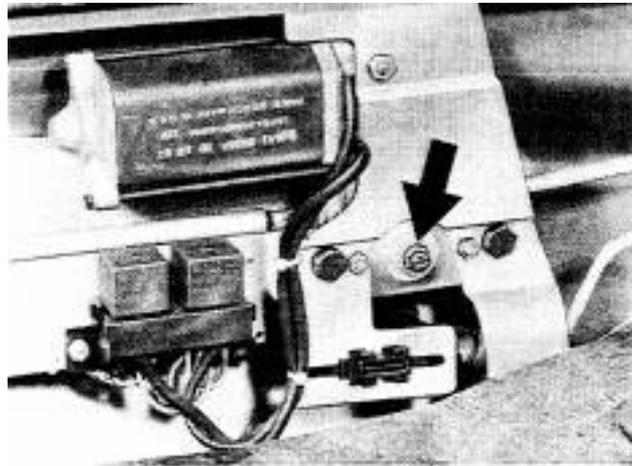
There are two different procedures for adjusting the slip clutch on a 944 sunroof motor based on whether you have an early style sunroof (before February 1986) or a late style sunroof. The early style sunroof slip clutch is set from the factory and should only be

adjusted if the slip clutch adjusting screw has been removed for manual operation of the sunroof.

On the style sunroof, the slip clutch adjusting screw is permanently attached and is not removed for manual operation of the sunroof. However, the slip clutch torque should be periodically checked and adjusted if needed. High slip clutch torque is the most common cause of the failure (stripping) of the plastic sunroof gears in the late style sunroofs.

If you are unsure whether you have an early or late style sunroof, refer to the pictures below. Note that the motor case on the early style sunroof system is black and the motor is oriented parallel to the ground. The late style sunroof motor case is gold in color, is oriented at an angle to the ground, and has its electrical connector on top of the motor.

### **Early Sunroof Motor and Slip Clutch Adjusting Screw Location**

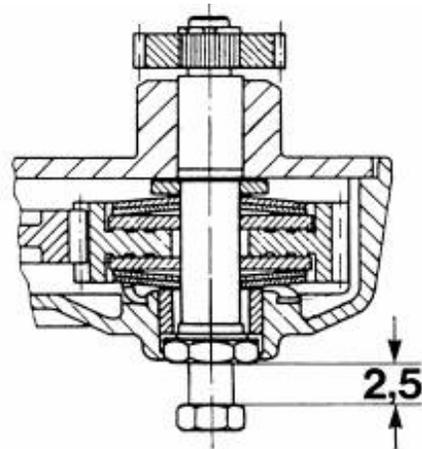
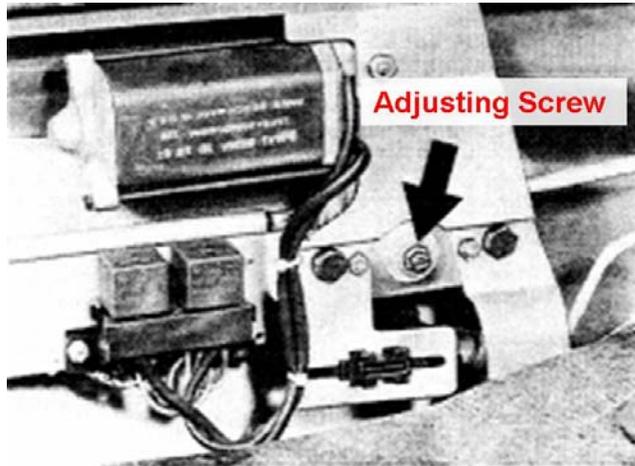


### **Late Sunroof Motor and Limit Switches**

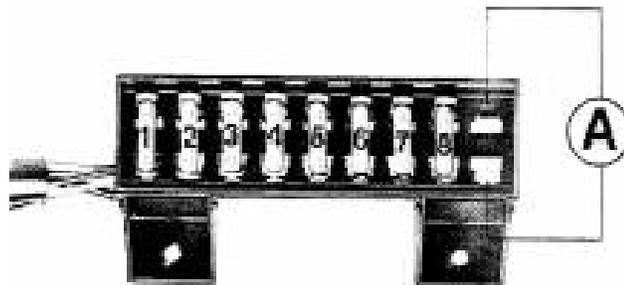


### **Early Style Slip Clutch Checking and Adjustment**

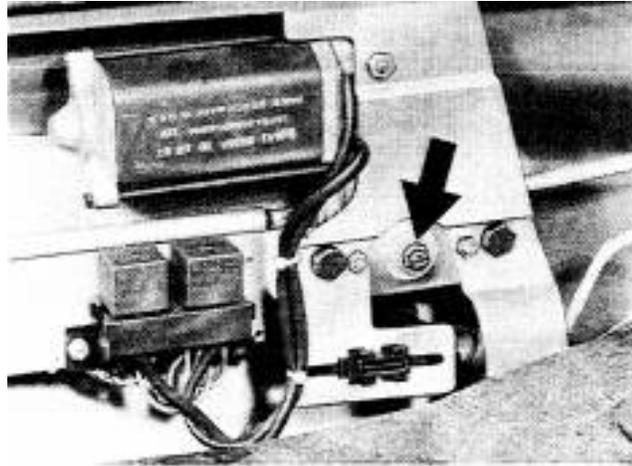
The early style sunroof motor slip clutch has an adjusting screw that has a locknut that is cemented to the adjusting screw at a preset distance from the head of the adjusting screw (2.5 mm) to ensure proper slip clutch torque. However, if the adjusting screw is removed for manual sunroof operation, the slip clutch torque must be verified by checking the sunroof motor current after the adjusting screw is reinstalled.



1. Remove fuse 9 from the Auxiliary Fuse Panel and connect an ammeter across the fuse block terminals.



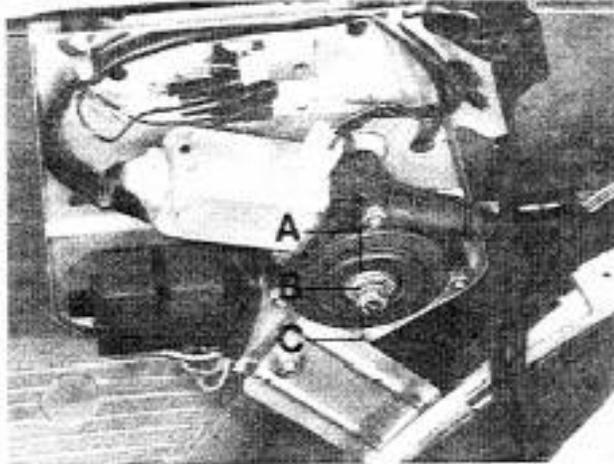
2. Thread the adjusting screw into the slip clutch until the lock nut comes in contact with the mounting surface and tighten it slightly.



3. Turn the ignition switch on (or insert the key into the ignition) and operate the sunroof switch until the sunroof reaches it's final drive position (full open or fully retracted). I prefer to operate the motor to the full open position as the motor current tends to be higher (due to the weight of the sunroof). Check the motor current when the drive motor reaches it's final drive position. On the early sunroofs the limit switch between the sunvisors may stop the motor before it reaches the full open position. If so, you may press the micro-switch manually to operate the motor long enough to check the motor current.
4. Tighten the adjusting screw until the motor current is 12 -14 Amps. This may require loosening the adjusting screw lock nut.
5. When the adjusting screw is properly set, tighten the lock nut against the mounting surface and apply heavy strength Loctite to the adjusting screw threads at the lock nut.
6. Disconnect the ammeter and reinstall the sunroof motor fuse (25 A).

### **Late Style Sunroof Slip Clutch Checking and Adjustment**

1. Open the sunroof about 1/2 open. This will prevent damaging the plastic gears during slip clutch testing.
2. Using a 21 mm socket and torque wrench, turn hexagonal nut A on the motor slip clutch (see picture below). The clutch should slip at 6 Nm ( $\pm 0.5$  Nm). I normally like to see the torque at the low end of the spec or even slightly below (5 - 5.5 Nm) to ensure that the plastic gears don't get stripped again.
3. The breaking loose torque of the motor can vary at different gear position. So, the torque should be checked six times at 60 degree angles of rotation on the hexagonal nut A (i.e. 360 degrees total or six times during one full rotation of the nut).



**A - Checking Torque**

**B - Adjusting Torque**

**C - Lock Nut**

4. If the slip clutch needs adjustment perform the following
  - a. Loosen lock nut **C**.
  - b. Adjust the motor torque by moving adjusting nut **B**. Loosening nut **B** will lower the torque. Tightening nut **B** will raise the torque.
  - c. When the torque is properly adjusted, apply a small amount of Loctite 270 to the adjusting screw threads and tighten lock nut **C** to a torque of  $15 \pm 2$  Nm.

## Troubleshooting and Repair Guide

Symptoms	Possible Causes	Checks
Sunroof motor will not operate.	Bad Fuse	Early 944s (Up to February 1986) Fuse 6 - Main Fuse Panel (Relay) Fuse 9 - Additional Fuse Panel (Motor) Fuse 8 - Main Fuse Panel (Relay) Late 944s (Since February 1986) Fuse 1 - Motor Fuse 8 - Relay
	Micro-Switch between Sun Visors Limit Switches Main Sunroof Relay Console Switch Directional Relays Sunroof Motor Ignition Switch	Sunroof Component Testing - <a href="#">ELECT-18</a>
Lifting arms retract to the "released" position for removal but will not raise to the "locked" position.	Sunroof Console Switch Micro-Switch between Sun Visors Limit Switch 2 Directional Relay 1	Sunroof Component Testing - <a href="#">ELECT-18</a>
Sunroof Arms move up and down but will not retract for removal.	Main Sunroof Relay Console Switch Limit Switch 1	Sunroof Component Testing - <a href="#">ELECT-18</a>
Sunroof will raise to the open position but will not lower to the locked position.	Console Switch Limit Switch 1 Directional Relay 2	Sunroof Component Testing - <a href="#">ELECT-18</a>
Sunroof lowers but will not raise.	Micro-Switch between Sun Visors Console Switch	Sunroof Component Testing - <a href="#">ELECT-18</a>

Symptoms	Possible Causes	Checks
Sunroof automatically raises when car is rolled backwards or forward.	Limit Switch 2 bad or misadjusted.	Sunroof Component Testing - <a href="#">ELECT-18</a>
Sunroof motor turns but nothing happens.	Slip clutch torque set too low. Plastic sunroof gears bad (late sunroof) or sunroof gear box (early sunroof) bad.	Replace plastic sunroof gears ( <a href="#">BODY-04</a> ) or replace gear box.
Sunroof arms not level or raise unevenly.	Drive cable Plastic sunroof gears	Replace plastic sunroof gears ( <a href="#">BODY-04</a> ) or drive cables as necessary.

Clark's Garage © 1998

---