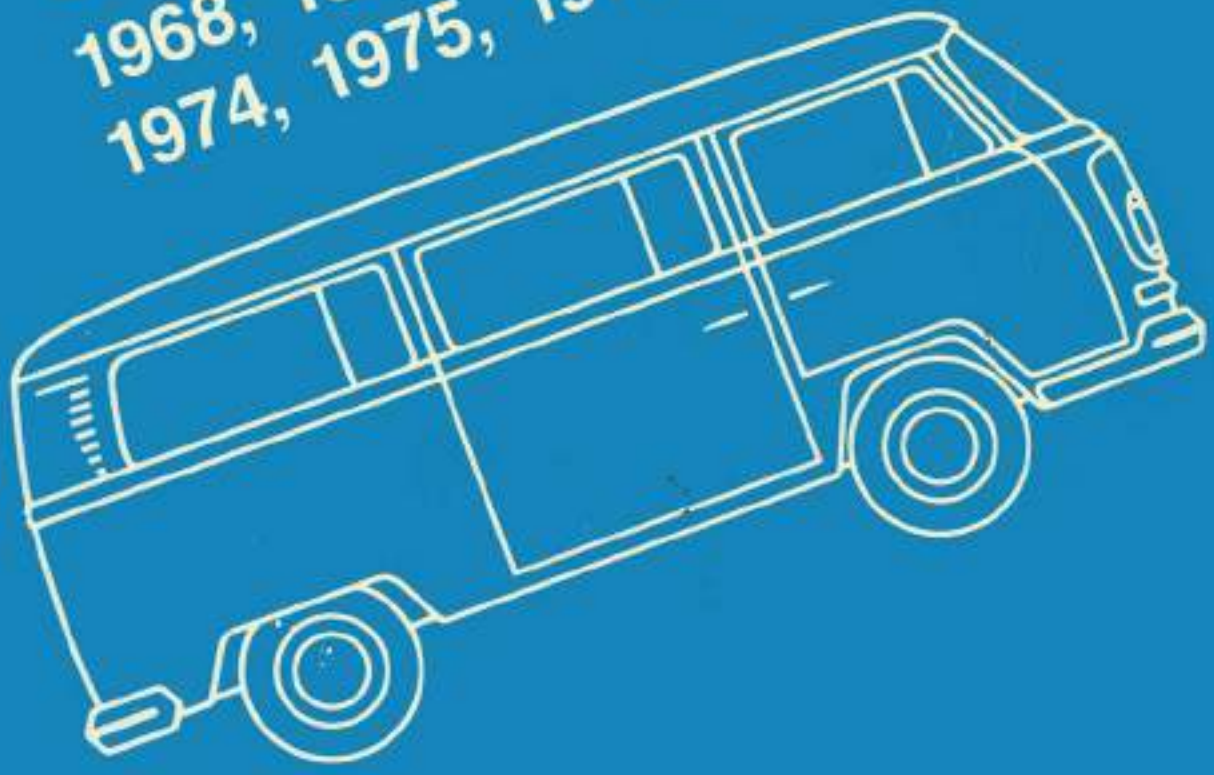
Volkswagen

Official Service Manual

Station Wagon/Bus
1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979



Volkswagen

Station Wagon/Bus

Official Service Manual Type 2

1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979

Robert Bentley Complete Service Manuals

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Station Wagon/Bus

Official Service Manual Type 2

1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979

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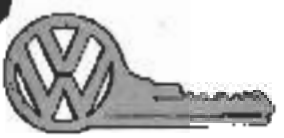



FOREWORD

Service to VW owners is of top priority to the Volkswagen organization and has always included the continuing development and introduction of new and expanded services. In line with this purpose, Volkswagen of America, Inc. has introduced this Volkswagen Official Service Manual.

This Type 2 Manual covers the Station Wagon, the Panel Truck, the Pickup Truck, the Kombi, and the Campmobile of Model Years 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, and 1979. (Cars of each Model Year are usually introduced in August of the preceding year.)

> **NOTE —**
> This Manual covers neither the automatic transmission used on 1978 and later models, nor the manual transmission used on 1977 and later models and all but the final 1976 models.

The chassis numbers assigned to the Station Wagon, the Panel Truck, the Pickup Truck, the Kombi, and the Campmobile for the Model Years covered in this Manual are:

Station Wagon

1968: 228 000 001 to 228 220 000
1969: 229 000 001 to 229 300 000
1970: 220 2000 001 to 220 2300 000
1971: 221 2000 001 to 221 2300 000
1972: 222 2000 001 to 222 2300 000
1973: 223 2000 001 to 223 2300 000
1974: 224 2000 001 to 224 2300 000
1975: 225 2000 001 to 225 2300 000
1976: 226 2000 001 to 226 2300 000
1977: 227 2000 001 to 227 2300 000
1978: 228 2000 001 to 228 2300 000
1979: 229 2000 001 to 229 2300 000

Kombi and Campmobile

1968: 238 000 001 to 238 220 000
1969: 239 000 001 to 239 300 000
1970: 230 2000 001 to 230 2300 000
1971: 231 2000 001 to 231 2300 000
1972: 232 2000 001 to 232 2300 000
1973: 233 2000 001 to 233 2300 000
1974: 234 2000 001 to 234 2300 000
1975: 235 2000 001 to 235 2300 000
1976: 236 2000 001 to 236 2300 000
1977: 237 2000 001 to 237 2300 000
1978: 238 2000 001 to 238 2300 000
1979: 239 2000 001 to 239 2300 000

Panel Truck

1968: 218 000 001 to 218 220 000
1969: 219 000 001 to 219 300 000
1970: 210 2000 001 to 210 2300 000
1971: 211 2000 001 to 211 2300 000
1972: 212 2000 001 to 212 2300 000
1973: 213 2000 001 to 213 2300 000
1974: 214 2000 001 to 214 2300 000
1975: 215 2000 001 to 215 2300 000
1976: 216 2000 001 to 216 2300 000
1977: 217 2000 001 to 217 2300 000
1978: 218 2000 001 to 218 2300 000

Pickup Truck

1968: 268 000 001 to 268 220 000
1969: 269 000 001 to 269 300 000
1970: 260 2000 001 to 260 2300 000
1971: 261 2000 001 to 261 2300 000
1972: 262 2000 001 to 262 2300 000
1973: 263 2000 001 to 263 2300 000
1974: 264 2000 001 to 264 2300 000
1975: 265 2000 001 to 265 2300 000
1976: 266 2000 001 to 266 2300 000
1977: 267 2000 001 to 267 2300 000
1978: 268 2000 001 to 268 2300 000

The chassis number is found in three places: behind the front passenger's seat on the right-hand engine cover plate and on the dashboard. This Manual is organized so that changes from model year to model year are noted, and if a change within one model year is made, the chassis number of the first VW with the change is given.

For the VW owner with mechanical skills and for independent garages, this Manual gives VW-approved specifications and procedures. In addition, a VW owner who has an intention of working on his car will find that reading and owning this Manual will enable him or her to discuss repairs intelligently with a professional mechanic.

The aim throughout has been simplicity, clarity, and completeness with step-by-step procedures and accurate specifications. Every human effort has been made to ensure the highest degree of accuracy possible. When the vast array of data presented in this Manual is taken into account, however, no claim to infallibility can be made.

The VW owner intending to do maintenance and repairs should have a set of metric wrenches, a torque wrench, screwdrivers, and feeler gauges, since these basic hand tools will be used in accomplishing a majority of the repairs described in this Manual. Usually, there will be a caution in the text when a repair requires special tools or special skills.

If you are a professional mechanic already working on imported cars, you may have some VW special tools that are shown in some of the illustrations in this Manual. If you have previously worked only on American manufactured cars, you will not have to replace your expensive micrometers, vernier calipers, and other precision tools because specifications are given both in millimeters and in inches, except when special VW metric tools are indispensable (such measurements are given only in millimeters).

Volkswagens are constantly being improved and sometimes such changes—both in parts and specifications—are made applicable to older VWs. Thus, a replacement part to be used on an older VW may not be the same as the part used in the original installation. Such changes are noted in this Manual. If a specification given in this Manual differs from one in an earlier source, disregard the earlier specification. The specifications in this Volkswagen Official Service Manual are accurate as of the publication date of this Manual.

Volkswagen offers an extensive warranty. Therefore, before deciding to repair a VW that is covered by the new-car warranty, consult your Authorized VW Dealer. You may find that he can make the repair either free or at minimum cost.

Volkswagen of America, Inc.

Please read these warnings and cautions
before proceeding with maintenance and repair work.

WARNING —

• Never work under a lifted car unless it is solidly supported on stands intended for the purpose. Do not support a car on cinder blocks, hollow tiles or other props that may crumble under continuous load. Do not work under a car that is supported solely by a jack.

• If you are going to work under a car on the ground, make sure that the ground is level. Block the wheels to keep the car from rolling. Disconnect the battery ground strap to prevent others from starting the car while you are under it.

• Never run the engine unless the work area is well ventilated. Carbon monoxide kills.

• Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing, or necklace when you work near machine tools or running engines. If your hair, clothing or jewelry were to get caught in the machinery, severe injury could result.

• Disconnect the battery ground strap whenever you work on the fuel system or the electrical system. When you work around fuel, do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.

• Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the car. Make sure its bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

• Catch draining fuel, oil, or brake fluid in suitable containers. Do not use food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store the oily rags, which can ignite and burn spontaneously.

• Finger rings should be removed so that they cannot cause electrical shorts, get caught in running machinery or be crushed by heavy parts.

• Keep sparks, lighted matches and open flame away from the top of the battery. If hydrogen gas escaping from the cap vents is ignited, it will ignite gas trapped in the cells and cause the battery to explode.

• Always observe good workshop practices. Wear goggles when you operate machine tools or work with battery acid. Gloves or other protective clothing should be worn whenever the job requires it.

CAUTION —

• If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this Manual, we suggest you leave such repairs to an Authorized VW Dealer or other qualified shop. We especially urge you to consult your Authorized VW Dealer before attempting any repairs on a car still covered by the new-car warranty.

• Before starting a job, make certain that you have all necessary tools and parts on hand. Read all instructions thoroughly; do not attempt shortcuts. Use tools appropriate to the work and use only replacement parts meeting VW specifications. Makeshift tools, parts, and procedures will not make good repairs.

• Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use such tools to tighten fasteners, especially on light alloy parts.

• Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond, or lake. Consult local ordinances that govern the disposal of wastes.

Letters from Manual users suggest that the following rules need to be emphasized.

• **The air cleaner** should always be installed before you adjust the ignition timing, the idle speed, or the idle mixture.

• Always check and adjust the ignition timing while the engine is running, using a **stroboscopic timing light**. Do not attempt to adjust the timing with the engine turned off, which was the procedure used on early VWs.

• Contrary to the mistaken instruction given in the **1972 Owner's Maintenance and Repair Guide**, it is never necessary to make an additional timing mark on the crankshaft pulley before you adjust the ignition timing. Set the ignition timing using the existing V-shaped notch.

• During routine maintenance, adjust the **idle speed only**. The idle mixture does not require adjustment unless (1) exhaust emissions are excessive; (2) the engine has had major repairs; (3) the carburetor has been replaced or rebuilt on a 1970 through 1974 model; or (4) the intake air sensor has been replaced or repaired on a 1975 or later model.

• Never try to adjust **the idle speed** until you have regapped or replaced the spark plugs, adjusted the valves, and set the ignition timing to specifications. The engine must be thoroughly warmed up when you adjust the idle speed.

• Never try to adjust the idle speed by turning the **throttle valve adjustment screw** (the procedure used on most other cars and on earlier model VWs). Doing this will upset the spark advance settings. Use only the idle speed adjustment procedure described in the **FUEL SYSTEM** or **FUEL INJECTION** sections of this Manual.

• After you have adjusted the idle speed, **recheck the ignition timing**. If the idle speed is correct and the ignition timing has not changed, you have adjusted the idle speed correctly.

• Before you adjust the idle mixture with an **exhaust gas analyzer**, always disconnect the evaporative emission control hose that connects the charcoal canister to the air cleaner. Otherwise, fuel tank vapors may upset the accuracy of the analyzer readings.

• Do not adjust the **valves** to less than the 0.15-mm (.006-in.) clearance specified in this Manual. The older, outdated clearance specification which may be given on an engine decal or in the Owner's Manual, has been superseded.

• Always adjust the valves while the engine is **cold** (oil temperature no more than 50°C (122°F)). Never attempt to adjust the valves with the engine hot or running.

• Never raise a VW by placing a **jack** under the engine or under the transmission. Doing this may ruin, or seriously damage, the light alloy castings from which these components are made.

Directions for using torque wrenches calibrated in newton meters

In adopting the SI (*Systeme International*) units of measure, which constitute the Modernized Metric System, tool manufacturers are beginning to introduce torque wrenches that are calibrated in newton meters. As metrication proceeds, torque specifications given in foot pounds (ft. lb.) and meter kilograms (mkg) will eventually be replaced by torque specifications given in newton meters (N m or Nm).

At present there are in use too few torque wrenches calibrated in newton meters to justify the inclusion of newton meter torque specifications in this Manual. Nevertheless, if you purchase a new torque wrench we recommend that you try to obtain one that is calibrated in newton meters. Such a tool can easily be used with this Manual by converting the meter kilogram specifications to newton meters.

To convert meter kilograms (mkg) to newton meters simply disregard the decimal point. For example, 3.5 mkg would become 35 Nm. To convert centimeter kilograms (cmkg) to newton meters, point-off the one place with a decimal. For example, 50 cmkg would become 5.0 Nm. These conversions are not mathematically precise (3.5 mkg actually equals 34.3 Nm) but they are adequate for normal workshop purposes.

Section 1

1

BODY AND FRAME

Contents

1

Body and Frame

VW Type 2 vehicles have a full-length ladder-type frame that provides mounting points for the axles, engine, and controls. The frame is welded to the all-steel unit construction body so that the body and frame together form one rigid assembly. Despite detail variations, this basic design has remained unchanged during the model years covered by this Manual.

The Station Wagon, Kombi, Campmobile, Delivery Van, and Pick-Up Truck share the same frame. The frame consists of two channel-section sidemembers, a number of crossmembers, supports, outriggers, and stiffeners—all joined by electric welding. The sidemembers are approximately 50 × 100 mm (2 × 4 in.) in cross section with a wall thickness of about 2 mm (.079 in.). The arched portions of the sidemembers, located above the axles, are considerably deeper and have welded plates to form a box section. On vehicles with the sliding steel roof, Campmobile roof, or sliding doors on both sides, the body structure is further strengthened by reinforcement plates welded beneath the floor panel.

The seat box, integral with the frame, is built up of sheet steel pressings welded to one another and to the frame sidemembers. The body floor panels, seat mounting platform, wheel housings, cab rear panel, and jack brackets are welded to the frame—in addition to being welded to the front, rear, or side panels of the body. This form of construction provides maximum strength with a minimum possibility for leaks and rattles.

The bodies of the Station Wagon, Kombi, Campmobile, and Delivery Van differ only in their window arrangements and trim. The Pick-Up and Double Cab Pick-Up bodies employ construction similar to that of the fully-enclosed models but with additional spot-welded box-section strengthening pillars for the cab. Also, the Pick-Up's cargo platform is made of ribbed 1-mm (.040 in.) steel panels, whereas the floor panels on fully-enclosed models are 0.76 and 0.89 mm (.030 and .035 in.) thick.

While many repairs described in this section can be carried out by car owners, a number of the procedures may be of practical value only to professional mechanics. If you lack the skills, tools, or the workshop necessary for making body adjustments and repairs, we suggest that you leave such work to an Authorized VW Dealer or other qualified shop. We especially urge you to consult your Authorized VW Dealer before attempting repairs on a car still covered by the new-car warranty.

1. GENERAL DESCRIPTION

The Type 2 body (Fig. 1-1) is a welded steel assembly that includes the front and rear ends, the inner and outer side panels, and the roof and floor panels. The sill panels are welded to the side panels, forming two box-section sidemembers.

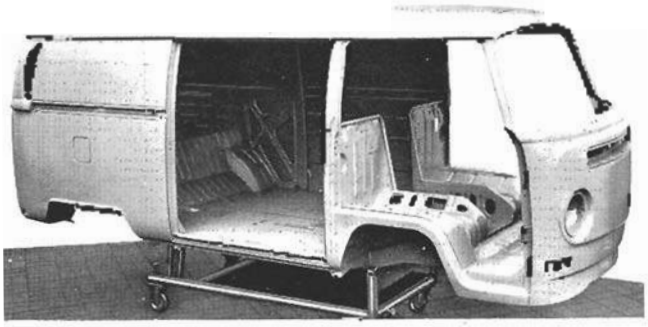


Fig. 1-1. Type 2 body welded to frame. Doors, windows and external parts have not been installed.

Doors and Windows

An exceptionally large variety of door and window arrangements are available on Type 2 vehicles. On all models, the front passenger doors are attached to the front body pillar by two hinges. The Double Cab Pick-Up has two rear passenger doors that are mounted on hinges on the door pillar. Sliding side doors are available on all fully-enclosed models and can be obtained on both sides of the Delivery Van. In addition, the fully-enclosed models have a large rear lid for access to the rear luggage compartment.

Seats

The driver's seat is individually mounted and adjustable front to rear. The angle of its seat back is also adjustable. Head restraints are available as an optional addition to all seats. The seats in the rear passenger compartment can be removed so that large objects can be carried inside the vehicle.

Heating and Ventilation

Fresh air is drawn in by the engine cooling fan and is heated as it passes through the fins of the heat exchangers. The flow of heated air into the passenger compartment is regulated by flaps at the front of each heat exchanger and at the heat outlets. The flaps are controlled by cables that link them to three levers located on the instrument panel.

A fresh-air box in the front of the vehicle collects outside air for cool-air ventilation. The air enters the interior through two vents below the windshield and two outlets in the dashboard. Two additional fresh-air discharge vents are located on the partition between the front seats and the rear passenger compartment. They are individually adjustable and provide fresh air ventilation toward the rear.

The air that enters the interior of the vehicle via the fresh air circulation system is drawn out through openings in the front door frames. The air flow can be regulated by levers in the inside panel of the front doors. Both an air conditioning system and an auxiliary heater are available as optional equipment.

Interior Trim and Sliding Roof

Those portions of the floor panel and wheel housings inside the passenger compartment are soundproofed with thermoplastic damping material, which also insulates against road heat. The floor is covered with synthetic rubber floormats. The upholstery is easily cleaned vinyl that is perforated to improve air circulation.

A sliding steel roof (sun roof) is optional equipment on several Type 2 models. Opening the sliding roof creates a clear space above the driver and front passenger seats. A hand crank controls the roof, which can be adjusted to any position from fully open to fully closed. For safety, the crank should be folded into its recess when not in use.

The interior trim panel for the sliding roof is made of the same perforated vinyl used for the headliner. The trim panel cannot be removed until the sliding roof and one of its side runners have been removed. The sliding roof can be adjusted, however, without completely removing the trim panel from the vehicle.

Campmobile Equipment

A wide variety of special equipment is available for Campmobile models. The center side window is a louvered knob-controlled jalousie-type window with removable mosquito net screening. The roof trim is plywood. Wood-grained material is used for the closets, bench seat frame, storage shelf, and other interior appointments. Campmobile information given in this Manual is directly applicable only to 1968 through 1973 models.

2. MAINTENANCE

Only one maintenance operation, lubrication of the door and lid hinges and locks, is required at regular mileage intervals. This procedure is covered in **LUBRICATION AND MAINTENANCE**. Care of the body, trim, upholstery and windows is also described briefly in **LUBRICATION AND MAINTENANCE**.

3. BUMPERS

The bumpers on 1968 through 1972 models are similar and mounted in the same way. The bumpers and their mountings are different on 1973 and later vehicles and will be covered separately from those of the earlier models.

3.1 Removing and Installing Front Bumper
(1968 through 1972)

Thoroughly clean the exposed threads on all bumper mounting bolts before you attempt to remove them. If corrosion is evident, or if the nuts or bolts are difficult to turn, apply penetrating oil to the threads.

To remove:

1. Remove the two side support bolts located just ahead of each front wheel as shown in Fig. 3-1.

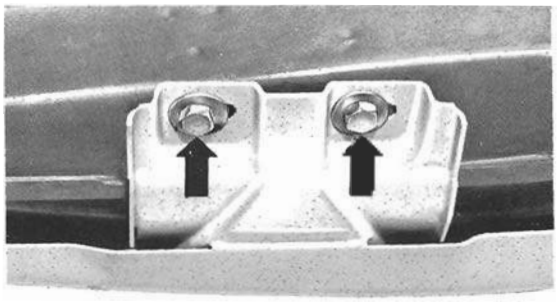


Fig. 3-1. Bolts and washers (arrows) that hold the front bumper side supports on the body

2. Remove the bolts indicated in Fig. 3-2 from one bumper bracket.

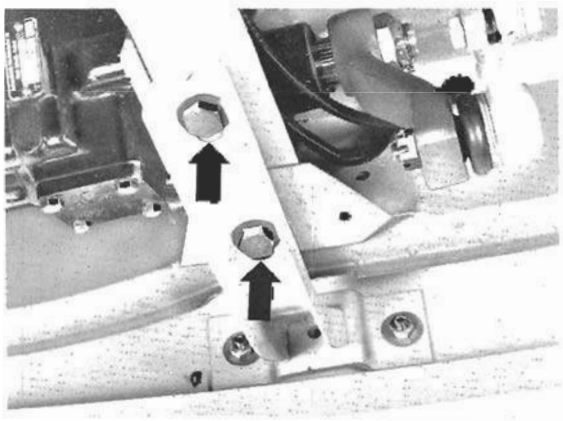


Fig. 3-2. Bolts that hold bracket on frame side member

NOTE —
On later models the towing eye is held by the bracket bolts and will come off when the bracket is unbolted from the body.

3. Place a support under the unbolted end of the bumper or have someone hold it. Then remove the two bolts from the other bracket and take the bumper off the car.

4. To remove the bracket from early models, remove the nuts and bolts indicated in Fig. 3-3; on later models remove the nuts and bolts indicated in Fig. 3-4.

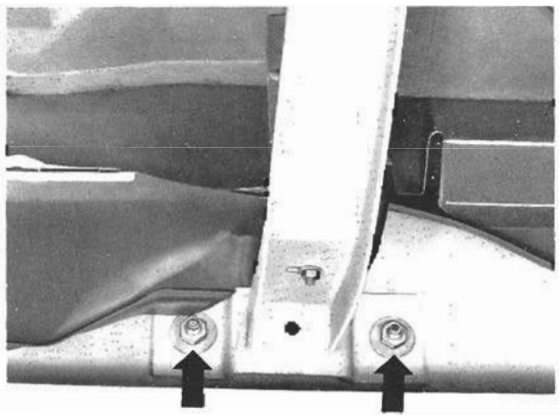


Fig. 3-3. Nuts and bolts (arrows) that hold early bracket on bumper

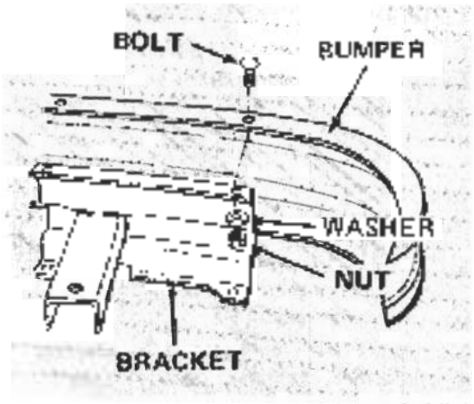


Fig. 3-4. Nuts and bolts that hold side bracket on bumper

5. To remove the end pieces, take out the three nuts and bolts that hold them on the bumper. Be careful not to damage the rubber seal.

Installation is the reverse of removal. Loosely install the assembled bumper and brackets on the vehicle. Then, by sliding the brackets and side supports on their elongated bolt holes, obtain a uniform gap between the bumper and the body. When the bumper is properly aligned, torque the bolts to 3.5 mkg (25 ft. lb.).

3.2 Removing and Installing Front Bumper (from 1973)

The one-piece front bumper installed on 1973 and later models is bolted on an energy-absorbing support. The bumper is removed by taking out the four bolts, one of which is indicated in Fig. 3-5. Installation is the reverse of removal. Torque the bolts to 3.5 mkg (25 ft. lb.).

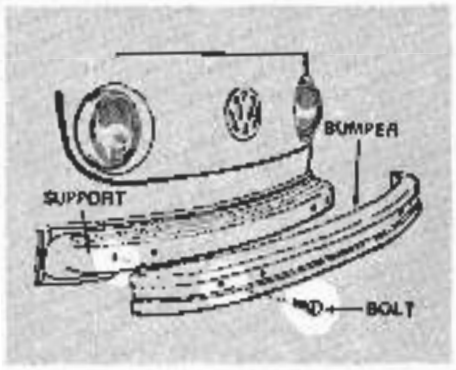


Fig. 3-5. Front bumper removal and installation on 1973 and later models

3.3 Removing and Installing Rear Bumper (1968 through 1972)

The gravel guard on late rear bumpers can be removed and installed without removing the bumper. See Fig. 3-6.

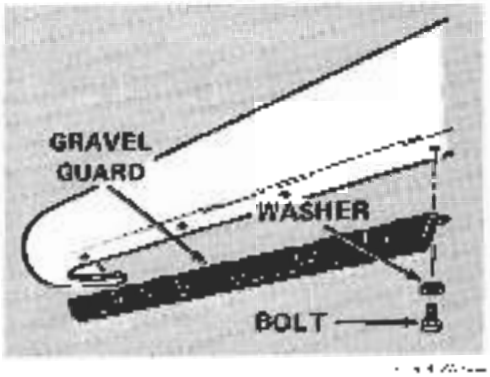


Fig. 3-6. Removal and installation of gravel guard

To remove bumper:

1. Remove the bolts and nuts at both sides of the vehicle that hold the cover plate to the body (Fig. 3-7).
2. Remove the two bolts that hold one of the bumper brackets to the frame sidemember.

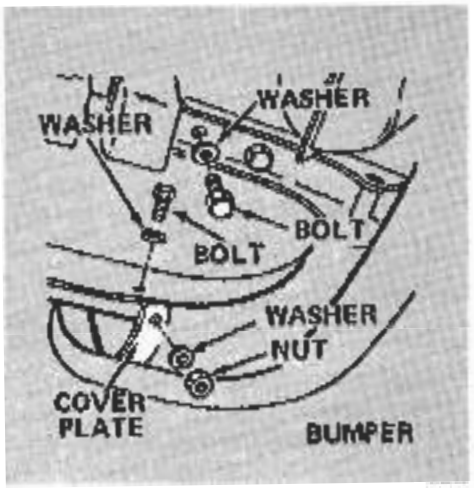


Fig. 3-7. Nuts and bolts that hold rear bumper

3. Place a support under the unbolted end of the bumper or have someone hold it. Then remove the two bolts from the other bracket and take the bumper off the car.
4. To remove the brackets, remove the nuts shown in Fig. 3-8.

NOTE

Thoroughly clean the exposed threads. If corrosion is evident, or if the nuts are hard to turn, apply penetrating oil.

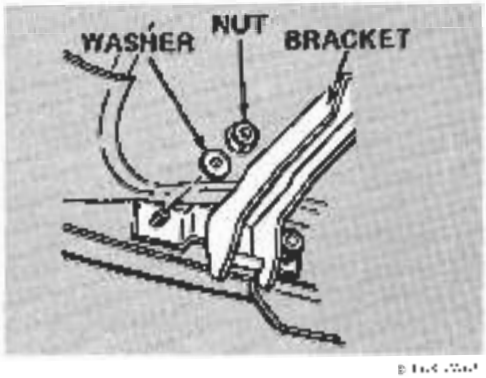


Fig. 3-8. Bracket being removed from rear bumper

5. To remove the cover plate, remove the nuts and bolts shown in Fig. 3-9.

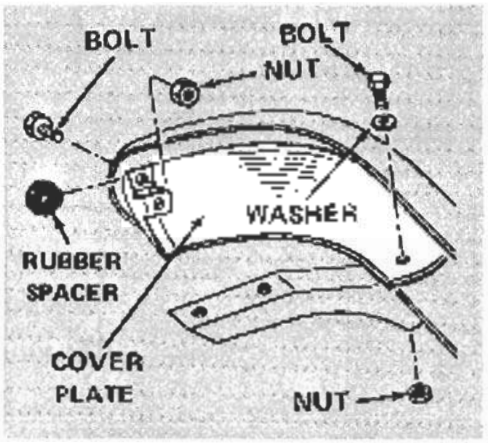


Fig. 3-9. Cover plate being removed or installed on rear bumper

Installation is the reverse of removal. Be careful not to damage the rubber spacers by overtightening the bolt on the cover plate. Loosely install the assembled bumper and brackets on the vehicle. Then, by sliding the brackets and cover plate on their elongated bolt holes, obtain a uniform gap between the bumper and the body. When the bumper is properly aligned, torque the bracket bolts to 3.5 mkg (25 ft. lb.). Do not overtighten the bolts that hold the cover plates on the body.

3.4 Removing and Installing Rear Bumper (from 1973)

To remove the rear bumper from 1973 and 1974 vehicles, remove the two bracket-securing bolts (see Fig. 3-10).

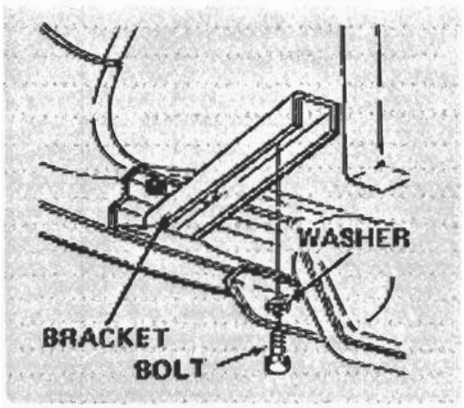


Fig. 3-10. One of the two bolts that hold the rear bumper bracket on the frame sidemember

Place a support under the unbolted end of the bumper or have someone hold the bumper. Then remove the two bolts from the other bracket and take off the bumper. If necessary, remove the brackets as shown in Fig. 3-11.

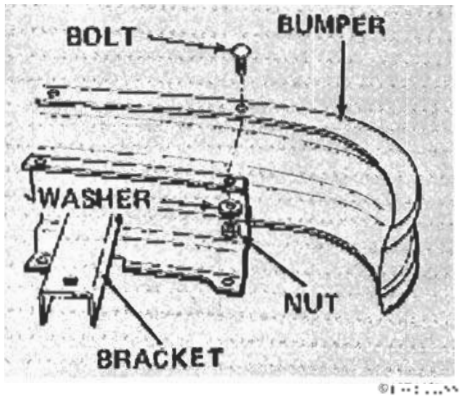


Fig. 3-11. Bracket being removed or installed on rear bumper of 1973 & 1974 vehicle

Installation is the reverse of removal. Loosely install the assembled bumper and brackets on the vehicle. Then, by sliding the brackets on their elongated bolt holes, obtain a uniform gap between the bumper and the body. When the bumper is properly aligned, torque the bracket bolts to 3.5 mkg (25 ft. lb.).

4. FUEL FILLER FLAP

The fuel filler flap does not lock and is discontinued on 1974 and later models. It can be removed by taking out the two Phillips head screws indicated in Fig. 4-1. The rubber bulfers can also be pried out and replaced. During installation, make sure that the flap contacts the body evenly all around before tightening the screws.

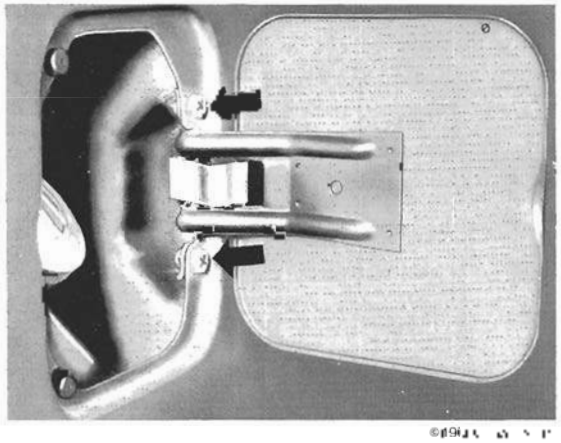


Fig. 4-1. Screws (arrows) that hold fuel filler flap

5. DOORS

In addition to the front doors and the sliding side door, the door locks and windows are also covered here.

5.1 Removing and Installing Front Door

If the same door is to be reinstalled, mark the position of the hinges on the body. This will prevent your having to align the door later. From Chassis No. 236 2126 032 new hinges (Part No. 281 831 405) are used on the front doors. When installing a new door on an earlier vehicle, you must also install the new-type hinges, which are maintenance-free and do not require oiling. However, if you press out the hinge pins, you must be careful not to damage the teflon bushing when the pin is reinstalled. Otherwise the hinge will jam and may then require periodic lubrication.

To remove:

1. Take the circlip off the pin for the door check strap. Remove the pin and disconnect the strap.
2. With the door solidly supported so that the upper hinge will not be bent or broken by the door's weight, remove the two Phillips head (or socket head) screws that hold the lower hinge to the hinge pillar (Fig. 5-1). If the screws are rusted tight, loosen them with an impact driver.
3. With the door supported, remove the two Phillips head (or socket head) screws from the upper hinge and remove the door together with its hinges.

Fig. 5-1. Door check strap and front door hinges (late models have socket head hinge screws)

To install:

1. Inspect the rubber weatherstrip around the door. If it is cracked or deformed, replace it.

   NOTE —
   Before replacing a weatherstrip, clean away all the old adhesive with solvent. Install the new weatherstrip with trim cement.

2. If a new door is being installed, remove the lock striker plate from the lock pillar.
3. If the original door is being installed, mount the hinges with reference to the marks you made before removing the door. If a new door is being installed, do not fully tighten the hinge mounting.

   NOTE —
   The hinges are screwed to movable threaded plates. This makes it possible to shift the position of the door in its opening for alignment purposes.

4. To align a new door, position the door in the door opening so that it contacts the weatherstrip evenly all around and the door's trim molding is in line with the trim molding on the side of the body.
5. After the door is aligned, tighten the hinge mounting screws. Set Phillips head screws firmly with an impact driver.
6. Attach the door check strap to its bracket with the pin and circlip.
7. Install the lock striker plate and adjust it as described in **5.2 Adjusting Door Striker Plate.**

5.2 Adjusting Door Striker Plate

(all doors and lids)

After installing a replacement door, adjust the striker plate so that the rear edge of the door aligns with the body. The striker plate should also be adjusted if the door rattles or requires excessive force to close and lock. A door rattle that persists even after you have made all possible adjustments indicates a worn rubber wedge. You can correct the condition either by installing a 0.50-mm to 1.50-mm (.020-in. to .060-in.) shim between the wedge and the striker plate, or by replacing the rubber wedge. The first three steps in the adjustment procedure will tell you whether such adjustment or replacement is necessary.

To adjust:

1. Take out the two large screws and remove the striker plate. Check the door alignment and, if necessary, correct it by moving the hinges as described in **5.1 Removing and Installing Front Door.**

2. Insert the striker plate bottom first in the latch. Press the latch down into its fully locked position. Then turn the striker plate as indicated in Fig. 5-2.

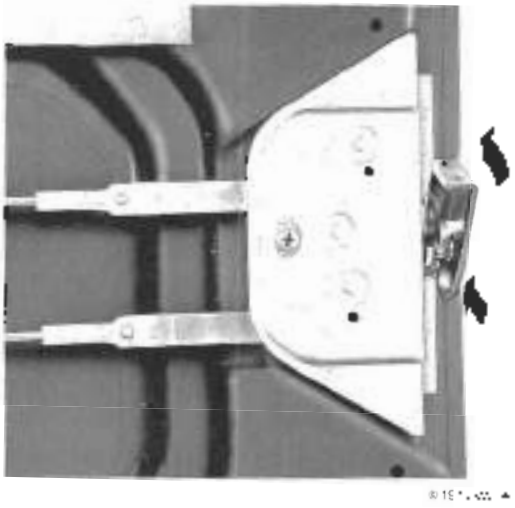


Fig. 5-2. Striker plate being positioned on door latch. Push in at button, then rotate striker up.

3. If you can move the striker plate vertically as indicated in Fig. 5-3, the rubber wedge is worn. Either add shims between the rubber wedge and the striker plate or replace the rubber wedge. If lack of lubrication has caused the pin on the striker plate to wear, replace the entire striker plate.

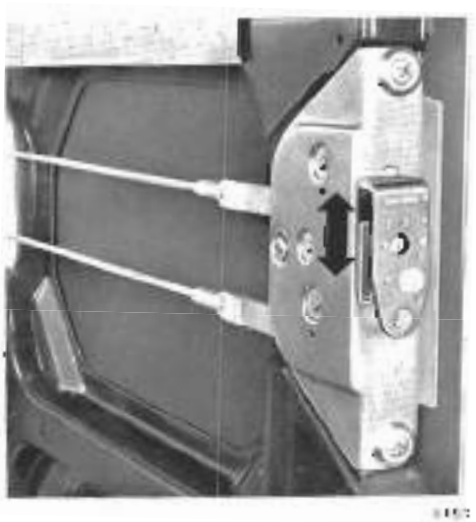


Fig. 5-3. Undesirable vertical movement (arrow).

NOTE —
To install shims, remove the two Phillips head screws in the angled part of the striker plate. Insert the shim as shown in Fig. 5-4, then reassemble.

1. Rubber wedge 2. Shim 3. Striker plate

Fig. 5-4. Position of shim in striker plate.

NOTE —
To correct either a misalignment between the door and front body or a lack of uniformity in the gap between the door and body, adjust the hinges and not the striker plate. Only misalignment (vertical or horizontal) between the door and rear body should be corrected by adjusting the striker plate.

4. After correcting any excessive wedge play, correct any misalignment between the door and rear body. To do this, install the striker plate in its centered position on the lock pillar.

5. Close the door. Then see if the door aligns with the rear body. If necessary, adjust the striker plate as indicated in Fig. 5-5.

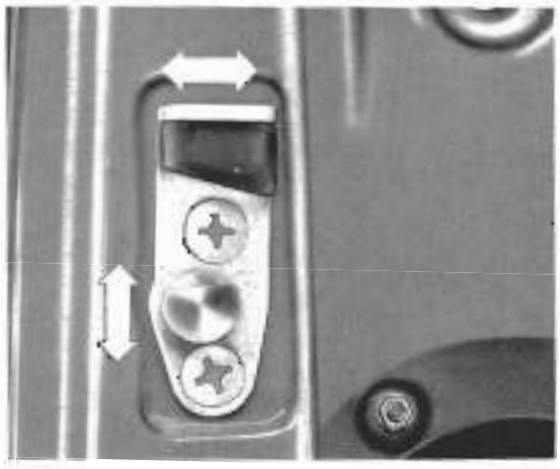


Fig. 5-5. Adjustments for correcting door misalignment. Move striker plate as indicated by top double arrow until door closes flush with side of body. Move the plate as indicated by the side (double) arrow to align the door (on) with the rear body trim.

6. After aligning the door, grasp the door handle and feel for play between the lock and the striker plate. If there is play or if the door will not latch, rotate the striker plate as indicated in Fig. 5-6. If the door is hard to close or if the handle works stiffly, rotate the striker plate in the opposite direction.

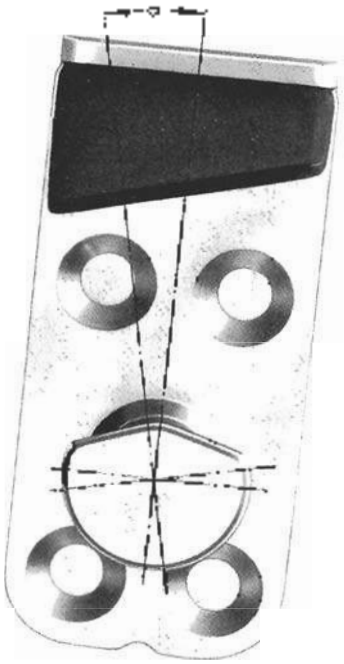


Fig. 5-6. Striker plate turned from vertical as indicated by arrow. This moves the wedge closer to the door latch. Notice the point at the center of the striker plate lug about which the striker plate is turned.

NOTE —
If the striker plate has been set too high, the door will be hard to open with the press button and will drop slightly as it swings open. If the plate has been set too low, the door will spring out of its locked position when slammed or barely engage the secondary latch position.

5.3 Removing and Installing Front Door Trim Panel

Only the air duct installed on new vehicles since April 1971 (beginning with chassis No. 221 2197 035) is available as a replacement part. If the late duct must be installed on an earlier model, the trim panel must be reworked as indicated in Fig. 5-7. Replacement trim panels already have the correct holes for the new air duct.

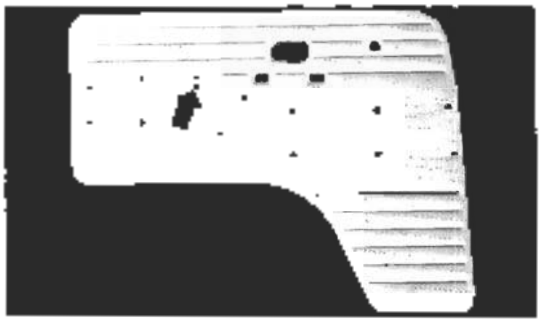


Fig. 5-7. Trim panel modification. A round hole must be drilled as indicated by the arrow. The slotted holes have been provided where necessary, to make possible the installation of earlier type air duct.

To remove trim panel:

1. Remove the screws indicated in Fig. 5-8. Then remove the two similar screws at the opposite end of the air duct.

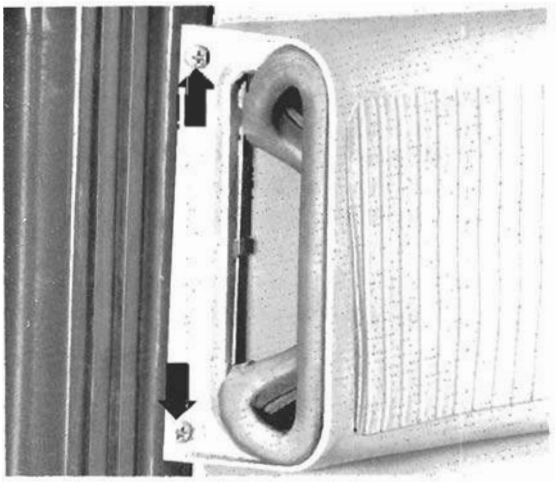


Fig. 5-8. Screws in edge of air duct (arrows). The rubber seal has been pushed aside for access to the screws.

2. Remove the two screws that hold the door pull handle. Then remove the pull handle.
3. Pry the plastic trim off the window crank. Remove the Phillips head screw that holds the crank on the window lifter shaft and remove the crank and the escutcheon.

NOTE —
The screw is held by Loctite® and requires a properly fitting Phillips screwdriver to snap it free.

4 Pry the finger pull out of the lock release lever escutcheon. Then remove the screw indicated in Fig. 5-9.

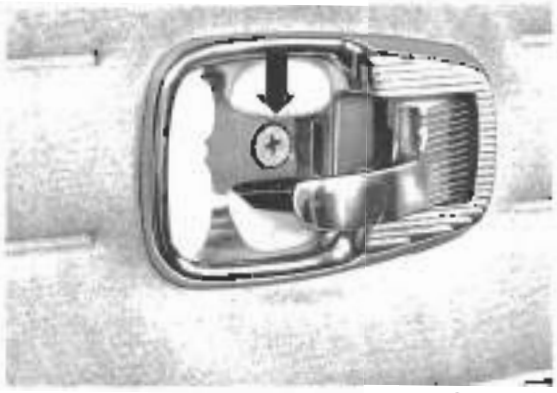


Fig. 5-9. Screw (arrow) to release lever bracket

5 Using a wooden wedge, pry off the trim panel all around the door.

6 Remove the trim panel. On some vehicles, there is a hook that engages a hole in the door (Fig. 5-10). When removing the trim panel, pull it away slightly, then lift the panel to unhook it.

Fig. 5-10. Hook (arrow) on the back of trim panel

7 If necessary, pull the plastic sheet off the inner door panel and pry out the seals for the trim panel clips.

8 If necessary, the air duct and the armrest can be dismounted from the trim panel by removing the screws.

Installation is the reverse of removal. If either the plastic sheet over the door inner panel or the rubber seal for the release lever have been removed, reglue them. Install the window crank screw with Loctite®. The crank should point forward and up with the window closed.

If necessary, replace the seal at the front of the air duct. Bend up the eight metal tabs on the frame (Fig. 5-11) to free the seal from the duct. Replacement seals are available in two thicknesses: 12 mm and 17 mm (1/2 and 5/8 in.).

Fig. 5-11 Air duct seal and mounting frame

5.4 Removing and Installing Door Check

If any part of the door check is faulty, the whole unit must be replaced. Individual components are not supplied. However, replacement pins, circlips, and socket head screws are available.

To replace the door check, remove the circlip and take out the check strap pin. Remove the door trim panel as described in **5.3 Removing and Installing Front Door Trim Panel**. Then remove the socket head screws indicated in Fig. 5-12. Installation is the reverse of removal. Lightly lubricate the check strap with multipurpose grease and the various joints with engine oil.

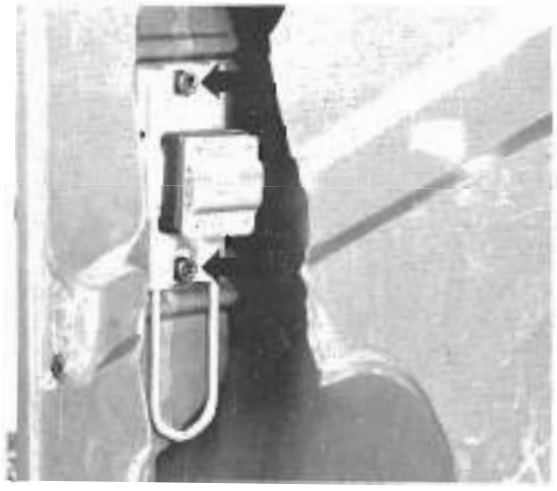


Fig. 5-12 Socket head screws that hold the door check. Remove them with a 5-mm Allen key

5.5 Removing and Installing Door Handle

To remove the door handle, first remove the trim panel as described in **5.3 Removing and Installing Front Door Trim Panel**. Partially remove the plastic sheet from the door inner panel. Then, using a 5-mm Allen key, remove the two socket head screws indicated in Fig. 5-13.

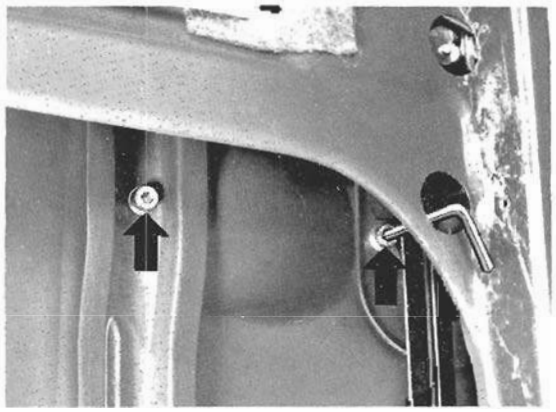


Fig. 5-13. Socket head screws (arrows) being removed

When installing the door handle, clean the lock and the door release trigger, then apply door and lock lubricant. Make sure the rubber gaskets between the handle and outer door panel are in good condition and that they seat properly when you mount the door handle on the door.

5.6 Removing and Installing Window Rear Guide Channel and Run Channel

The window rear guide channel is held at the top by a retaining clip and at the bottom by the bolt indicated in Fig. 5-14.

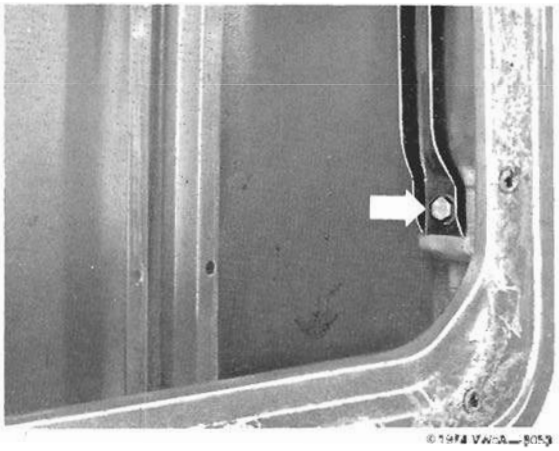


Fig. 5-14. Bolt (arrow) that holds guide channel

Though the rear guide channel seldom requires replacement, it is necessary to remove it for access to the door lock. To remove the guide channel, take out the bolt and pull the guide channel downward.

Before installing, make sure that the retaining clip is tight. Detach the run channel slightly near the window slot in order to see that the guide channel engages the clip properly. The run channel must be knocked into the clip with a blunt wedge of wood or plastic and not with a sharp tool such as a screwdriver.

The run channel should be replaced if it is worn. The rear run channel is held in the window slot with hardened steel clips. The front run channel is simply pressed into the guide channel. The window will operate stiffly after a new run channel has been installed. To correct this, dust the run channel with talcum powder.

5.7 Removing and Installing Front Door Lock, Release Lever, and Pull Rod

The lock release lever and the pull rod must be removed before you can remove the door lock mechanism.

To remove release lever and pull rod:

1. Remove the door trim panel as described in **5.3 Removing and Installing Front Door Trim Panel**. Then remove the two bolts indicated in Fig. 5-15.

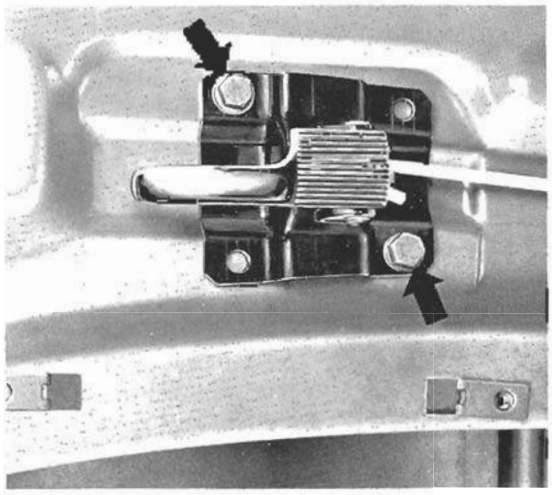


Fig. 5-15. Bolts (arrows) that hold lock release lever

2. Swing the release lever downward at the front and unhook it from the pull rod. On 1969 through 1973 models, also unhook the rod for the locking lever.

3. Working through the opening in the door inner panel, remove the spring clip indicated in Fig. 5-16, then unhook the rod from the door lock.

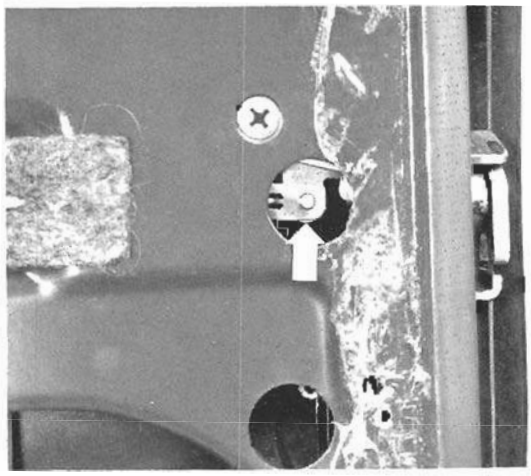


Fig. 5-16. Spring clip for rod on door lock.

Installation is the reverse of removal. Place the rubber packing on the pull rod before you install the lock release lever and do not forget the washers for the screws that hold the release lever on the door. After the rod(s) and release lever have been installed, check the security of the anti-rattle felt on the pull rod. If necessary, move the felt to the correct location and reglue it.

Check to see that the lock operates properly before installing the trim panel. If you install a new pull rod, it is often necessary to correct the length of the rod by bending it. This can be done with a pair of pliers or the bending tool shown in Fig. 5-17.

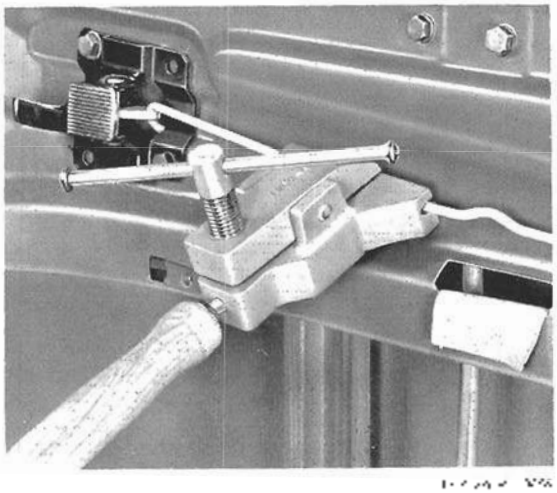


Fig. 5-17. Bending tool being used to alter the effective length of the pull rod.

The door lock (Fig. 5-18) can only be removed after taking off the door handle and the rear guide channel as described under the two preceding headings and then removing the lock release lever and pull rod(s) as just described. On 1968 and on 1974 and later models, you must also unscrew the locking knob at the rear of the window. Remove the three Phillips screws, place the latch in its vertical position, then take the lock out downward complete with its plastic cover.

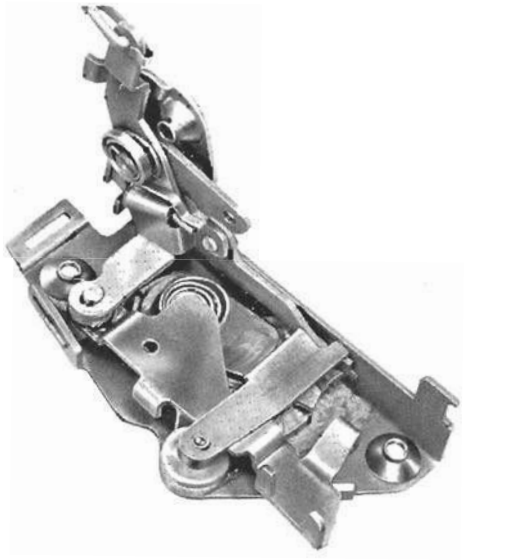


Fig. 5-18. Door lock removed from the door.

Installation is the reverse of removal. Check the locks and the plastic cover. If the lock is worn or the cover does not fit properly, replace the faulty part. Prior to installation, thoroughly lubricate all moving parts of the lock with door and lock lubricant. Check the operation of the lock after you have installed the pull rod(s) and lock release lever.

5.8 Removing and Installing Window Lifter and Door Window Glass

The door window glass can only be removed after you have removed the window lifter mechanism. The window lifter is a crank-operated flexible cable that is carried inside curved tubes. The window lifter is attached to the door panel at three points.

To remove lifter and glass:

1. Remove the door trim panel as described in **5.3 Removing and Installing Front Door Trim Panel**.
2. Remove the plastic sheet that is beneath the door trim panel.

3. Remove the bolt indicated in Fig. 5-19.

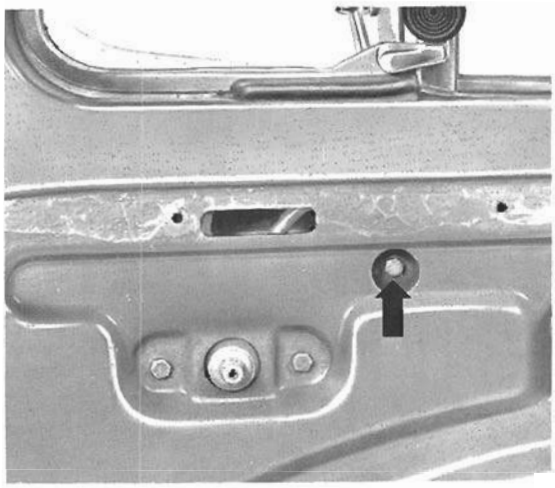


Fig. 5-19. Bolt for the window front guide channel.

4. Lower the window. Then remove the two bolts indicated in Fig. 5-20 and disconnect the window lifter cable bracket from the window lifter channel.

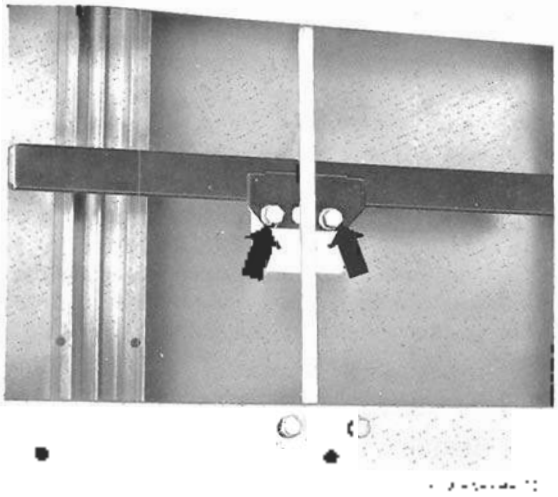


Fig. 5-20. Bolts that hold the window lifter cable bracket to the window lifter channel.

5. Working near the bottom of the door inner panel disengage the plastic cable guide tube from the tab on the door inner panel.

NOTE

To disengage the plastic guide tube, use a screwdriver at the point indicated in Fig. 5-21 to slightly bend the tab away from the plastic guide tube. Then move the plastic guide tube sideways to disengage it.

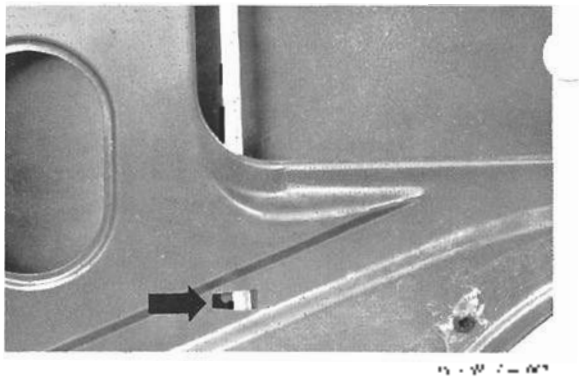


Fig. 5-21. Metal tab (arrow) that must be pried away to free plastic guide tube from door inner panel.

6. Remove the two bolts from the cable drive gear. (The bolts are located on either side of the shaft to which the window lifter crank attaches.)

7. Remove the four bolts indicated in Fig. 5-22.

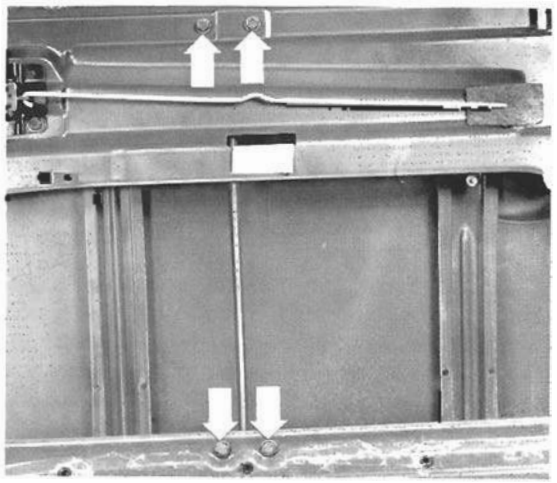


Fig. 5-22. Bolts (arrows) that hold the window lifter assembly to the door panel.

8. Press the window front guide channel forward off its bracket. Then, through the gap thus formed pull the window lifter assembly downward and out of the door.

9. If necessary, slide the door window together with its lifter channel downward and out through the same opening.

10. If the glass must be replaced, knock the lifter channel off using a rubber hammer and a wooden or plastic block. Inspect the rubber in the lifter channel. If it is in poor condition, it too should be replaced.

11. When installing new glass in the lifter channel, the dimension indicated in Fig. 5-23 must be the same on both sides of the glass.

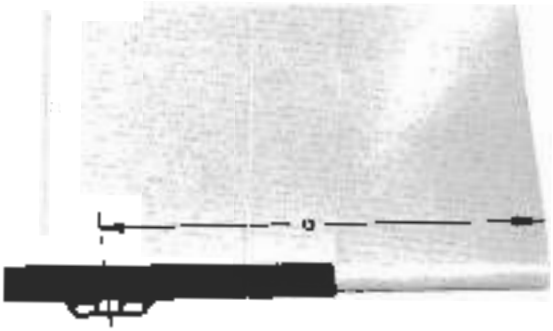


Fig. 5-23. Glass lifting dimension. Dimension a, measured from the center of the lifter channel, must be the same on both edges of the glass.

To install:

1. Check to see that the lifter mechanism works easily. If necessary, lubricate the spiral cable with molybdenum grease. Replacement cables are available and can be installed as described under the next heading. However, if other parts of the lifter are worn or damaged, replace the lifter as a unit.
2. To prevent rattles, make sure that the plastic foam strips at the top of the window lifter tubes are fixed firmly in position.

NOTE
If the cable rattles in the metal guide tube carefully squeeze the guide tube together at the appropriate places.

3. If removed earlier, install the window glass together with the lifter channel.
4. Press the window front guide channel off its bracket for clearance, then insert the window lifter mechanism through the gap thus formed.
5. Using the bolts removed earlier, attach the window winder and the front guide channel. Make sure that you install the dished washers with their convex surface upward.
6. Engage the plastic guide tube in the metal tab on the door inner panel. Then bend the tab around the guide tube and out into the slot in the panel.
7. Pull the window down and loosely attach the cable bracket to the lifter channel. To center the bracket on the lifter channel, temporarily install the crank and raise and lower the window several times. Then tighten the bolts that hold the bracket on the lifter channel.
8. Assemble the remaining parts of the door.

Replacing Window Lifter Cable

Replacement cables for the door window lifter have recently become available. In replacing the cable, the window winder mechanism need not be removed completely from the door. However, it must be unbolted as described in the procedure just given so that the window lifter mechanism can be tilted inside the door. To hold the window fully up while you are changing the cable, insert a punch or screwdriver through one of the openings in the door inner panel.

Push the cable drive (the shaft to which the crank is attached) out of the door inner panel. Then tilt and lower the window lifter assembly until the cable bracket hangs below the bottom edge of the door and the cable drive is accessible through the large opening in the door inner panel. To remove the old cable, temporarily install the crank and wind the cable out as far as possible. Bend up the sheet metal tabs on the guide tube at the point where the cable emerges from the guide tube's lower end. Then pull the old cable out of the guide tube.

Lubricate the new cable with molybdenum grease and insert it into the guide tube until it is engaged by the cable drive. Use the window lifter crank to fully pull in the cable. Then bend down the sheet metal tabs on the end of the guide tube. The remainder of installation is the reverse of removal.

5.9 Removing and Installing Vent Wing and Vent Wing Frame

The vent wing and frame should be removed from the door before attempting to remove the vent wing from the frame.

To remove:

1. Remove the door trim panel as described in **5.3 Removing and Installing Front Door Trim Panel**.
2. Remove the plastic sheet that is under the door trim panel.
3. Working through the openings in the upper part of the door inner panel (Fig. 5-24), remove the one bolt that holds the front guide channel and the one bolt that holds the rear guide channel. Then push the door window fully down.

NOTE
The window must be up for access to the bolts. If you cannot push the door window down after you have removed the bolts, temporarily install the window winder crank and lower the window in the normal way.

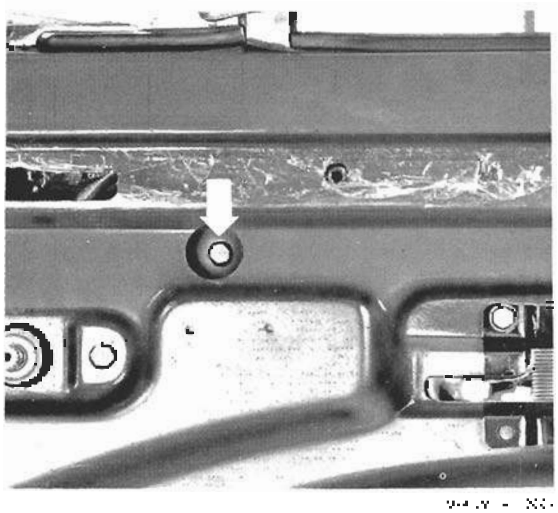


Fig. 5-24. Opening (arrow) for access to guide channel bolt

4. Pull the rear run channel out of its slot at the point adjacent to the top of the front guide channel (Fig. 5-25). Then remove the Phillips head screw that holds the top of the front guide channel.

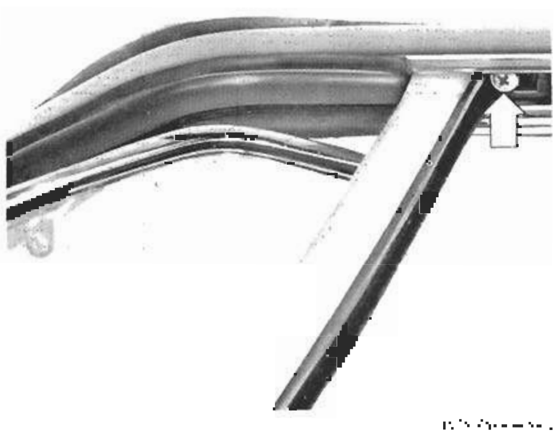


Fig. 5-25. Phillips head screw that holds top of door front guide channel. Rear run channel must be pulled out for access to this screw.

5. Pull out the window slot weatherstrip at the point adjacent to the front guide channel (Fig. 5-26).
6. Pull the vent wing together with its frame toward the door lock (toward the rear edge of the door).
7. Tilt the top part of the vent wing frame toward the inside of the vehicle. Then, being careful not to damage the paint in the window slot, lift the vent wing together with its frame out of the door.

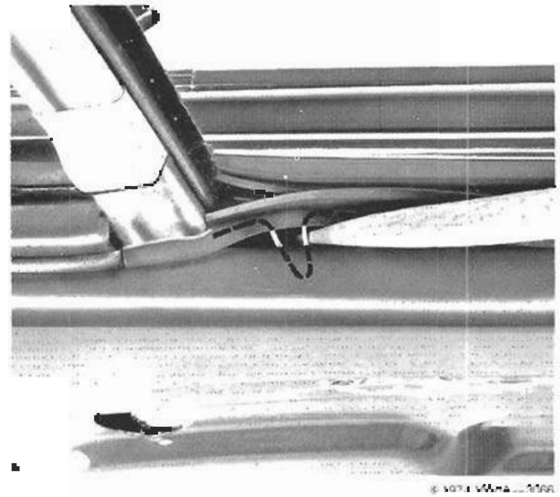


Fig. 5-26. Wooden wedge being used to pry the window slot weatherstrip out of the door panel. The spring wire clip that holds the weatherstrip is shown by the dotted line.

8. To remove the vent wing from its frame, grind off the bottom of the rivet indicated in Fig. 5-27. Then, using a punch, drive the rivet out upward.

Fig. 5-27. Rivet that holds the vent wing to the vent wing frame. Grind the end off the rivet at the point indicated by the arrow.

9. Loosen the clamp screw. Tilt the vent wing outward, then pull the spindle on its lower edge up and out of the clamp in the frame.
10. To install the vent wing in the frame, insert the vent wing in the rubber slot and locate the spindle in the clamp on the frame.

11 Align the upper bracket on the vent wing with the bracket on the frame. Then, making sure that the washers are installed, install a new rivet as shown in Fig. 5-28.

Fig. 5-28. New rivet being installed

12. Adjust the opening-closing friction of the vent wing by turning the clamp screw indicated in Fig. 5-29.

NOTE —
This screw is also accessible with the vent wing and its frame installed in the door. If the vent wing will not stay open, or requires excessive force to open and close, remove the door trim panel. Insert a screwdriver through the opening in the door inner panel and adjust the screw.

Fig. 5-29. Location of adjusting clamp screw (arrow)

13 Using the reverse of the removal procedures, insert the vent wing and frame in the door. If necessary, adjust its position as described in the following procedure before installing the remainder of the door parts.

To adjust vent wing:

1 Lightly coat the vent wing weatherstrip with glycerine, talcum powder, or silicone spray. Then open and close it to check for jamming.

2 If the vent wing jams at side **A**, as given in Fig. 5-30, pull the lower weatherstrip out of the vent wing frame as far as the pivot point. Then place a plastic or wooden wedge on the exposed frame. Using a hammer, lightly tap the frame deeper into the window slot.

3. If the vent wing jams at side **B**, as given in Fig. 5-30, fully open the door window. Loosen the bolt for the front guide channel and pull the vent wing frame and the front guide channel slightly to the rear. Then tighten the bolt.

NOTE —
It may be necessary after making the preceding adjustment to adjust the rear guide channel slightly rearward. To do this, loosen the bolt at the bottom of the channel.

4 If the vent wing glass is not parallel with the front window frame at side **C**, as illustrated in Fig. 5-30, open the vent wing to 90°. Then carefully align the front guide channel with the door window glass. If the vent wing still is not parallel along side **C**, slightly bend the upper hinge brackets, as necessary.

Fig. 5-30. Points for checking vent wing alignment

5.10 Removing and Installing Sliding Door Outside Runner Cover

The outside runner cover (Fig. 5-31) must be removed before you can remove the sliding door.

1 Headstrip 2 Cover 3 Retaining strip

Fig. 5-31. Components of sliding door outside runner cover

To remove:

1 Remove the three Phillips head screws that hold the cover on the body. Their locations are shown in Fig. 5-32 and Fig. 5-33.

NOTE —
On vehicles manufactured after September 1967 you must also remove a cover-securing nut and bolt from inside the passenger compartment.

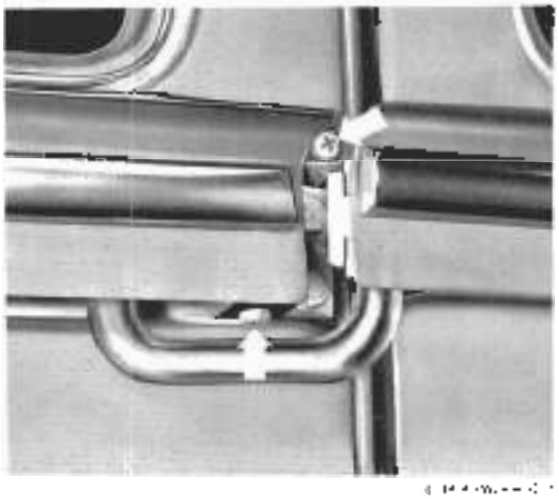


Fig. 5-32. Phillips head screws (arrows) at the front of the outside runner cover

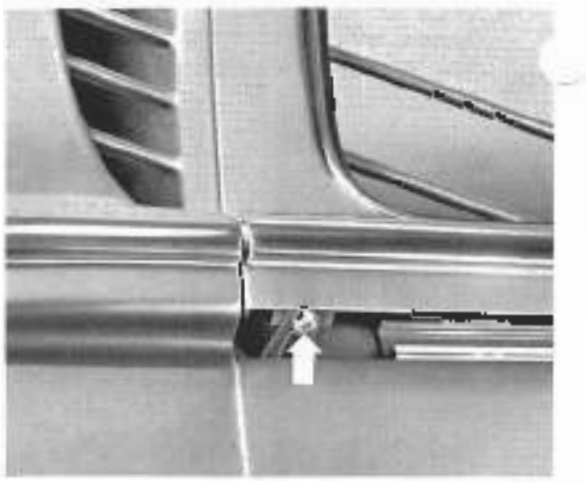


Fig. 5-33. Phillips head screw (arrow) at the rear of the outside runner cover

2. Fully open the sliding door.
3. Loosen the Phillips head screw on the retaining strip (Fig. 5-34) by about 15 turns.

Fig. 5-34. Phillips head screw (arrow) that is threaded into the end of the retaining strip

4 Place a punch against the head of the Phillips head screw. Then, using a hammer, tap the punch sharply to drive the retaining strip toward the rear of the body.

5. Starting at the rear of the sliding door, lift the outside runner cover up and out of the retaining strip.

6. After taking off the cover, fully remove the Phillips head screws from the ends of the retaining strip and take the retaining strip off the body.

To Install:

1. Loosely install the retaining strip. Press the cover into the gap between the body and the retaining strip from above. Then insert the beading.

   NOTE —
   Place a small amount of plastic sealing compound ("dum-dum") between the retaining strip and the body to maintain a gap while the cover and beading are being installed.

2. Install the two Phillips head screws that screw in from below.
3. By turning the Phillips head screw in the front end of the retaining strip, tension the retaining strip while making sure that the beading is correctly positioned.
4. Secure the cover at the lock pillar end with the remaining Phillips head screw. On vehicles manufactured after September 1967, install the nut and bolt from inside the passenger compartment.

5.11 Removing and Installing Sliding Door

Before you can remove the sliding door, you must remove the outside runner cover as described in **5.10 Removing and Installing Sliding Door Outside Runner Cover.**

To remove door:

1. Remove the outside runner cover. Then push the door far enough to the rear so that the guide piece and the roller on the hinge link can be lifted sideways out of the recess in the center runner. See Fig. 5-35.

Fig. 5-35. Roller (arrow) aligned with recess in the top of the center runner.

2. Push the door fully to the rear and lift it until the upper roller can be lifted out of the top runner (Fig. 5-36).

Fig. 5-36. Upper part of sliding door being unhooked. Lift the door as indicated by the left arrow. Then lift the roller at right arrow out of the top runner.

3. Swing the door slightly outward and pull the lower rollers out of the break in the bottom runner (Fig. 5-37) and remove the door.

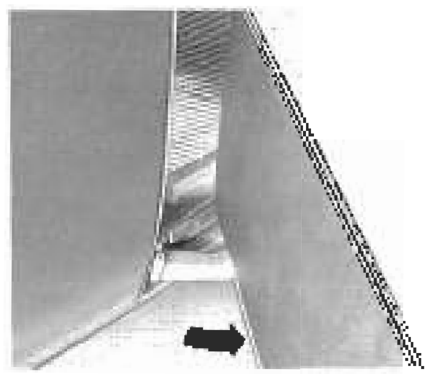


Fig. 5-37. Door being swung outward (arrow) so that the lower rollers can be unhooked from the bottom runner.

To Install:

1. Inspect the runners and, if necessary, straighten them. Check the guide and support rollers on the door. Replace damaged rollers. Lubricate the rollers with multipurpose grease if they turn stiffly.
2. Inspect the rubber weatherstrip around the door opening in the body. If necessary, remove the old weatherstrip, clean away all old adhesive with solvent, then use trim cement to glue a new weatherstrip into place.
3. Insert the door first into the bottom runner and then into the top runner.
4. Push the door forward until the roller and guide can be inserted in the break in the center runner.

5.12 Adjusting Sliding Door

The sliding door is properly adjusted if the gap between the door and the door opening is even all around. The trim or waistline on the door must align with the trim or waistline on the body and the door surface must be flush with the surface of the body.

To adjust:

1. If the door is not in line at the bottom, adjust the lower roller. To do this, loosen the Phillips head screw and the two socket head screws that hold the lower roller bracket. Then insert or remove shims as indicated in Fig. 5-36.

Fig. 5-38. Lower roller adjustment. The roller bracket can be repositioned horizontally or vertically as indicated by the double arrows. Shims are inserted at the point indicated by the right-hand arrow.

2. If the door is not flush with the body at the top, loosen the nut on the top roller shaft. Then adjust the roller as indicated in Fig. 5-39.

Fig. 5-39. Top roller adjustment. Position the roller on the bracket as needed (arrows) to align the door with the body.

3. To prevent excessive vertical door movement, loosen the three Phillips head screws that hold the top roller bracket. Then raise the bracket until the clearance between the roller and runner is as small as possible.

4. To adjust the door gap to a uniform width, close the door. Then loosen the four bolts on the hinge housing and adjust the angle of the hinge link.

5. To check for excessive latch play, press the door firmly near the hinge link. If there is any detectable play, adjust the striker plate (Fig. 5-40).

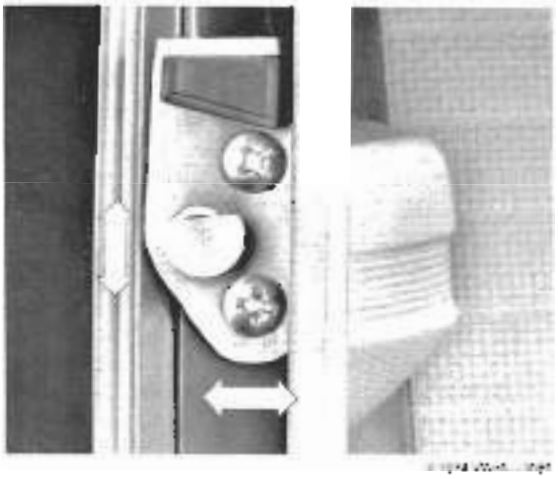


Fig. 5-40. Striker plate adjustment. Loosen the Phillips head screws. Then relocate the striker plate as indicated by the double arrows until all play is removed from the door.

6. To align the door retainer with the rear bracket, loosen the Phillips head screws and shift the position of the retainer as indicated in Fig. 5-41.

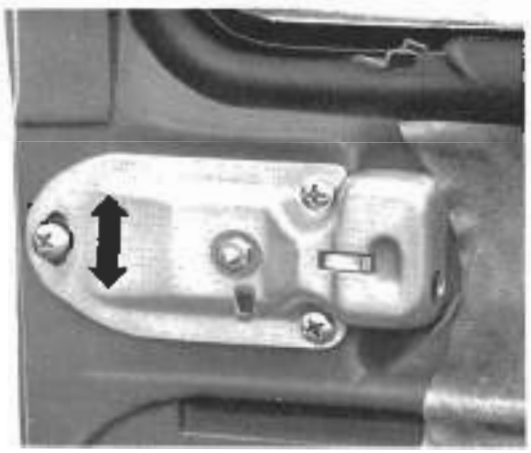


Fig. 5-41. Door retainer adjustment. Shift position of retainer as indicated by double arrow.

7 To adjust the locking plate (Fig. 5-42) for the remote control lock, slightly loosen the two locking plate bolts and then close the door to center the locking plate. Open the door and tighten the bolts. If necessary, up to two spacer shims can be placed behind the locking plate.

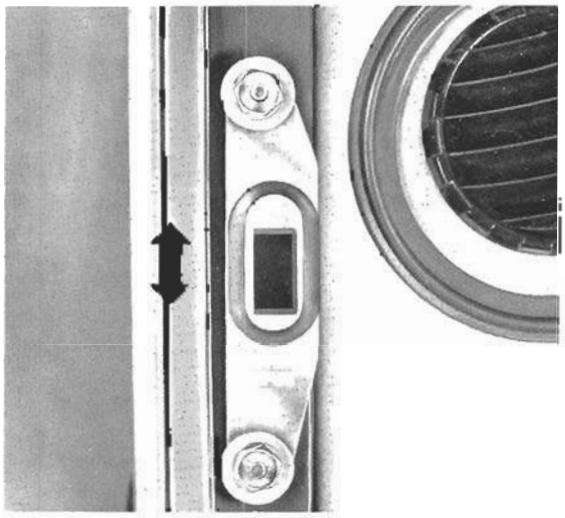


Fig. 5-42. Locking plate adjustment (double arrow)

5.13 Removing and Installing Sliding Door Retainer

To remove the retainer, remove the three Phillips head screws that hold it on the door panel. Then push the connecting rod off the pin on the door retaining catch and withdraw the retainer as shown in Fig. 5-43. Following installation, adjust the retainer as described in **5.12 Adjusting Sliding Door.**

Fig. 5-43. Retainer clamp removed. Note relationship of the pin and the eye in the door retaining catch

5.14 Removing and Installing Remote Control Lock and Center Lock

The door must be removed as described in **5.11 Removing and Installing Sliding Door.** Remove the retainer as described in **5.13 Removing and Installing Sliding Door Retainer.** Then, using a wooden wedge, carefully pry off the door trim panel.

To remove remote control lock:

1 On 1968 through 1970 models, loosen the locknuts on the connecting rods. Then unscrew the connecting rod sleeves from the threaded rods on the lock. Remove the screws indicated in Fig. 5-44.

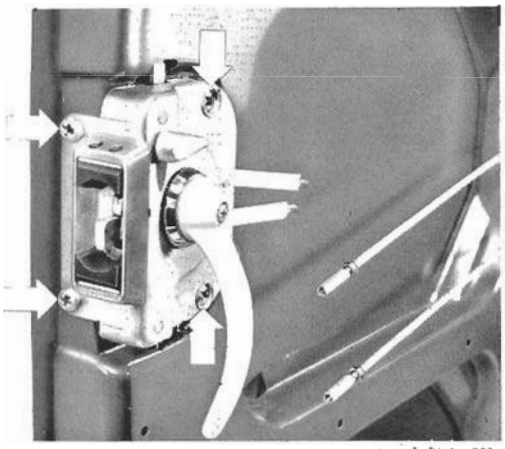
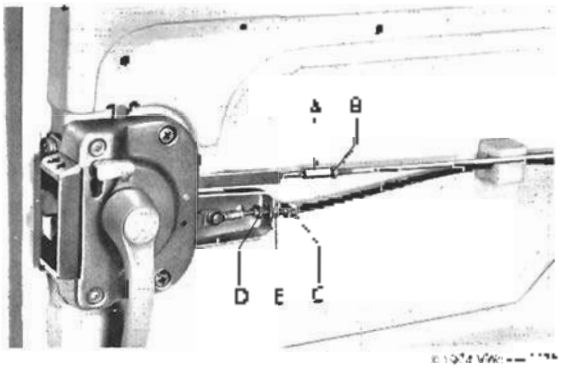


Fig. 5-44. Lock removal. On 1968 through 1970 models, unscrew connecting rods, then take out screws (arrows)

NOTE —
1971 and later models have one cable and one connecting rod. See Fig. 5-45.



A - Rod sleeve
B - Rod locknut
C - Cable adjusting nut
D - Cable locknut
E - Cable adjuster

Fig. 5-45. Remote control lock with cable

2 On 1971 and later models, remove the circlip that holds the cable eye on the lock. Loosen the cable locknut, then screw the cable adjuster inward the remote control lock. Push the cable adjuster out of the opening in the remote control lock. Disconnect the connecting rod as on earlier models, then remove the screws indicated in Fig. 5-46.

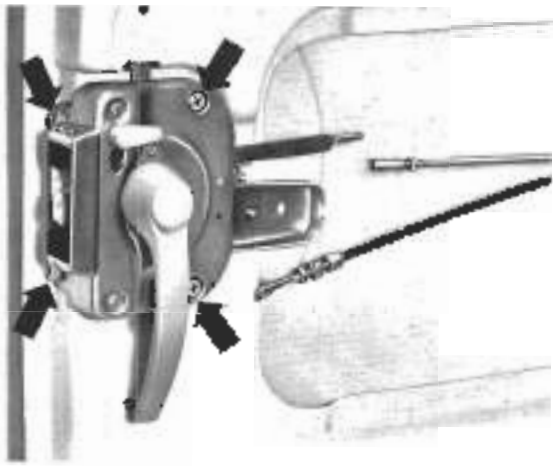
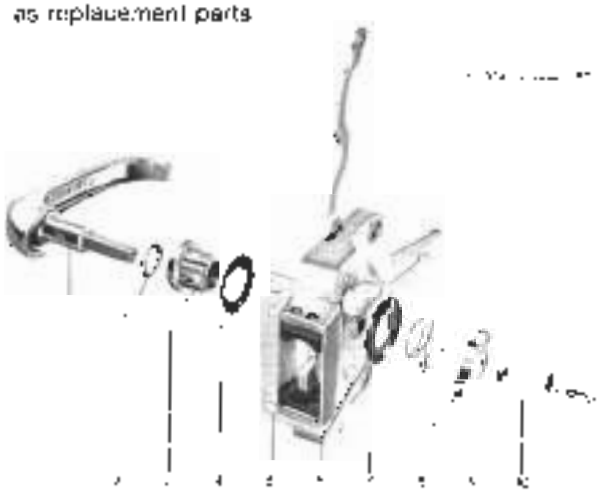


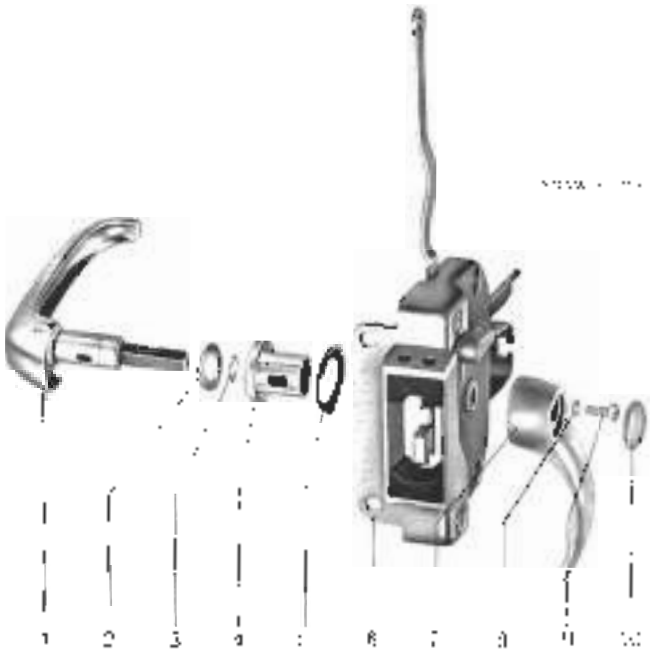
Fig. 5-46 Lock removal (from 1971). Disconnect cable and rod, then take out the screws (arrows)

3 Pull the remote control lock down until its upper control rod is out of the door inner panel, then remove the lock. If necessary, the remote control lock can be disassembled as shown in Fig. 5-47 or Fig. 5-48. The components shown are those available as replacement parts.



1. Outer handle
2. Sealing ring
3. Cylinder escutcheon
4. Gasket
5. Remote control lock
6. Gasket
7. Spring
8. Inner escutcheon
9. Guide piece
10. Inner handle

Fig. 5-47 Components of early lock (1960-1970)



1. Outer handle
2. Sealing ring
3. Guide washer
4. Escutcheon
5. Grommet
6. Remote control lock
7. Inner handle
8. Locking knob
9. Phillips head screw
10. Cap

Fig. 5-48 Components of the lock (from 1971)

Installation is the reverse of removal. Before installing the trim panel, adjust the remote control lock as described in 5.15 **Adjusting Remote Control Lock and Center Lock**. Also adjust the retainer as described in **5.12 Adjusting Sliding Door**.

To remove center lock:

1 Remove the remote control lock. Then remove the Phillips head screws indicated in Fig. 5-49.

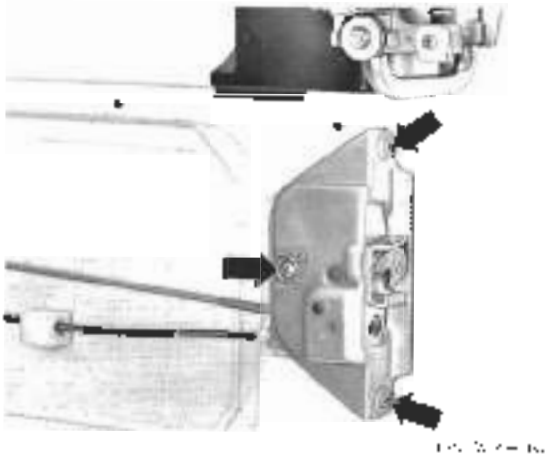


Fig. 5-49 Screws that hold center lock on door

2. Remove the center lock from the door. On 1971 and later models, pull the lock out to the side so that the cable is withdrawn from the rubber guide on the door.
3. If necessary, the connecting rod(s) and cable can be removed from the center lock by prying off the E-clips as indicated in Fig. 5-50.

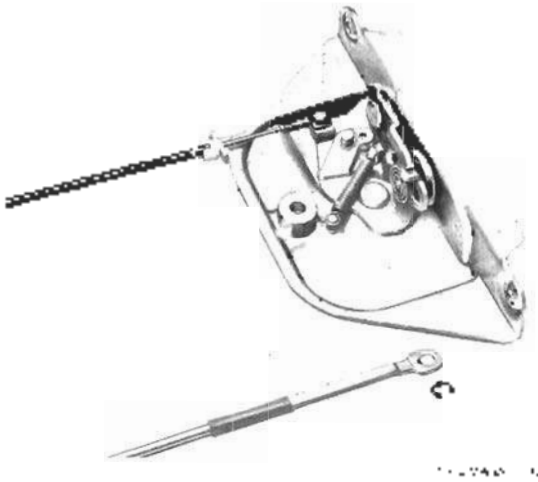


Fig. 5-50. E-clip and connecting rod removed

Installation is the reverse of removal. Inspect all parts particularly the rubber buffers indicated in Fig. 5-51, and replace any parts that are worn or damaged. Lubricate all moving parts with door and lock lubricant. Before installing the trim panels, adjust the center lock together with the remote control lock as described in **5.15 Adjusting Remote Control Lock and Center Lock**. Also adjust the retainer as described in **5.12 Adjusting Sliding Door**.

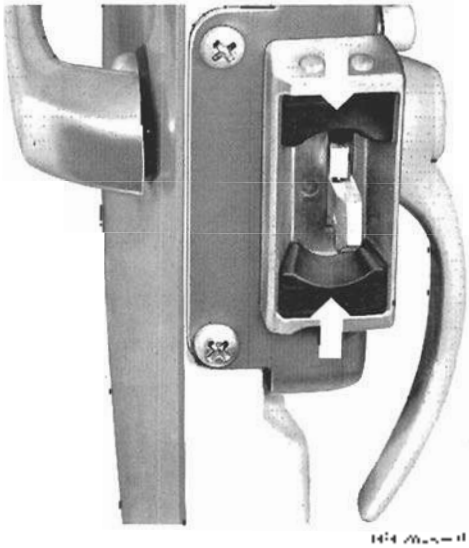


Fig. 5-51. Rubber buffers in center lock

5.15 Adjusting Remote Control Lock and Center Lock

If the door cannot be opened and closed or locked properly after carrying out the adjustments described in **5.12 Adjusting Sliding Door** the adjustment of the connecting rods should be checked.

The procedure for adjusting 1968 through 1970 locks is slightly different from the procedure for adjusting 1971 and later locks. The two procedures are covered separately.

To adjust locks (through 1970):

1. Secure the center lock mechanism with two 4-mm screws as shown in Fig. 5-52 or use suitable punches or nails for the same purpose. Screws, however, can be threaded into the operating levers.

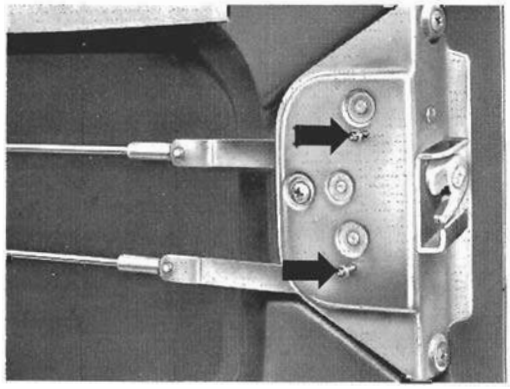


Fig. 5-52. Screws (arrows) being used to secure the operating levers inside the center lock

2. Similarly secure the remote control lock by installing a 4-mm screw or other suitable object through the lock housing and into the lower pull rod.
3. Install the connecting rods on the threaded ends of the remote control lock pull rods. Turn the adjusting sleeves until the connecting rods are just barely tensioned, then tighten the locknuts. Remove the 4-mm screws from the locks.

Check the lock operation. Owing to overlapping tolerances, it may be found that the door locking mechanism does not work satisfactorily despite careful adjustment. In such cases, shortening or lengthening the upper and lower connecting rods will correct the problem. To open the door, it should be necessary to move the outer door handle at least 40 mm (1⅝ in.).

To prevent rattles, make sure that the foam rubber pad at the center of the connecting rods is securely glued to the door inner panel.

To adjust late locks:

1 Secure the center lock mechanisms with a 4 mm screw as shown in Fig. 5-53, or use suitable punches or nails for the same purpose. A screw, however, can be threaded into the operating lever

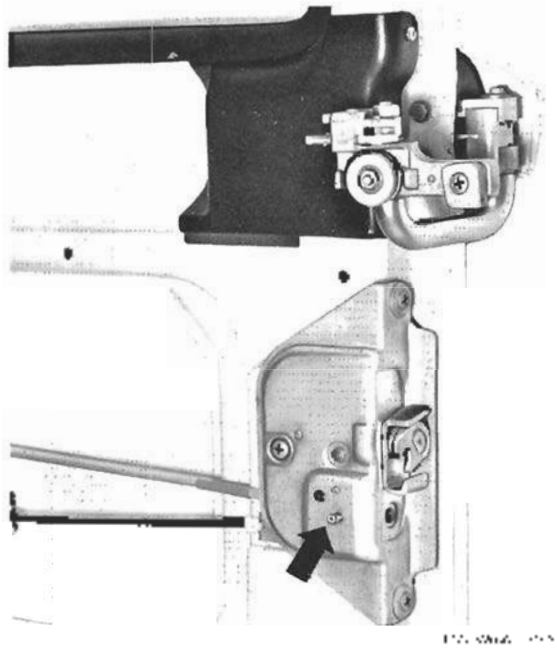


Fig. 5-53 Screw (arrow) being used to secure the operating rod inside the center lock

2 Install the cable eye on the operating lever and secure it with the circlip. Then install the cable adjuster in the notch in the remote control lock.

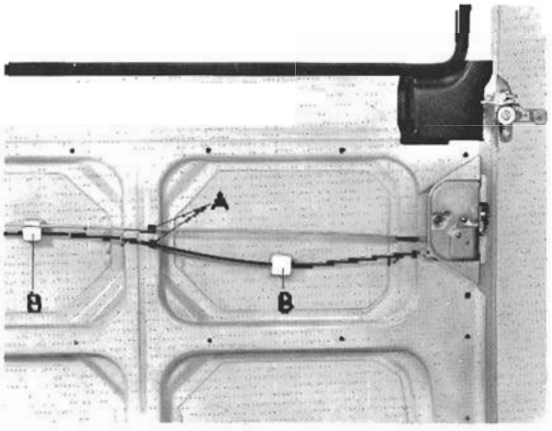
3 To adjust the cable, hand turn the adjusting nut until it is finger-tight. Then tighten the locknut.

4. To adjust the connecting rod, pull the rod light. Screw the threaded sleeve as far as the stop on the lock pull rod. Then tighten the locknut.

5. Remove the 4-mm screw from the center lock.

Check the lock operation. Owing to overlapping tolerances, it may be found that the door locking mechanism does not work satisfactorily despite careful adjustment. In such cases, shortening or lengthening the connecting rod and cable will correct the problem. To open the door, it should be necessary to move the outer door handle at least 40 mm (1⁹⁄₁₆ in.); however, it should not be necessary to move the handle more than 50 mm (2 in.).

To prevent rattles, make sure that the foam rubber blocks and the plastic clips are positioned as shown in Fig. 5-54. They should also be properly glued to the door panels.



A Plastic clips B Foam rubber blocks

Fig. 5-54. Proper position for foam rubber blocks and plastic clips on the door panels

5.18 Removing and Installing Sliding Door Retainer Rear Bracket

The sliding door retainer rear bracket is located at the extreme rear of the center runner. The rear bracket is the part that the retainer latches onto when the door is fully opened.

For access, you must remove the sliding door as described in **5.11 Removing and Installing Sliding Door**. To remove the retainer rear bracket, partially detach the rear trim panel. Then remove the Phillips head screw as indicated in Fig. 5-55.

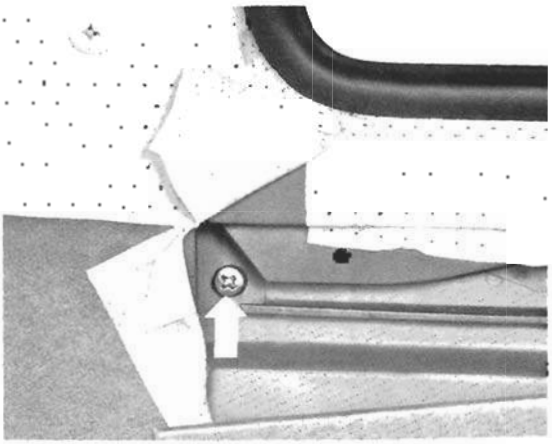
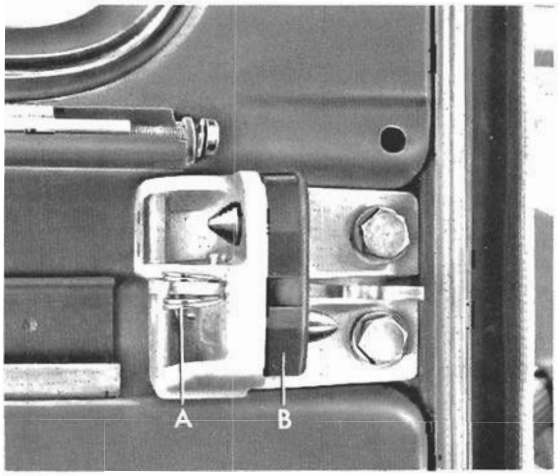


Fig. 5-55. Screw (arrow) that holds the retainer rear bracket main inside the passenger compartment

Working outside the vehicle remove the two bolts and take off the bracket. The bracket, bolts, and replaceable components of the bracket are shown in Fig. 5-56.



A - Spring B - Rubber buffer

Fig. 5-56. Sliding door retainer rear bracket

Installation is the reverse of removal. Inspect the spring and rubber buffer. Replace worn or damaged parts. The retainer rear bracket should be carefully aligned on the panel. After installing the sliding door, it may be necessary to adjust the door retainer as described in **5.12 Adjusting Sliding Door.**

5.17 Removing and Installing Hinge

The components of the hinge are shown in Fig. 5-57. Most of them are available as individual replacement parts.

1 - Return spring
2 - Hinge link
4 - Mounting nut
5 - Lock washer
6 - Roller bracket
8 - Guide block
9 - Roller and bearing
10 - Phillips head screw
11 - Spring washer
12 - Thrust ring
13 - Housing
14 - Circlip
15 - Pivot
16 - Pin
17 - Operating cam
18 - Spring washer
19 - Washer
20 - Lower locking lever
21 - Spacer
22 - Spring
23 - Upper locking lever
24 - Pin
25 - Bolt

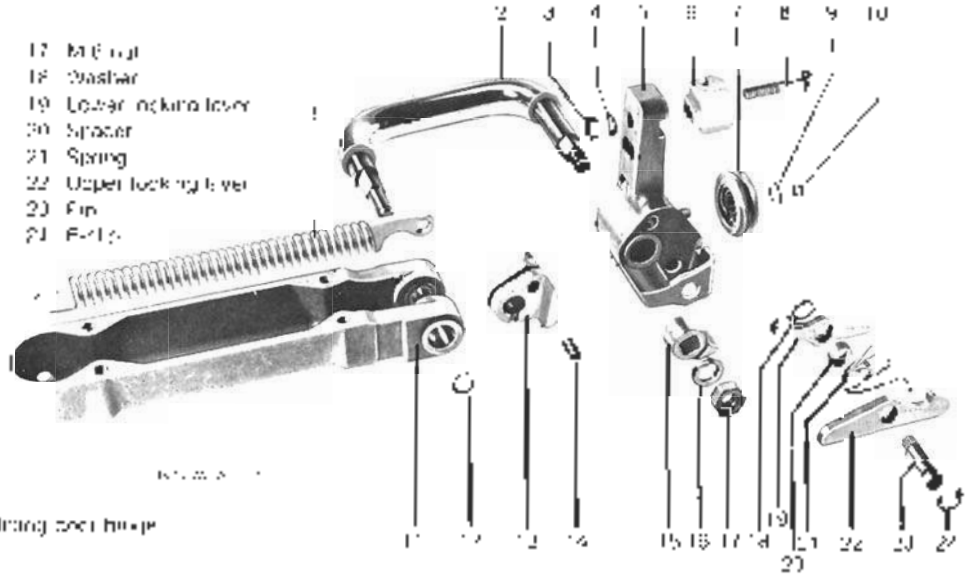


Fig. 5-57. Components of sliding door hinge

The sliding door must be removed as described in **5.11 Removing and Installing Sliding Door** before you can remove the hinge. To remove the hinge from the door, take out the four bolts shown in Fig. 5-58.

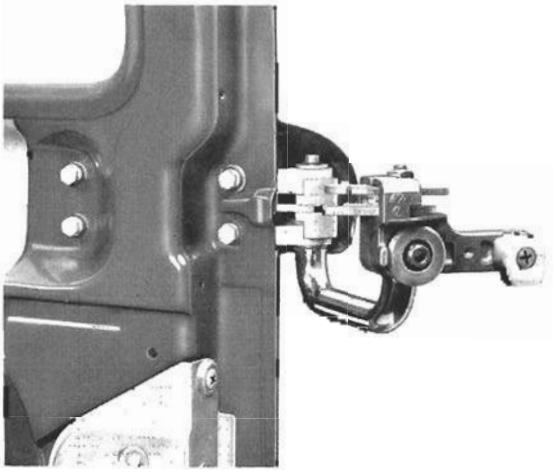


Fig. 5-58. Bolts that hold hinge on door (arrows).

Before you install the hinge, apply engine oil to the pivot points for the hinge link. There are grooves on the pivot so that oil can easily be introduced between the pivot and the housing. Also oil the washers and other parts of the pivot points, but do not oil the roller and bearing or the return spring. Lightly coat the return spring with multi purpose grease. Apply the same lubricant to the roller and bearing, working as much grease as possible into the bearing itself.

Installation is the reverse of removal. Following installation adjust the door as described in **5.12 Adjusting Sliding Door.**

5.18 Removing and Installing Sliding Door Vent Wing

The vent wing pivot spindles are mounted in a stamped steel frame. If the vent wing opens and closes too easily, or if it is difficult to move, the clamp for the lower pivot should be adjusted. To do this, raise the weatherstrip as shown in Fig. 5-58. Then turn the Phillips head adjusting screw until the correct degree of friction is obtained.

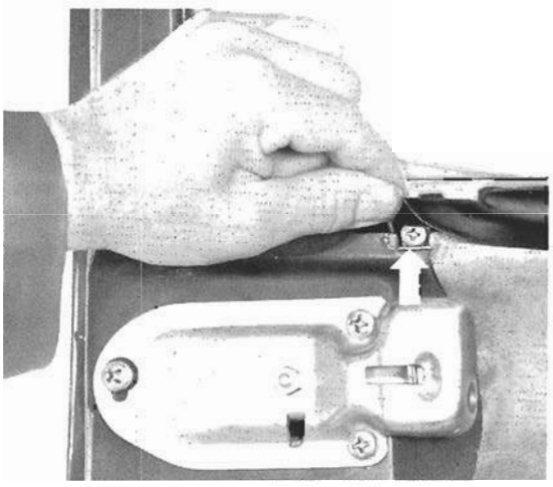


Fig. 5-58. Vent wing adjusting screw (arrow)

To remove vent wing:

1. Bend up the two metal tabs (Fig. 5-60) on the vent wing frame. With the vent wing installed, these will be found in the end face of the door.

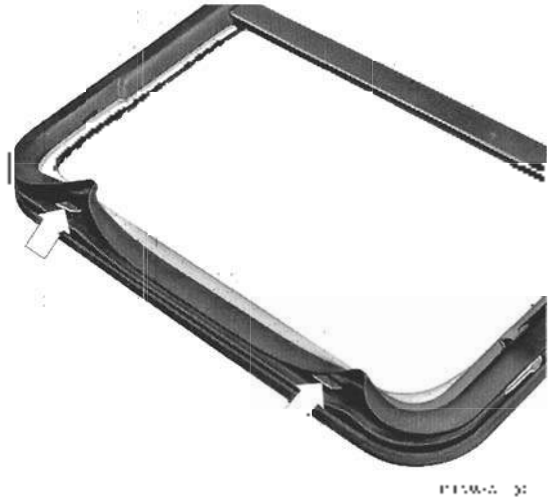


Fig. 5-60. Metal tabs that hold the vent wing frame in the sliding door

2. Hand-press the vent wing, vent wing frame, and weatherstrip out of the window opening.
3. If necessary, remove the Phillips head adjusting screw (Fig. 5-61) from the pivot spindle clamp. Then take the vent wing out of the frame.

CAUTION —
Proceed carefully so that you do not accidentally damage the paint on the frame.

Fig. 5-61. Screw (arrow) that must be removed before you can take the vent wing out of its frame

To install:

1. If the vent wing was removed from the vent wing frame, place a glass installer's cord in the outer lip of the weatherstrip. Then install the vent wing in its frame while pulling out the cord.
2. Check to see that the weatherstrip is properly positioned on the frame and against the vent wing. Then install the adjusting screw and tighten it until the correct degree of pivot friction is obtained.
3. Install the vent wing and frame from the outside of the sliding door. Starting at the top, insert the frame behind the sealing flange in the window opening.

NOTE —
Installation is easier if you first remove the large window from the sliding door.

4. Pull the weatherstrip lip over the flange with a glass installer's cord, making sure that the weatherstrip fits properly all around.
5. To secure the frame and vent wing in the door, bend down the two metal tabs that are on the frame.

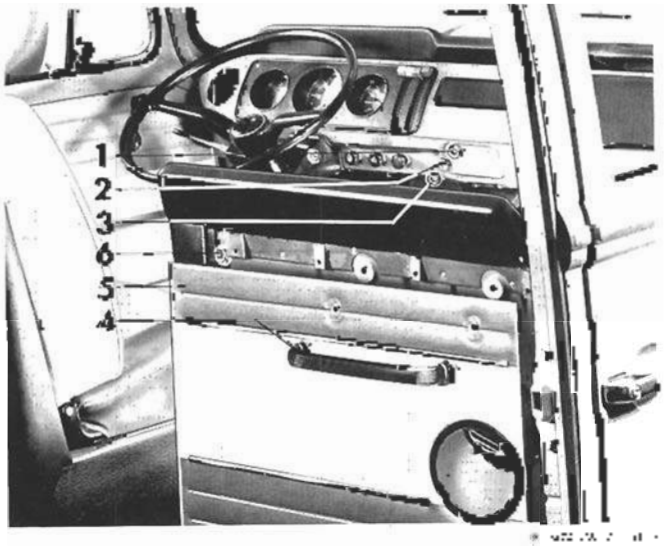
6. SEATS AND INTERIOR TRIM

The seats in the rear passenger compartment can be removed by unbolting their retainers from the floor. To remove the driver's seat, fully lift the adjusting lever, then slide the seat forward and out of the runners. If the seat is hard to move, check the runners on the seat frame. Straighten the runners and remove burrs as necessary. To remove the front passenger seat, lift the front edge of the seat until the loops on the backrest disengage from the retainer on the partition panel. The seat is riveted to the backrest and the two parts must be removed as a unit. Lifting the front of the seat causes the backrest to slide down, thus unhooking it.

When you install the front passenger seat, first engage the seat on the two rear brackets that are welded to the floor. Then lower the front edge of the seat until the backrest hooks on its retainer. If the backrest does not engage the retainer, or if the front of the seat cannot be pushed fully down, loosen the two Phillips head screws and move the retainer loop up or down on the partition panel.

Removing and Installing Partition Panel Trim

Fig. 6-1 shows the trim panel removed. To remove the trim panel, first squeeze the handle together and pull it out (right-hand panel only). Then, using a wooden wedge, carefully pry the trim panel off the partition.



1 Nut (2)
2 Spring washer (2)
3 Flat washer (2)
4 Handle
5 Trim panel
6 Steel clips (5)

Fig. 6-1. Trim panel removed

Installation is the reverse of removal. When you install the handle, squeeze it together, push it through the trim panel, then release it. Check to see that it has hooked solidly to the partition.

Once the right-hand trim panel is off, you can replace the padded strips and the seat mounting trim. However, you must also remove the front passenger seat before you can remove the Phillips head screws indicated in Fig. 6-2 and Fig. 6-3.

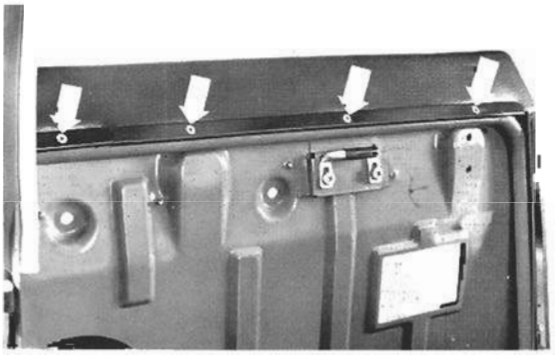


Fig. 6-2. Screws that hold top padded strip

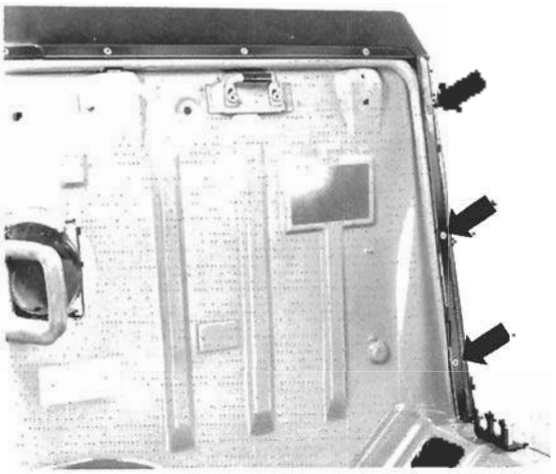


Fig. 6-3. Screws that hold side padded strip

NOTE —
After you have removed the Phillips head screws, take off the plastic trim strip that is installed between the screws and the padded strips.

To remove padded strips, drill out the rivets as shown in Fig. 6-4.

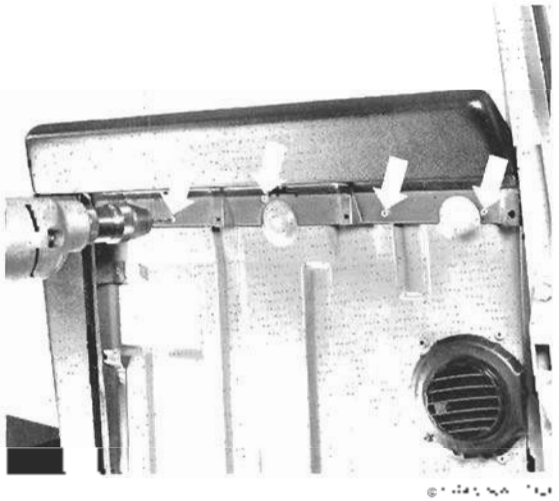


Fig. 6-4. Rivets for padded strips being drilled out. Four similar rivets hold the side padded strip.

Install the new padded strips with pop rivets as shown in Fig. 6-5.

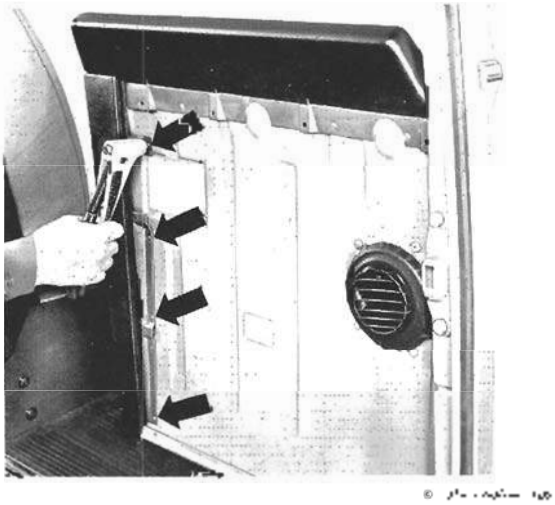


Fig. 6-5. Pop rivets being installed.

NOTE —
The seat mounting trim strip, which is mounted at the bottom of the partition, is held at the top by three rivets. To replace the trim strip, drill out the rivets as described for the padded strips. Then install the new seat mounting trim strip with pop rivets.

Removing and Installing Side Trim Panels

The side trim panels for the rear passenger compartment and for the luggage compartment are shown removed in Fig. 6-6 and Fig. 6-7. The passenger compartment side trim panel is attached with steel clips and is also held by the armrest and its screws. The luggage compartment side trim panel is held by Phillips head screws. The heads of the screws are covered by plastic caps.

To remove the passenger compartment side trim panel, carefully pry the plastic caps out of the holes for the armrest screws. Remove the screws and take off the armrest.

NOTE —
The screws, which are not easily seen after the caps have been pried off, are installed at an angle.

Using a wooden wedge, pry off the trim panel. Insert the wedge near each of the 19 steel clips, being careful not to damage the vinyl covering on the trim panel or the paint on the body.

Installation is the reverse of removal. During installation, make sure that the side trim panel is flush with the rear side trim panel.

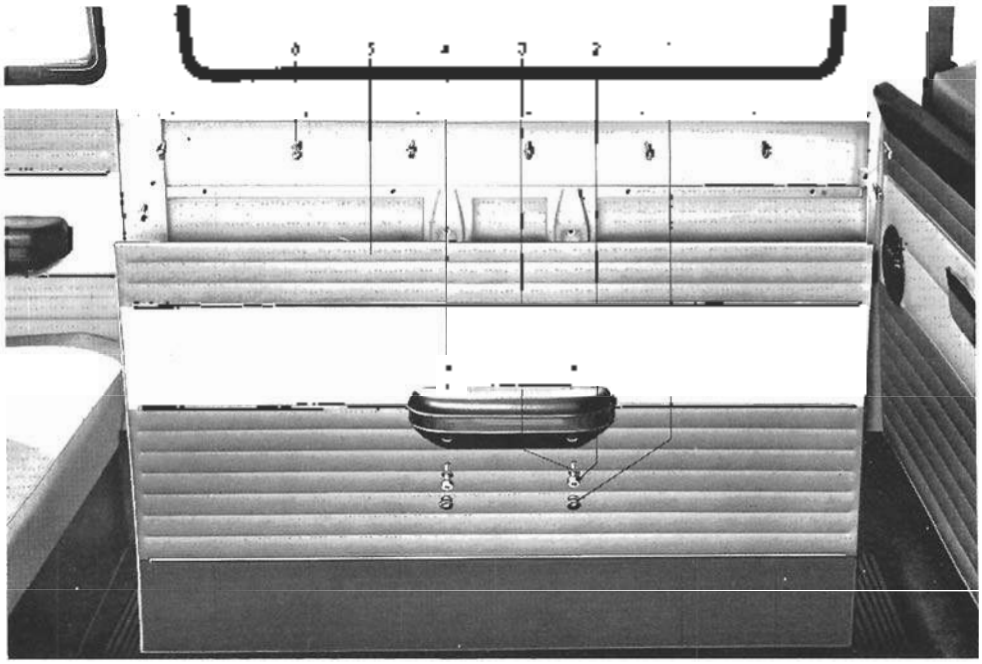
NOTE —
The rear side trim panels, located at each end of the rear seat, are also installed with steel clips. These panels can be removed and installed using a procedure similar to that just described for the side trim panel.

To remove luggage compartment side trim.

1. When removing the left-side trim panel, remove the spare wheel cover and the spare wheel. Then remove the rubber buffers for the spare wheel.
2. Detach the rear seat backrest brackets on both sides of the rear seat, then push the backrest forward.
3. Pry out the plastic caps and remove the five Phillips head screws.
4. Pull the side trim panel forward and out of the retaining channel on the rear body pillar.

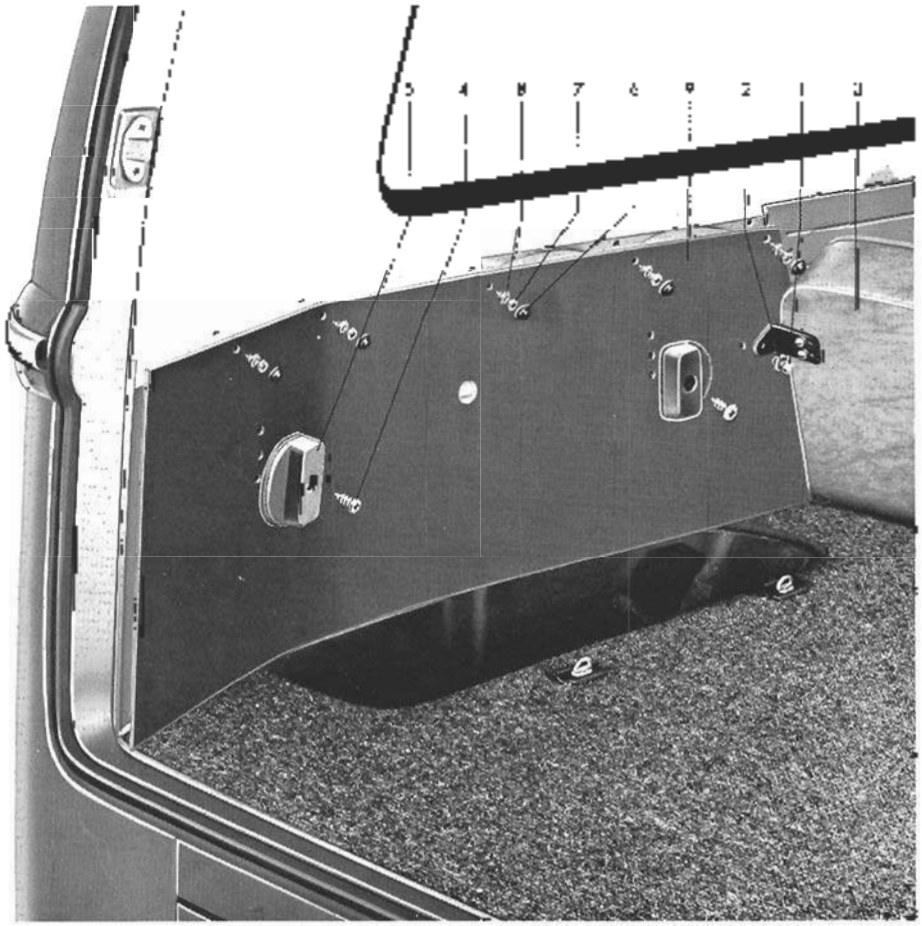
Installation is the reverse of removal. Before installing the screws, make sure that the front edge of the luggage compartment side trim panel is flush with the edge of the rear passenger compartment rear side trim panel.

CAUTION —
Be careful not to bend or otherwise damage the luggage compartment side trim panel as you insert it in the retaining channel on the rear body pillar.



1 Caps for armrest screws (2)
2 Armrest screw (2)
3 Spring washer (2)
4 Armrest
5 Side trim panel
6 Steel clips (13)

Fig. 6-6. Rear passenger side trim panel removal.



1 Pin (2)
2 Spring washer (2)
3 Rear seat backrest
4 Screw (2)
5 Rubber buffer (2)
6 Cap (5)
7 Screw (3)
8 Washer (3)
9 Trim panel

Fig. 6-7. Luggage compartment side trim panel removal

7. CAMPMOBILE EQUIPMENT

The procedures given here apply mainly to 1968 through 1973 Campmobiles. The publisher regrets that service information for 1974 and later Campmobiles is unavailable from the vehicle's manufacturer. To determine whether a particular procedure applies to a late model Campmobile, please compare the equipment found on the vehicle with the pictures of Campmobile equipment that appear on this page and on following pages.

Removing and Installing Icebox Cabinet

The icebox cabinet is mounted against the partition behind the front passenger seat. To remove the icebox cabinet, remove the front passenger seat. Then remove the two hand nuts indicated in Fig. 7-1.

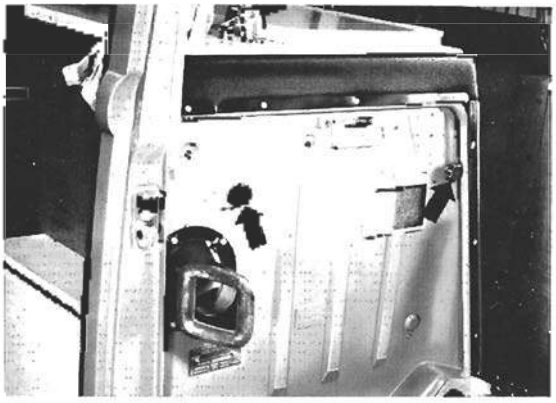
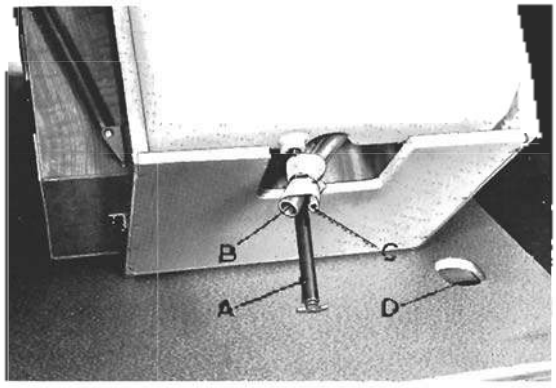


Fig. 7-1. Hand nuts (arrows) behind front seat.

Pull the cabinet away from the partition, lift it slightly, and then lift it up to withdraw the drain hoses from the hole in the floor (Fig. 7-2).



A. Hose with spigot to water container
B. Drain hose for sink
C. Drain hose to drip tray
D. Hole in floor

Fig. 7-2. Hoses under icebox cabinet

Installation is the reverse of removal. Replace the rubber seal (Fig. 7-3) if it is worn or damaged.

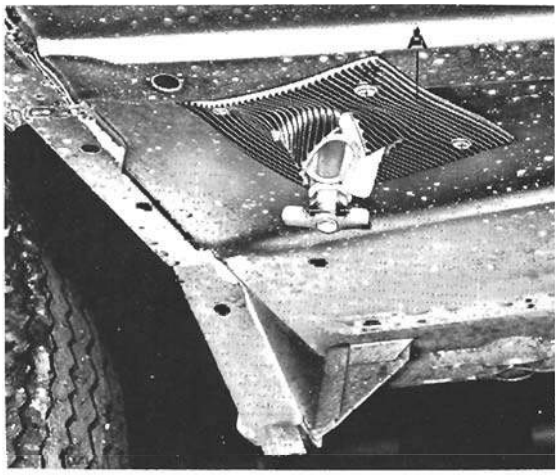


Fig. 7-3. Rubber seal A behind water filler pipe

Checking, Removing, and Installing Water Pump

If the pump fails to deliver water though the water container is full, remove the drawer from the icebox cabinet. Check to see that the hose from the water container is attached to the pump. (The pump is in the plastic housing that is integral with the base of the spigot.) If the hose is correctly connected, remove the hand nuts (shown earlier in Fig. 7-1) that hold the icebox cabinet on the partition. Check to see that the hose is connected to the water container. If the hose connections are in order, but no water is delivered, remove the two screws from the sides of the spigot housing and remove the pump as shown in Fig. 7-4 for inspection, repair, or replacement. Installation is the reverse of removal.

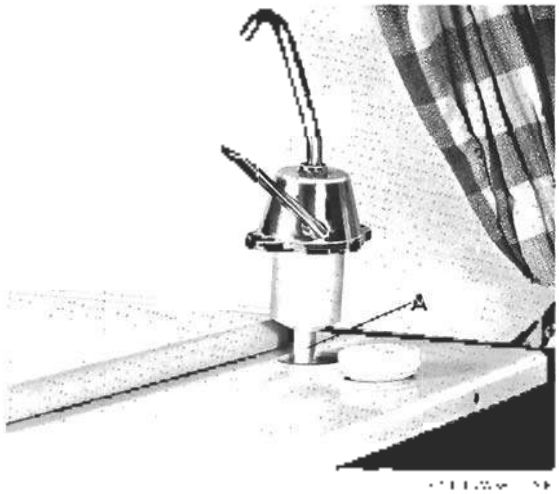


Fig. 7-4. Pump removal through hose at A

Removing and Installing Front Bench Seat

To remove the front bench seat (which is mounted back-to-back with the driver's seat), first lift out the seat cushion. Then take out the four bolts that hold the seat retaining plates to the floor. See Fig. 7-5.

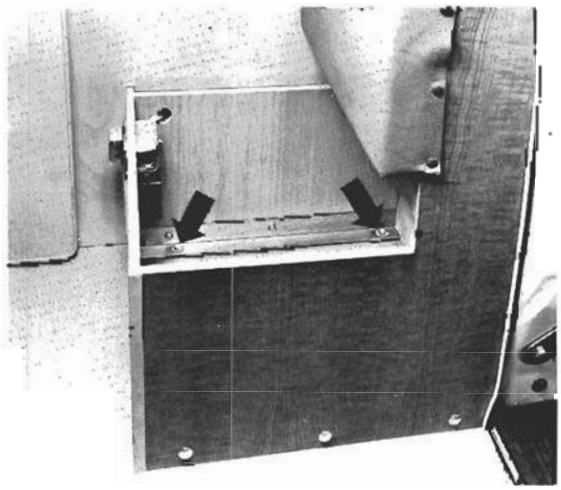


Fig. 7-5. Two of four bolts (arrows) that hold seat.

Remove the two screws in the face of the electrical receptacle and pull out the receptacle cover. Remove the screw and the wires indicated in Fig. 7-6. Attach tags to the wires as you remove them so that they can be reinstalled on the correct terminals. The seat may then be removed from the vehicle.

Installation is the reverse of removal. When installing the receptacle cover, hold the housing to keep the screws from pushing it off the inside of the seat box.

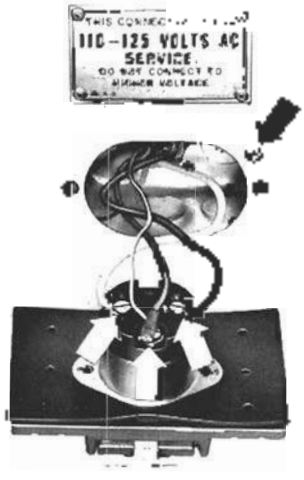


Fig. 7-6. Screw and wires that hold receptacle.

Removing and Installing Rear Bench Seat

The rear bench seat must be removed together with the storage cabinet that is under it. But before it can be removed, you must remove the front bench seat and the folding table.

To remove rear bench seat:

1 Release the rear bench seat cushion. Then lift it up and secure it with the support. (The catches that hold the cushion are inside the storage cabinet and are accessible after you open the cabinet door.)

2 Remove the nuts indicated in Fig. 7-7. Then, working under the vehicle, pull the bolts out of the floor panel. If necessary for access to the left-side bolt, temporarily remove the heater pipe extension.

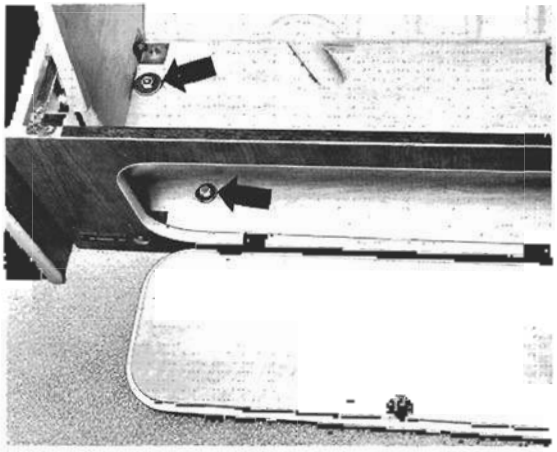


Fig. 7-7. Nuts and bolts that hold cabinet (other).

3 Remove the nuts indicated in Fig. 7-8. Then, working under the vehicle, remove the studs and plate.

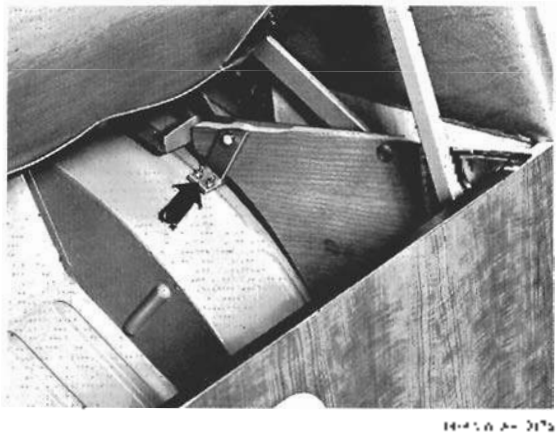


Fig. 7-8. Bracket on wheel housing.

4. To detach the seat brackets from the engine cover panel, remove the two Phillips head screws and the bolt indicated in Fig. 7-9 from the right-hand bracket. Remove the two similar screws (but no bolt) from the left-hand bracket.
5. Take the seat out forward.

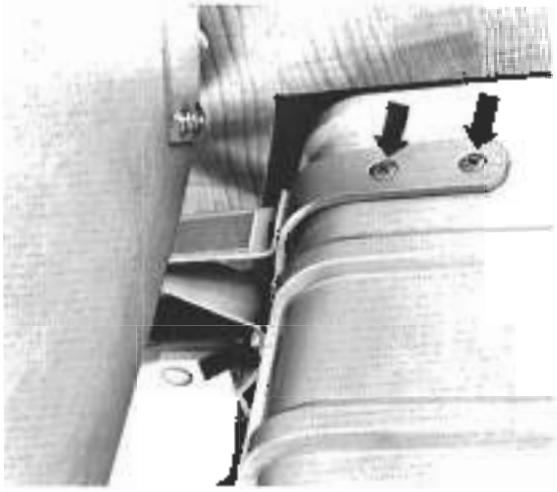


Fig. 7-9. Screws and bolt (arrows) that hold the right-hand bracket.

Installation is the reverse of removal. The stud plate for the bracket on the wheel housing is shown in Fig. 7-10. Use new self-locking nuts during installation. Also, do not forget the rubber seal since leaks will occur if you do. If the rubber seal is worn or damaged, replace it. Following installation, check to see that seat cushion hinges work properly.

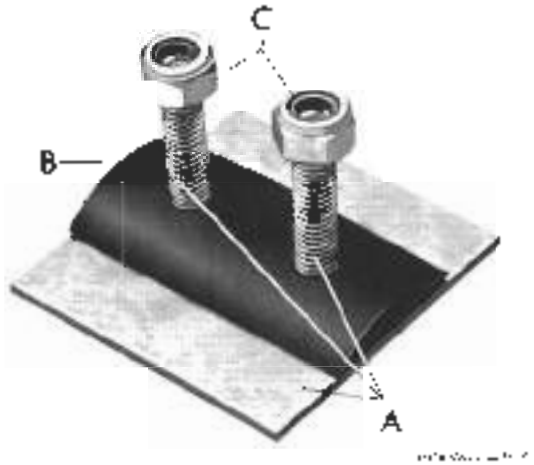


Fig. 7-10. Stud plate assembly. A, the rubber seal is at B, the self-locking nuts are at C. The studs are welded to the plate, but the rubber seal can be removed.

Removing and Installing Linen/Clothes Closet

You must remove the icebox cabinet, the storage shelf, the front bench seat, and the rear bench seat before you can remove the closet. To remove the closet, take out the two Phillips head screws indicated in Fig. 7-11.

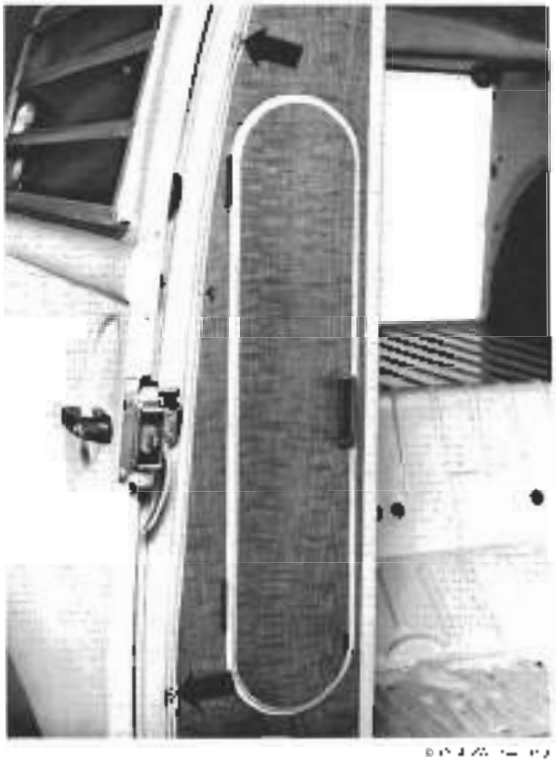


Fig. 7-11. Screws (arrows) that hold the closet front brackets to the body. The sliding door must be opened for access to the screws.

After removing the hand nut just inside the linen closet door (Fig. 7-12), you can swing the closet sideways, pull it forward, and lift it out of the car.

Fig. 7-12. Hand nut (arrow) at rear of closet.

Installation is the reverse of removal. Install the two Phillips head screws at the front before you secure the rear of the closet. Insert the rear bracket through the hole in the cabinet and engage it over the edge of the rear side panel as shown in Fig. 7-13. Install the hand nut if necessary, tighten the locknut against the outside of the closet after the hand nut is installed.

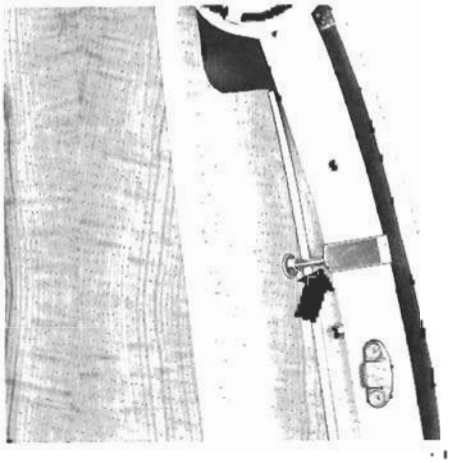


Fig. 7-13. Position of rear bracket (arrow) on closet and on body rear side panel. The luggage compartment lid must be opened for access

Eliminating Closet Door Rattle

If the closet doors rattle, use trim cement to stick small pieces of foam rubber on the door edges as shown in Fig. 7-14. If the rattle persists, move the latch plate slightly inward (Fig. 7-15)

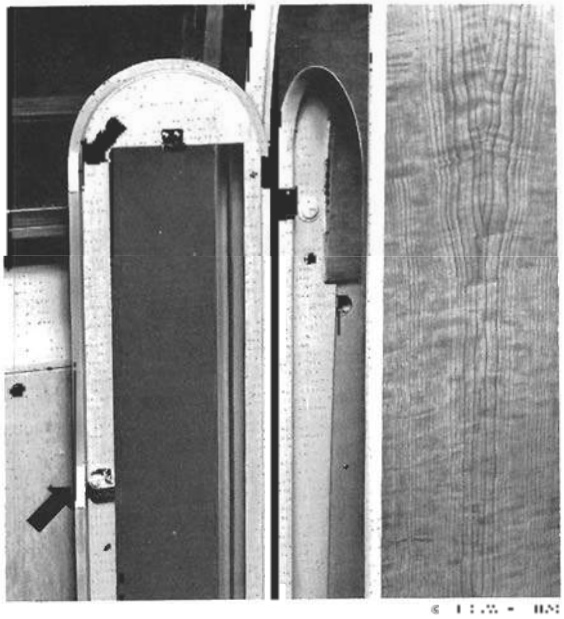


Fig. 7-14. Foam rubber strips (arrows) applied to door

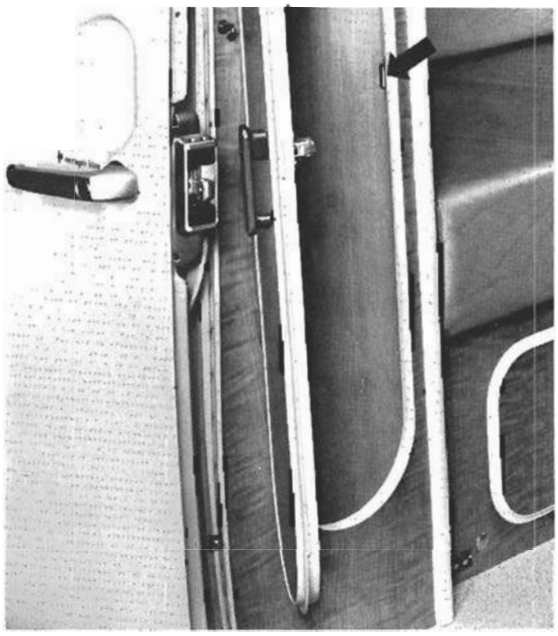


Fig. 7-15. Latch plate. Move deeper into closet

Removing and Installing Storage Shelf

The storage shelf, located at the rear of the Camprmobile, must be removed before you can remove the clothes/linen closet. It is helpful to have someone support the storage shelf after it is partially unbolted, freeing you to complete the removal procedures. If you attempt the job by yourself, be careful that the shelf does not fall or shift its position in such a way that it damages the interior trim.

To remove shelf:

1. Remove the two screws indicated in Fig. 7-16.

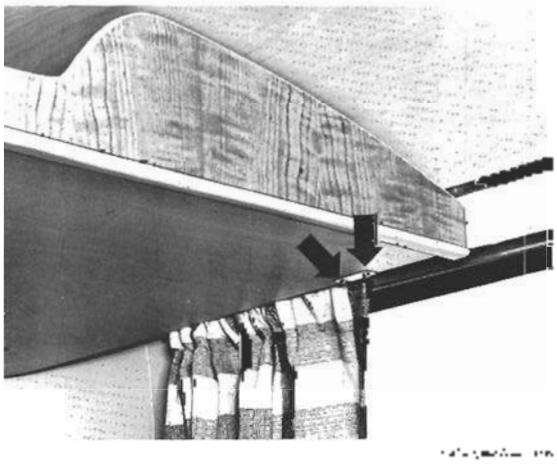


Fig. 7-16. Screws (arrows) that hold left side of shelf

2. Remove the nut, washer, and carriage bolt at the right-hand side of the storage shelf. Push the bolt back into the linen/clothes closet (Fig. 7-17).

Fig. 7-17. Bolt at left hand side of storage shelf

3. Remove the five screws with press button retainers (Fig. 7-18).

Fig. 7-18. Three of the six screws (arrows) that hold shelf to the roof frame. Luggage compartment lid must be raised for access to the screws

4. Using a screwdriver at the left-hand side of the storage shelf, pry the bracket down toward the side window. (This is the bracket you removed the screws from in Step 1.) Then carefully take the storage shelf out downward.

Installation is the reverse of removal. Again pry down the left-side bracket while you lift the storage shelf into position.

Removing and Installing Plywood Roof Trim

Though it makes the job easier, it is not absolutely necessary to remove the side roof trim panel over the sliding door before you remove the front roof trim. However, both side trim panels must be removed before you can remove the rear roof trim.

To remove the side roof trim panel above the sliding door, pull the panel out of its retaining and locating channels as shown in Fig. 7-19. Then take the locating channels off the roof trim. Installation is the reverse of removal.

Fig. 7-19. Panel above sliding door being removed. Locating channel is at **A**, retaining channel at **B** and roof trim panel at **C**

The side roof trim panel above the side window is shown in Fig. 7-20. To remove the panel, first remove the interior lamp and disconnect it from its wire. To remove the panel, pull it out of the retaining and locating channels. Then take the locating channels off the roof trim. Installation is the reverse of removal.

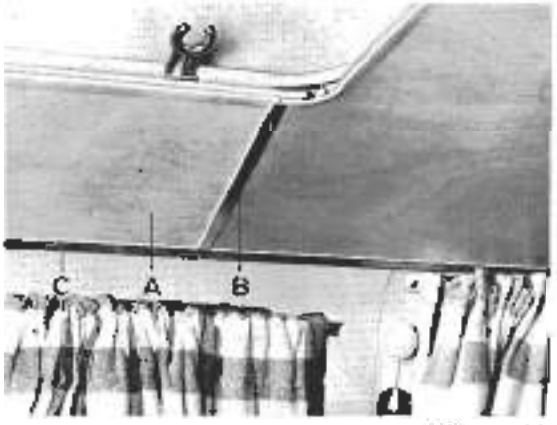


Fig. 7-20. Panel above side window and related parts. Roof trim panel is at **A**, locating channel at **B**, and retaining channel at **C**.

To remove front roof trim:

1. Remove the roof side trim panel over the side window.
2. Slightly loosen the four Phillips head screws that hold the retaining plate for the folding col. Then fully remove the two self-locking nuts and screws.
3. Pull the beading (Fig. 7-21) off the roof frame until the beading no longer contacts the front roof panel.

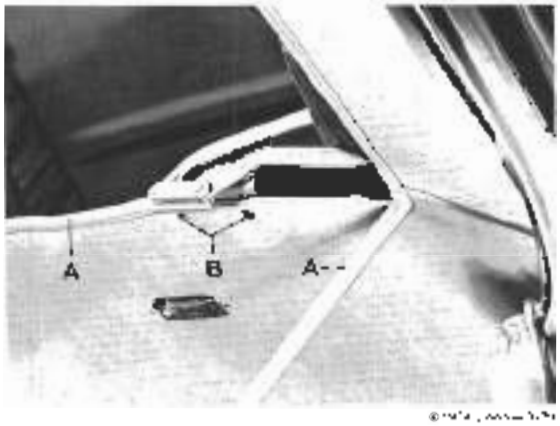


Fig. 7-21. Screws with self-locking nuts **B** that must be removed before you can remove beading **A**.

4. Remove the sun visors together with their retainers, the rear view mirror, and the interior lamp. Then remove the Phillips head screws indicated in Fig. 7-22.

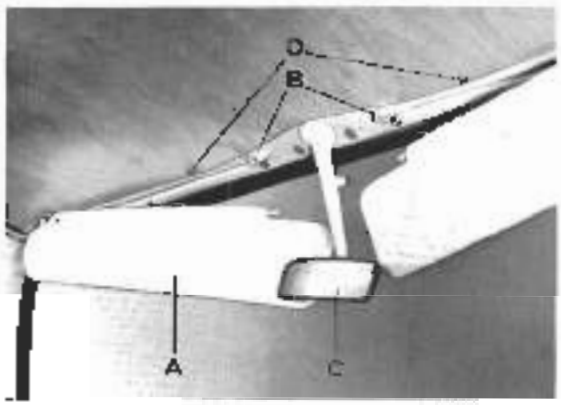


Fig. 7-22. Sun visors **A**, retainers **B**, rear view mirror **C**, and Phillips head screws **D**.

5. Pull down the roof front trim panel in the center as shown in Fig. 7-23. Press it out of the retaining channel on one side or the other, then pull the panel out of the retaining channel on the opposite side and remove the panel.

Fig. 7-23. Roof front panel being removed.

Installation is the reverse of removal. Install the trim panel in one retaining channel, bend the panel down in the center, then locate it in the other retaining channel. Lift the plate for the folding col while you install the beading on the edge of the roof frame. Use new self-locking nuts for the col screws.

To remove roof rear trim panels:

1. Remove the roof side trim panels over the sliding door and the side window. Then remove the storage shelf as previously described or remove the luggage net on vehicles that are so equipped.
2. Pull the beading off the front of the roof frame until it no longer contacts the trim panel. Then remove the screws and self-locking nuts indicated in Fig. 7-24.

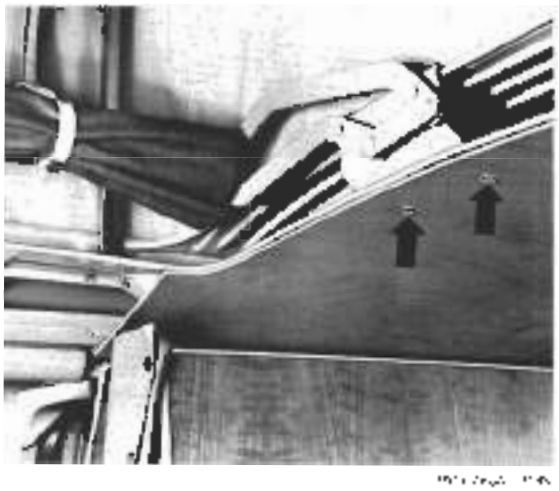


Fig. 7-24. Folding col screws with self-locking nuts (arrows).

3 Remove the three Phillips head screws that are near the rear edge of the trim panel. Also remove the securing bracket below the screws (Fig. 7-25).

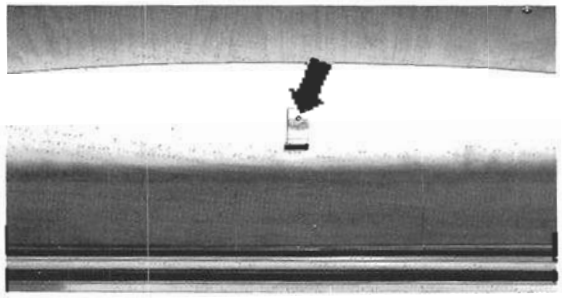


Fig. 7-25. Securing bracket (arrow). Phillips head screws in roof panel are just above the bracket.

4 Pull the panel down in the center, then carefully lift its edges out of the retaining channels. Remove the trim panel from the vehicle.

5. If necessary, raise the luggage compartment lid. Then remove the Phillips head screws with press-button fasteners indicated in Fig. 7-26. Then remove the end part of the roof trim.

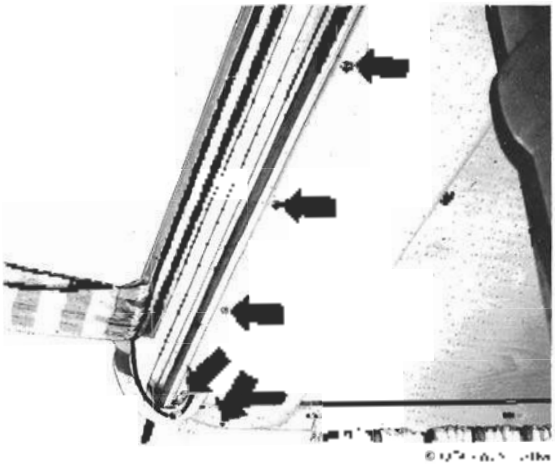


Fig. 7-26. Five screws with press button fasteners.

Installation is the reverse of removal. Install the trim panel in one retaining channel, bend the panel down in the center, then locate it in the other retaining channel. Use new self-locking nuts on the screws for the folding bed retaining plate.

Removing and Installing Louver (Jalousie) Window

To remove the jalousie side window, first remove the curtain and curtain rail by taking out the screws. Push the mosquito net screen up about 5 mm (1/5 in.), then pull the screen down and out of the frame. Pull off the rubber weatherstrip as shown in Fig. 7-27.

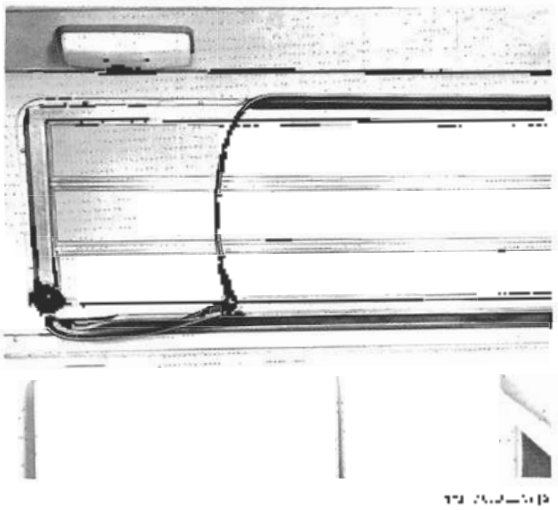


Fig. 7-27. Rubber weatherstrip partially removed.

Remove the 15 Phillips head screws around the window frame (Fig. 7-28), then carefully hand-press the jalousie window out of its opening in the body.

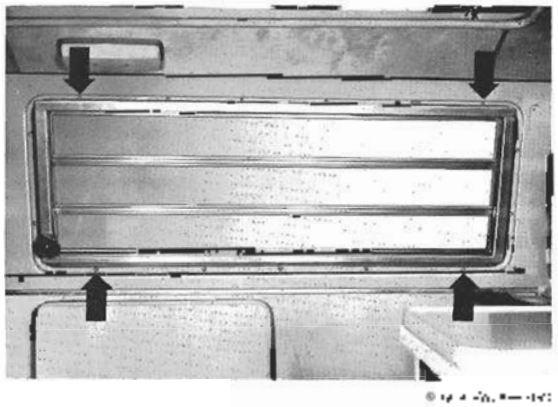


Fig. 7-28. Four of 15 screws (arrows) that hold the jalousie window in body.

Installation is the reverse of removal. Make sure that the rubber weatherstrip on the window's outer seal is properly positioned, then install the window and frame upper edge first. Install the four screws indicated in Fig. 7-28, and then the remaining 11 screws. When installing the inner rubber seal, do so with the wide part of the seal along the bottom of the window.

7.1 Front Hinged Roof

The front hinged roof, available on Campmobiles, provides space for a folding cot. A Campmobile with the front hinged roof raised is shown in Fig. 7-29.

Fig. 7-29. Front hinged roof in its raised position

Removing and Installing Front Hinged Roof

The front hinged roof must be in its raised position before you can remove it.

To remove:

1. Remove the screws and detach the straps that hold the bellows on the roof panel (Fig. 7-30).

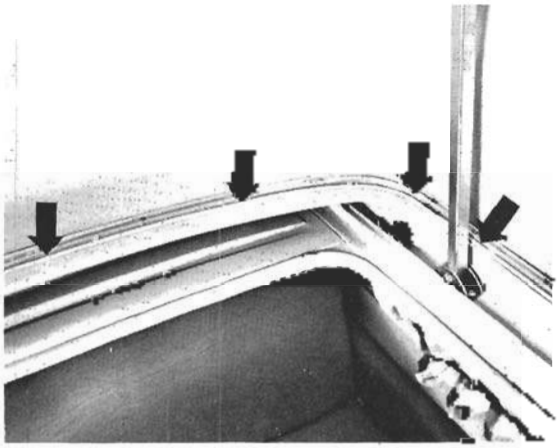


Fig. 7-30. Straps that hold the bellows on the body. Remove screws at arrows

2. Remove the hinge mounting bolts indicated in Fig. 7-31. Have someone hold the roof firmly while you remove the bolts on the opposite side.

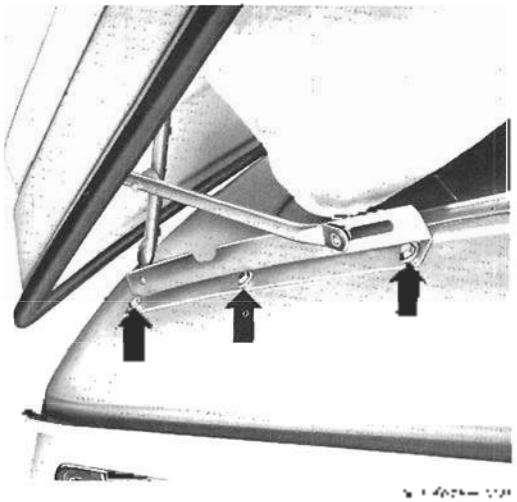


Fig. 7-31. Bolts (arrows) that hold hinge on roof panel. Be careful not to let the unbolted hinge scratch the paint on the roof panel

3. Remove the two Phillips head screws indicated in Fig. 7-32 from both roof support retaining plates. Then, while holding the hinges and supports to avoid damaging the paint, carefully lift off the roof.

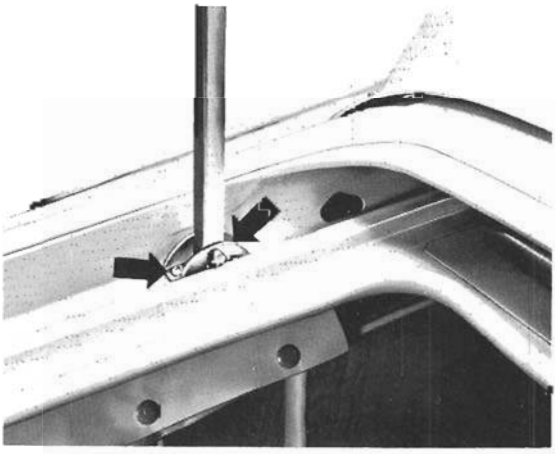


Fig. 7-32. Screws (arrows) that hold the roof supports

To install:

1. Place the roof in position and loosely install the hinge mounting bolts.
2. Carefully align the roof with the pins in the luggage pan at the rear part of the vehicle roof. Then tighten the hinge mounting bolts.
3. Using the Phillips head screws, install both roof supports on the roof frame.
4. Carefully lower the roof.

5. Check the position of the rear rubber seal at the points indicated in Fig. 7-33. If necessary, reposition the hinges so that the seal makes proper contact all along the rear roof edge

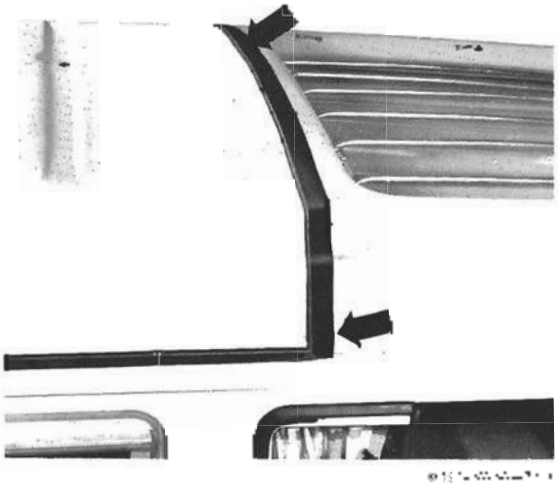


Fig. 7-33. Points where seal contact should be checked (arrows). Check on models 916 also.

6. Using trim cement, glue the plastic molding to the vehicle roof. Then position the bellows on the strip.
7. Using the screws, install the bellows-securing strips in the following order: front, rear and sides

Removing and Installing Roof Seal

To remove the rubber seal, raise the hinged roof. Then pull off the seal as shown in Fig. 7-34

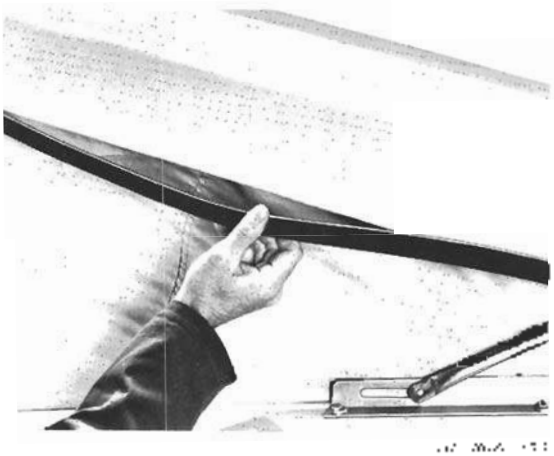


Fig. 7-34. Seal being removed from front hinged roof

The cross section of the rear seal is different from the cross section of the seals used at the front and sides. This difference is shown in Fig. 7-35

Fig. 7-35. Cross section of rear seal (left); cross section of front and side seals (right). The rubber seals are at B, the steel clips at A.

Coat the new seal with glycerine or silicone spray. Then hand-press the seal over the lip on the hinged roof. Fully drive the seal over the lip as shown in Fig. 7-36.

NOTE —
If the steel clips fit loosely, squeeze them together with pliers to restore their tension. Pull the seal off at appropriate points while doing this.

Fig. 7-36. A wooden block and rubber mallet being used to drive the seal fully into place

Removing and Installing Bellows

Though the front hinged roof is shown removed in the illustrations, you do not need to remove it in replacing the bellows. If the existing bellows is not to be reinstalled, cut the material off just above the vehicle roof so that the screws in the securing strips are more readily accessible.

To remove the bellows, remove the screws and securing strips around the lower edge of the bellows. Pull out the staples that hold the plastic strips around the upper edge of the bellows and remove the plastic strips as shown in Fig. 7-37. Then remove the additional staples

that hold the bellows to the wooden frame and remove the bellows from the front hinged roof.

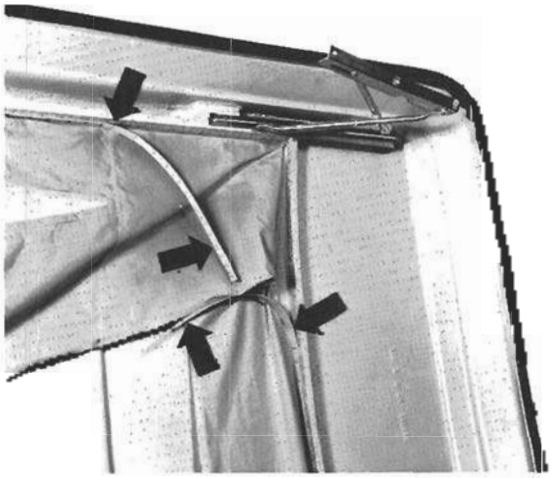


Fig. 7-37. Plastic strips being removed. The top and right-hand arrows indicate the staples. The two central arrows indicate the plastic strips

When you install the bellows, first tack or staple it to the wooden frame at the four corners. Then tack or staple the material to the wooden frame all around and staple on the plastic strips as shown in Fig. 7-38

Fig. 7-38. Staple gun being used to attach the bellows and plastic strips to the wooden frame.

To install the lower edge of the bellows on the vehicle roof, first use trim cement to glue the plastic molding to the vehicle roof. Then position the bellows on the strip. Using the screws, install the bellows-securing strips in the following order: front, rear, and sides.

Removing and Installing Hinges and Roof Supports

The hinged roof supports are held on the vehicle roof by two Phillips head screws, as shown earlier in the procedures for removing and installing the front hinged roof. A single bolt with a self-locking nut holds each support on its top bracket. Use new self-locking nuts during installation. Install the supports first at the top and then at the bottom.

When you remove a hinge, support the unbolted side of the roof so that it does not shift and bend the hinge on the opposite side. If both hinges are being replaced, replace them one at a time.

To remove the hinge, raise the front hinged roof and then remove the three bolts and the two self-locking nuts indicated in Fig. 7-39. Be careful not to scratch the paint as you remove the hinge from the vehicle.

Fig. 7-39. Bolts (lower three arrows) and self-locking nuts (upper two arrows)

Installation is the reverse of removal. Use new self-locking nuts on the bolts in the hinged roof. Loosely install the three bolts that hold the hinge on the vehicle roof, then carefully close the roof. Align the hinged roof along its rear edge, then tighten the three bolts that hold the hinge on the vehicle roof.

Removing and Installing Folding Cot

You do not need to fully remove the folding cot in order to replace the canvas cover and side tubes. The removal of the canvas cover and side tubes is described following the regular removal and installation procedure.

The front hinged roof must be raised before the cot can be unfolded into its sleeping position as shown in Fig 7-40

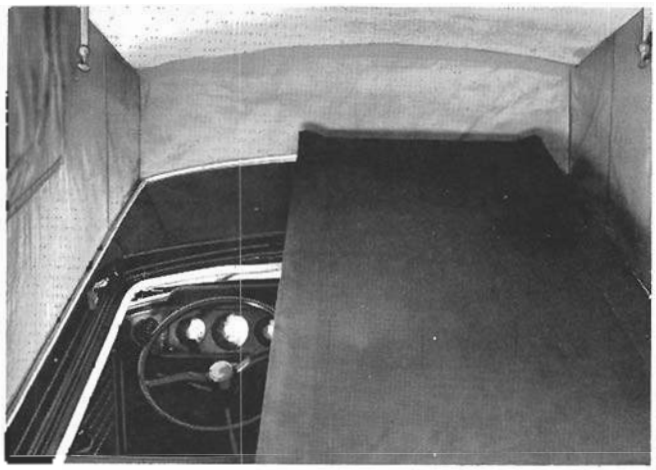


Fig. 7-40. Folding cot ready for use.

To remove folding cot:

1 Raise the front hinged roof, but do not unfold the cot

2 Remove the four Phillips head screws that hold the front folding cot hinge to the vehicle roof (Fig 7-41)

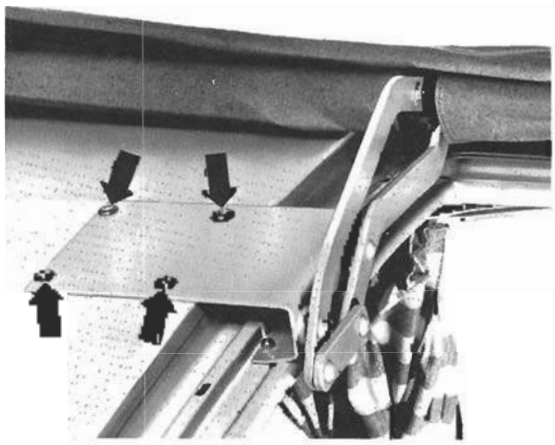


Fig. 7-41. Phillips head screws that hold the folding cot front hinge to the vehicle roof

3. Remove the two screws indicated in Fig. 7-42 from the front hinge

NOTE —
Use a wrench from above to hold the self-locking nuts.

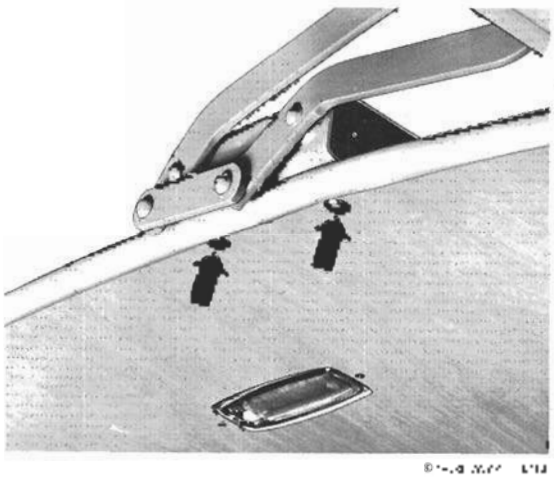


Fig. 7-42. Phillips head screws with self-locking nuts. These screws hold the front hinge on the trim pane and roof pan

4. Remove the four Phillips head screws and two self-locking nuts indicated in Fig. 7-43. Then carefully remove the folding cot from the vehicle

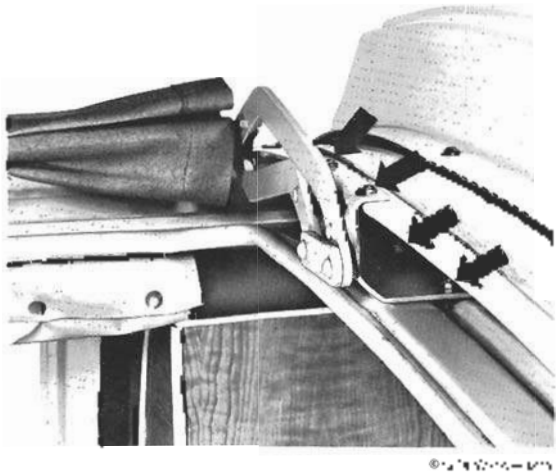


Fig. 7-43. Screws that hold rear hinge. The screws indicated by the left two arrows are threaded into the roof frame. The screws indicated by the right two arrows have self-locking nuts (obscured)

Installation is the reverse of removal. Use new self-locking nuts when you install the screws that pass through the trim panels and roof pan

To remove the folding cot tube and canvas:

1. Remove the self-locking nuts from the bolts in the front and rear hinges. This may be done with the cot installed inside the vehicle.

2. Push the bolts out of the holes in the hinge arms and connecting tube brackets (Fig. 7-44).

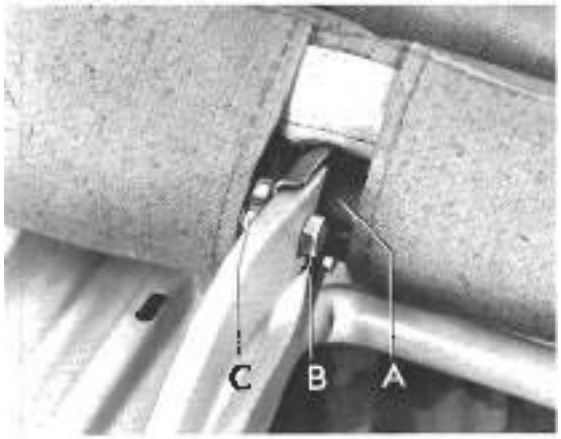


Fig. 7-44. Connecting tube mounting on hinge. The connecting tube with bracket is at A, the bolt at B and the self-locking nut at C

3. Carefully lower the tubes and canvas into the vehicle interior. Then withdraw the tubes from the canvas.

Installation is the reverse of removal. Use new self-locking nuts on the bolts that hold the tubes on the hinges.

Removing and Installing Roof Luggage Rack

To remove the luggage rack, first remove the four Phillips head screws from the front edge of the rack (Fig. 7-45).

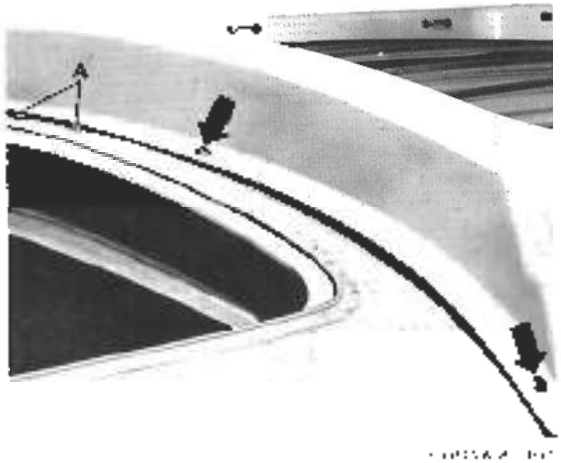


Fig. 7-45. Screws at front edge of luggage rack. Arrows indicate two of the four Phillips head screws. There are two rubber spacer washers at A. Two plastic caps must be pried off to access to the two center screws

Remove the three Phillips head screws at the rear edge of the luggage rack (Fig. 7-46). Lift the luggage rack off the vehicle and remove the three rubber spacers so that they will not be lost.

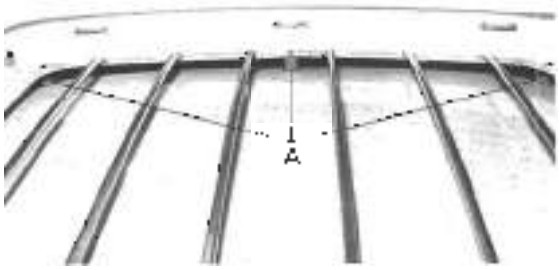


Fig. 7-46. Phillips head screws with rubber spacers A that hold the rear of the luggage rack

Installation is the reverse of removal. Do not forget the two rubber spacer washers that go between the front of the luggage rack and the center of the roof. Carefully press the plastic caps over the two front center screws after they have been installed. Tighten the screws at the rear of the luggage rack until they hold the rack firmly but not so tightly that the rubber spacers are compressed.

8. SLIDING ROOF

(sun roof)

The sliding steel roof (sun roof) is optional equipment on the vehicles covered by this Manual. The trim panel cannot be removed until you have removed the sliding roof itself and have removed the left side runner.

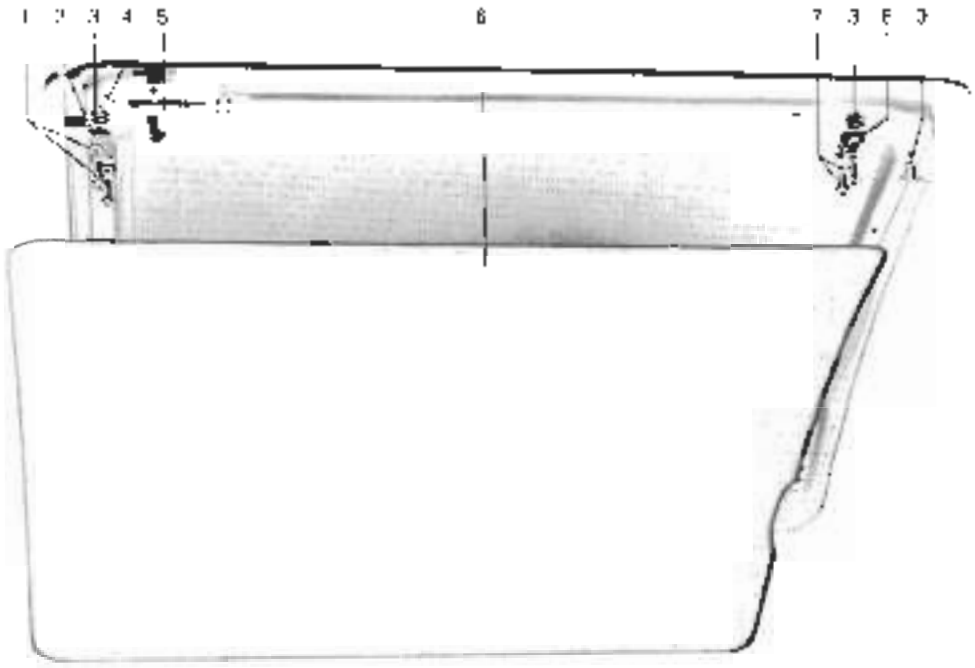
8.1 Removing and Installing Sliding Roof

The sliding roof can be adjusted without removing it from the vehicle. If the sliding roof does not operate properly, read **8.4 Adjusting Cables** and **8.5 Adjusting Sliding Roof Height** before deciding whether it is necessary to remove the sliding roof.

To remove sliding roof:

1. Using the hand crank, slightly open the sliding roof.

NOTE —
A gap of from 125 to 150 mm (5 or 6 in.) should be adequate.



1 Phillips head screw with spring washer (4)
2 Front guide (2)
3 Height adjusting screw (4)
4 Rear guide (2)
5 Leaf spring (swings aside as indicated by arrow) (2)
6 Trim panel
7 Phillips head screw with spring washer (4)
8 Front guide (2)
9 Clip for trim panel (5)

Fig. 8-1. Components of sliding roof panel (viewed from right-hand side)

2 Using a wooden wedge, carefully pry the front edge of the trim panel off the sliding roof panel. Work as closely as possible to each of the five clips (see Fig. 8-1).

3. Push the trim panel to the rear as far as it will go.

4. Using the hand crank, close the sliding roof until it is only open about 50 mm (2 in.). Then take out the four Phillips head screws with spring washers and remove the front guides.

5. Unhook the leaf springs from the lifters. Then swing the springs inward as indicated by the arrow in Fig. 8-1.

6. Pull the left and right lifters—located at the rear of each cable—out of the brackets on the roof, then turn the lifters down.

7. Taking care not to damage the seal or scratch the paint, lift the sliding roof panel out through the top of the roof opening. (The rear guides must come out through the recesses in the side runners.)

To install:

1 Insert the sliding roof panel into the roof opening rear edge first and engage the rear guides in the runners.

2. Slowly push the sliding roof panel to the rear while gradually lowering the front edge into position.

3 Pull the sliding panel fully forward. Insert the left and right lifters—located on the ends of the cables—into the brackets on the sliding roof. Then hook the leaf springs over the lifters.

4. Using the Phillips head screws and spring washers, install the front guides.

5 Adjust the sliding roof as described in **8.4 Adjusting Cables** and **8.5 Adjusting Sliding Roof Height**.

6 Using the hand crank, open the sliding roof halfway.

7 Pull the trim panel forward and attach it to the sliding roof by hand-pressing in the five clips.

8.2 Removing and Installing Sliding Roof Trim Panel

The sliding roof trim panel should be removed only if the trim panel itself must be replaced or repaired.

To remove:

1 Remove the sliding roof panel as described in **8.1 Removing and Installing Sliding Roof.**

2 Working through the roof opening, remove the eight Phillips head screws and the single countersunk screw that hold the left runner on the body. (The runners and related parts are shown in Fig. 8-2.)

3. Pull the left runner and its rear retainer forward out of the bracket and lift it out through the top of the roof opening.

4. Carefully take out the trim panel—left side first—through the top of the roof opening.

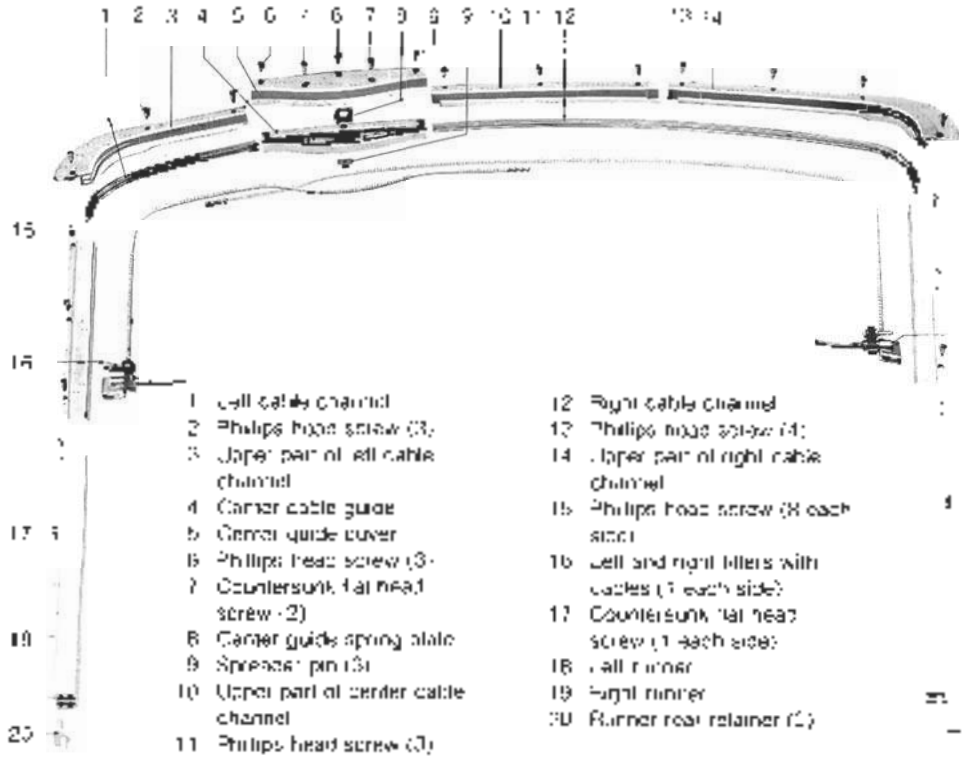


Fig. 8-2. Runners, cables and related parts

To install trim panel:

1 Inspect the trim panel frame, trim panel, and the steel clips. Replace worn or damaged parts. Dirty trim panels can be cleaned with plastic cleaner.

2 Place the trim panel in the runners. Then install the left runner.

3. Install and adjust the sliding roof panel. See **8.1 Removing and Installing Sliding Roof.**

4. Pull the trim panel forward and attach it to the sliding roof by hand-pressing in the five clips.

8.3 Removing and Installing Runners and Cables

In removing and installing the runners, cables, and other parts shown in Fig. 8-2, be careful not to scratch the paint on the roof. To prevent rust, touch up any paint scratches that you find.

To remove:

1. Remove the sliding roof as described in **8.1 Removing and Installing Sliding Roof.** It is not necessary to remove trim panel.

2. Remove the center guide cover. To do this, remove the three Phillips head screws and the two countersunk flat head screws.

3 Remove the upper part of the center cable channel by taking out three screws.

4. Remove the upper part of left cable channel by taking out three screws.

5. Remove the upper part of the right cable channel by taking out three screws.

6. Remove the center guide spring plate.

7 To remove the left and right side runners, remove the 16 Phillips head screws and the two countersunk flat head screws. Pull each runner together with its rear retainer forward out of the brackets, and then out through the top of the roof opening.

8. Lift out the center cable guide and the left and right cable channels.

9. Pull the cables and lifters off the runners.

To install:

1 Reversing the removal procedures, loosely install the side runners and lifters with cables in the sliding roof opening.

2 If previously removed, install the trim panel before installing the left runner.

3 Carefully align the side runners. Then tighten the screws.

> ***CAUTION —***
> *The runner rear retainers must fit tightly in their brackets. If improperly aligned, the side runners will shift sideways as the roof is opened and closed, thus preventing the roof from working smoothly.*

4 Install the center cable guide and the left and right cable channels.

5. Position the cables as shown in Fig. 8-2.

6. Install the left, right, and center cable channel upper parts. Do not forget the center guide spring plate and the spreader pin.

7 Install the sliding roof as described in **8.1 Removing and Installing Sliding Roof**; adjust the roof as described under the following two headings.

8.4 Adjusting Cables

The cables should be adjusted after removing and installing the sliding roof panel and whenever the sliding roof fails to open and close evenly at both sides.

To adjust:

1. Using the hand crank, slightly open the sliding roof.

> **NOTE —**
> A gap of from 125 to 150 mm (5 or 6 in.) should be adequate.

2 Using a wooden wedge, carefully pry the front edge of the trim panel off the sliding roof panel. Work as close as possible to each of the five clips. (See **8.1 Removing and Installing Sliding Roof.**)

3. Push the trim panel to the rear as far as it will go.

4 Using the hand crank, fully close the sliding roof.

5 Carefully pry the plastic cap off the hub of the hand crank. Then remove the Phillips head screw and take off the hand crank and escutcheon. (See Fig. 8-3.)

6. Loosen by approximately six turns each the two Phillips head screws that hold the cable drive gear assembly on the roof.

7. Pull the cable drive gear assembly down until the gear no longer engages the cable. (When disengaged, the gearshaft can easily be finger-turned.)

1 Cable drive gear assembly
2 Phillips head screw (2)
3 Escutcheon
4 Hand crank
5 Short Phillips head screw
6 Plastic cap

Fig. 8-3. Components of hand crank and cable drive gear.

8. Check the position of the sliding roof in the roof opening. If necessary, hand-shift the roof until it is square with the opening.

9. Place the lifters—located at the rear of each cable—in a vertical position and, if necessary, adjust the roof height as described under the following heading.

10. Finger-turn the drive gearshaft clockwise as far as it will go, then turn it counterclockwise one-half turn.

11. Hand-press the cable drive gear assembly upward until the gear engages the cables; then tighten the two Phillips head screws.

12. Install the escutcheon, hand crank, short Phillips head screw, and plastic cap.

13. To check the cable adjustment and crank position, open and close the sliding roof several times. If necessary, reposition the hand crank on the drive gearshaft so that the crank can be folded into the recess when the sliding roof is fully closed.

14. If the sliding roof does not open and close evenly on both sides, repeat the adjustment. When the adjustment is correct, pull the trim panel forward and attach it to the sliding roof by hand-pressing in the five clips.

8.5 Adjusting Sliding Roof Height

The height of the sliding roof should be adjusted after removing and installing the sliding roof panel and whenever the top of the closed sliding roof does not lie flush with the roof of the vehicle.

To adjust height:

1. Using the hand crank, slightly open the sliding roof.

   NOTE
   A gap of from 125 to 150 mm (5 or 6 in.) should be adequate.

2. Using a wooden wedge, carefully pry the front edge of the trim panel off the sliding roof panel. Work as close as possible to each of the five clips. (See **8.1 Removing and Installing Sliding Roof.)**
3. Push the trim panel to the rear as far as it will go.
4. Using the hand crank, fully close the sliding roof.
5. Loosen the two Phillips head screws with spring washers in each of the two front guides (Fig. 8-4).
6. To adjust the height of the front edge of the sliding roof panel, turn the adjusting screw one way or the other on each of the two front guides.

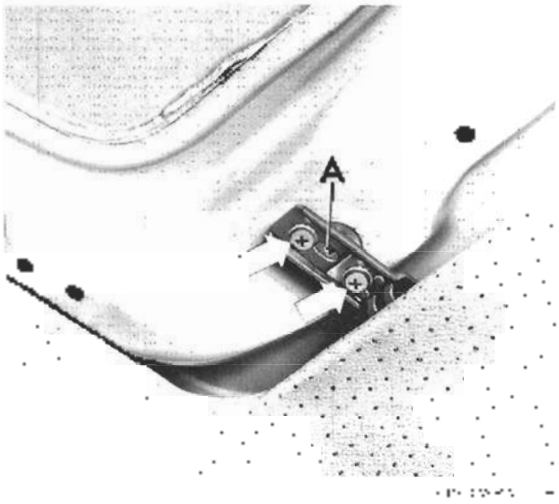


Fig. 8-4. Front guide. The arrows indicate the Phillips head screws and spring washers. The adjusting screw is at **A.**

7. To adjust the height of the rear edge of the sliding roof panel, open the roof slightly. Then unhook the leaf springs from both rear lifters and swing the springs to the position shown in Fig. 8-5.
8. Loosen the nut and bolt indicated in Fig. 8-5 on both rear lifters.
9. To correct the height, move the lifter pins in their elongated holes. When the height is correct, tighten the nuts and bolts.
10. Swing the leaf springs back to their original position and hook them over the lifters.

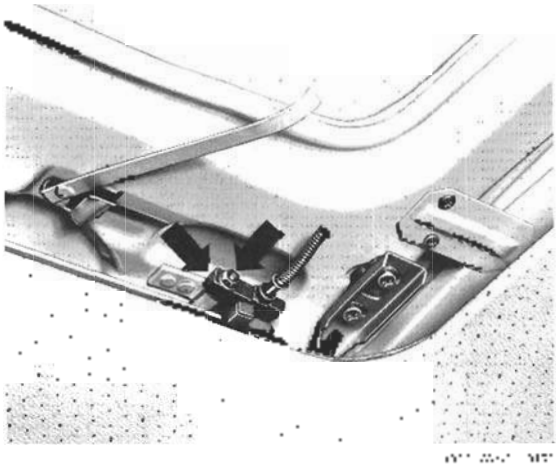


Fig. 8-5. Rear lifter with leaf spring moved aside. The arrow indicates the nut and bolt that lock the position of the lifter pin.

11. Loosen the two Phillips head screws with spring washers on each rear guide. Then, by turning screw **A** indicated in Fig. 8-6, adjust the height of each rear guide so that it fits in the recess in the runner when the roof is being opened or closed.

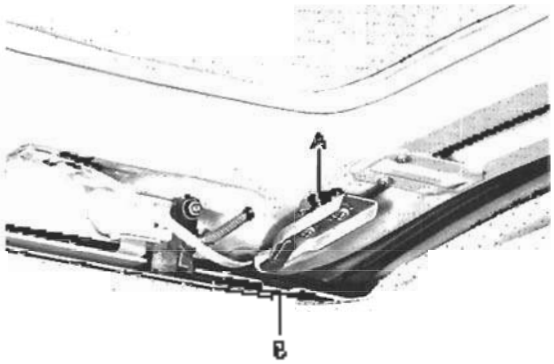


Fig. 8-6. Close adjusting screw **A** and recess in guide runner **B.**

NOTE
If the rear guide is not properly adjusted, the roof will rattle.

12. Tighten the Phillips head screws with spring washers in each rear guide. Then check to see that the roof opens and closes evenly on both sides. If not, adjust the cables as described in **8.4 Adjusting Cables.**
13. Pull the trim panel forward and attach it to the sliding roof by hand-pressing in the five clips.

9. Outside Mirror

The outside mirror mounting has two pivots so that the mirror can be adjusted to any angle. You can remove the outside mirror as shown in Fig. 9-1. Use a 19-mm (¾ in.) wrench to unscrew the retainer from the door.

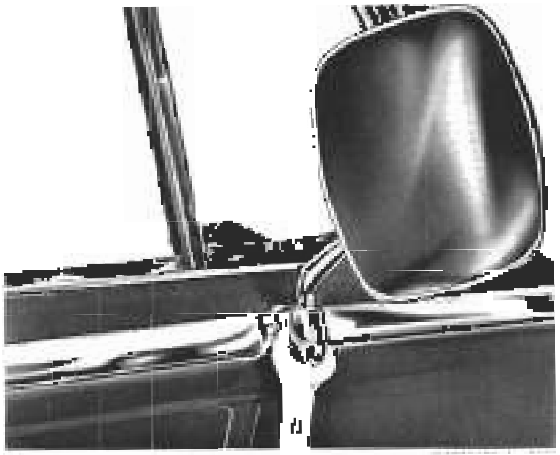
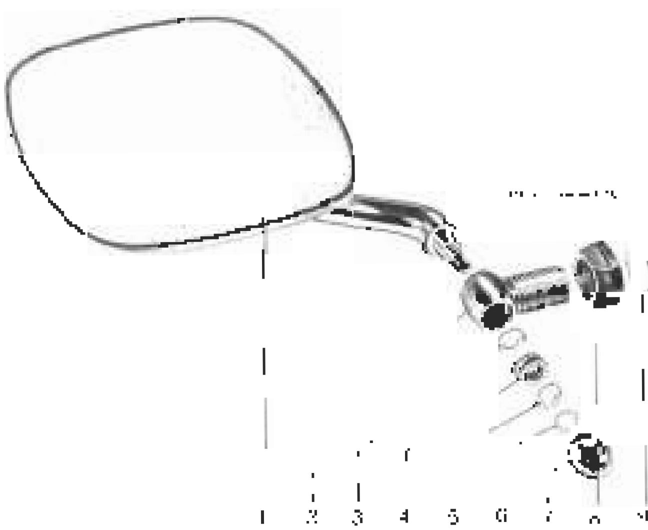


Fig. 9-1. Outside mirror being removed.

Before you install the mirror, make certain that the two pivots move freely. Their freedom of movement can be altered by tightening or loosening the mirror retainer or the cap nut. If necessary, disassemble the mirror as shown in Fig. 9-2 so that you can clean and lubricate the pivots.



1. Mirror
2. Mirror bracket
3. Washer with hexagonal hole
4. Coil spring
5. Serrated washer
6. Washer
7. Self-locking cap nut
8. Mirror retainer
9. Plastic washer

Fig. 9-2. Components of the outside mirror.

During assembly, use multipurpose grease to lubricate the taper and thread on the mirror, the taper inside the mirror bracket, and the coil spring. If the plastic washer or the serrated washer is damaged, replace it. Do not forget to install the plastic washer under the mirror retainer when you install the mirror on the vehicle.

10. Heating and Ventilation

No special instructions are necessary for the removal of many heating and ventilation components. An examination of the components will quickly reveal the locations of the screws that hold them to the vehicle body. Though there have been detail modifications to some parts of the heating and ventilation system during the model years covered by this Manual, the basic design of its components has remained unchanged.

10.1 Removing and Installing Fresh Air and Heating Controls

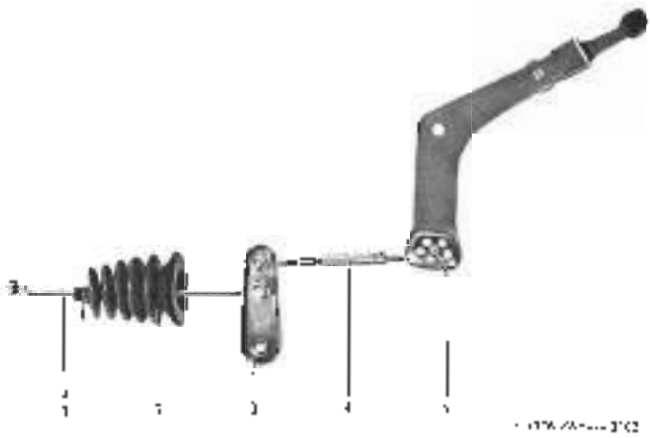
The fresh air and heating controls are located behind the dashboard. The control knobs project through slots in the right-hand side of the instrument panel.

To remove controls:

1. Press out the four plastic plugs that hold the lever end pieces to the control levers. The locations of the plugs are shown in Fig. 10-1.
2. Pull the lever ends out through the slots in the instrument panel. Then remove the leaf springs that are also held to the levers by the plastic plugs.

Fig. 10-1. Locations of plastic plugs (arrows). Although the instrument panel is removed in this illustration, you cannot remove it until after you have pulled the lever ends out of the slots in the panel.

3 Working behind the dashboard, pry off the spring clips that hold the adjustable connecting links to the control levers and to the relay levers. The parts are identified in Fig. 10-2.



1 Connecting rod
2 Rubber boot
3 Relay lever
4 Adjustable connecting link
5 Control lever

Fig. 10-2. Components of ventilation control linkage

4 Remove the three Phillips head screws indicated in Fig. 10-3. Then pull the control downward, disconnect the heater cables, and remove the controls from the vehicle.

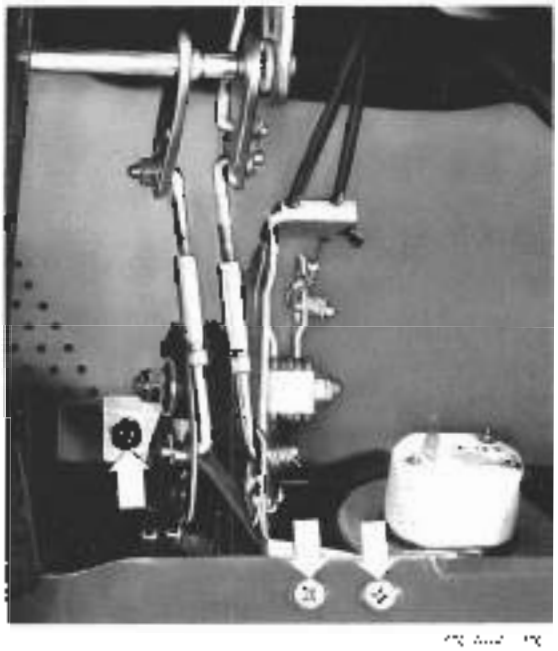


Fig. 10-3. Screws (arrows) that hold controls to dash panel

To disassemble the control lever assembly, remove the self-locking nuts. Then remove the levers and the friction washers from the pivot pins. Be sure to take note of the order in which the levers and the friction washers are installed on the pins. If any friction washer is worn or damaged, replace it. During assembly, you can adjust the friction by loosening or tightening the self-locking nuts.

Installation is the reverse of removal. Following installation, make sure that the fresh air flaps are closed with the control lever in its highest position. If the flaps fail to close, or close too soon, you can adjust the linkage by installing the adjustable connecting link in a different hole in the control lever or by altering the length of the adjustable connecting link.

10.2 Removing and Installing Fresh Air Flaps and Linkage

It is not necessary to remove the control linkage in order to remove the fresh air flaps. However, if you must remove the linkage, it is necessary to remove the air intake grille and mesh panel from the front of the vehicle so that you can disconnect the connecting rods from the fresh air flaps.

To remove:

1 Remove the six Phillips head screws that hold the air intake grille to the body. Three of these screws are indicated in Fig. 10-4.

2 Remove the air intake grille and the mesh panel that is behind the grille.

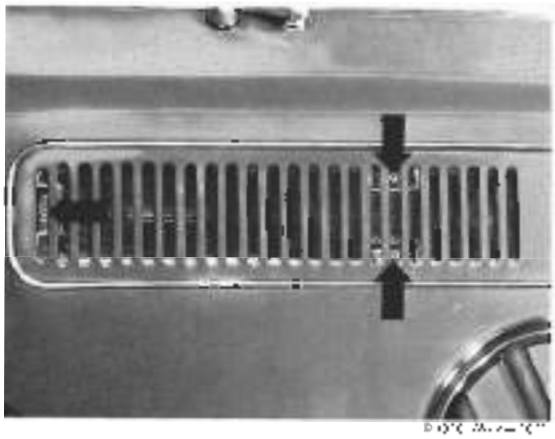


Fig. 10-4. Phillips head screws (arrows) that hold air intake grille and mesh panel

3 Open the fresh air flap. Carefully pry off the spring clip that holds each connecting rod to its flap. Then disconnect the connecting rod from the flap.

4. Remove the two screws indicated in Fig. 10-5. Then remove the fresh air flap from the vehicle.

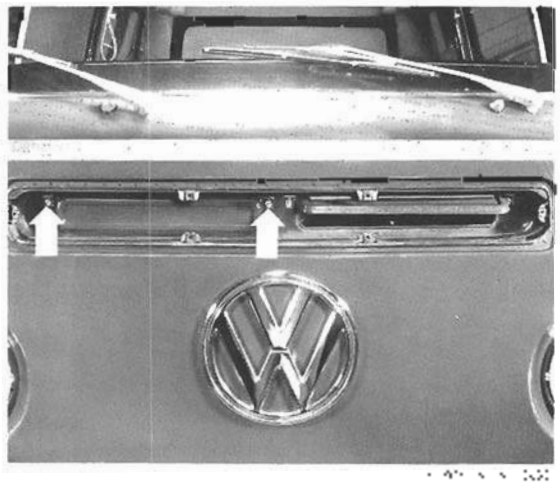


Fig. 10-5. Screws (arrows) that hold fresh air flap to vehicle body

5. Working beneath the dashboard, carefully pry off the spring clips that hold the connecting rods and the adjustable connecting links to the relay levers. Then disengage the rods and links from the relay levers. (These parts were previously identified in Fig. 10-2.)

6. Working outside the vehicle, push the rubber boots and the connecting rods out of the front panel toward the interior of the car.

7. Remove the Phillips head screws that hold the linkage brackets to the body (Fig. 10-6). Then remove the linkage from the vehicle.

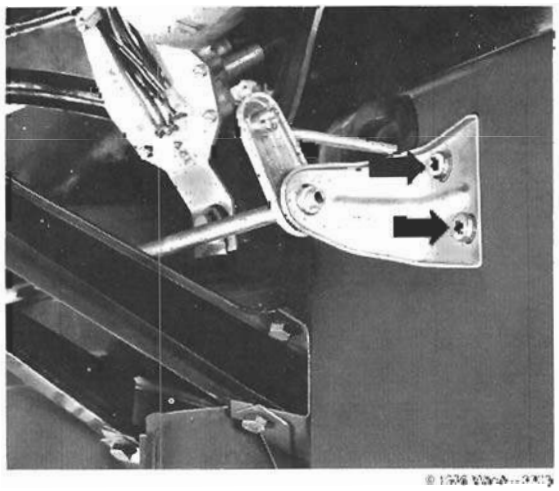


Fig. 10-6. Screws (arrows) that hold linkage to body

Before you reinstall the flap(s) or the linkage, inspect the plastic bearings and replace any that are worn or damaged. Also replace worn or damaged rubber boots and replace the flap seals if they are in any way faulty.

Installation is the reverse of removal. Make sure that the rubber boots for the connecting rods are installed correctly (Fig. 10-7). Following installation of all the components, check that the flaps and control levers operate smoothly. The flaps should be closed when the control levers are in their highest positions. If the flaps close too soon or fail to close, adjust the linkage by installing the adjustable connecting links in different holes in the control levers or by altering the lengths of the adjustable connecting links.

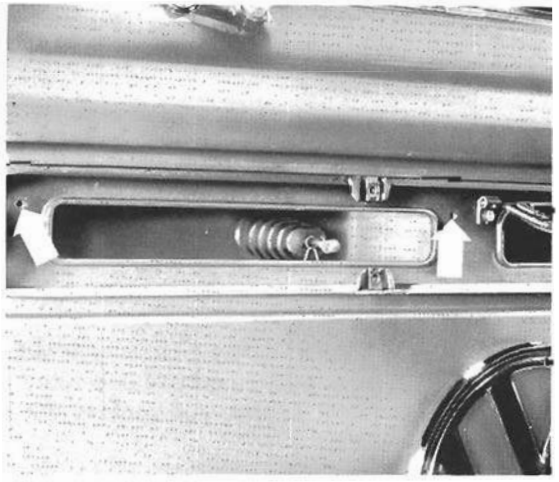


Fig. 10-7. Rubber boot and connecting rod installed in body. Arrows indicate holes for flap bearing retaining screws

10.3 Heat Ducts and Outlets

Except for the front heater outlets (defroster ducts), the removal of the various heat outlet components will be apparent by looking at them. Replacement cables are available for the rear heater outlets.

To remove the front heater outlets (defroster ducts), remove the two screws that hold each defroster trim plate to the top of the dashboard. Then, working beneath the dashboard, squeeze the slots of the plastic outlet pipes together so that you can push the outlet pipes up slightly—through the holes in the top of the dashboard. This will make it possible to pull the Y-shaped branch pipe off the heat pipe. Separate the Y-shaped branch pipe from the two outlet pipes. Then, while squeezing their slots together, pull the plastic outlet pipes down and out of the dashboard. Installation is the reverse of removal.

Section 2

FRONT AXLE

2

Contents

Front Axle

Prior to the models covered by this Manual, the Type 2 front axle was similar to the front axle of the Volkswagen Beetle. However, beginning with the 1968 models, the front axle for Type 2 vehicles was completely redesigned. Although it employs the same operating principles as the earlier axle, every part of the new unit differs in size and shape. The worm and peg steering used on earlier models has likewise been revised and is replaced by worm and roller steering on the 1973 and later models.

The front axle has three functions: springing (or suspension), steering, and wheel alignment. Tire wear and vehicle handling are good indicators of how well these functions are being fulfilled. However, it is always best to maintain the front axle in serviceable condition so that abnormal tire wear and poor handling never affect the car.

Independent front wheel suspension is by trailing links and transverse torsion bars. This system not only prevents the transfer of road shocks from one front wheel to the other, but also provides excellent resistance in their transfer to the suspension parts, chassis, and passengers. Vertical travel of the front suspension is limited by progressively acting rubber stops. The greater the impact of the torsion arms (the trailing links) against the rubber stops, the greater their springing and energy absorbing reaction. But because the trailing link system minimizes the suspension deflection caused by severe bumps, the stops are seldom called upon during normal highway driving.

Ball joints at the ends of the torsion arms provide a flexible mounting for the steering knuckle. These joints not only permit the free vertical movement of the front wheels during bump and rebound, but also allow the wheels to be turned around a vertical axis for steering. Front wheel camber adjustments are accomplished by turning an eccentric bushing incorporated in the upper ball joint mountings. And, since the joints are lubricated at the factory, they rarely require further lubrication.

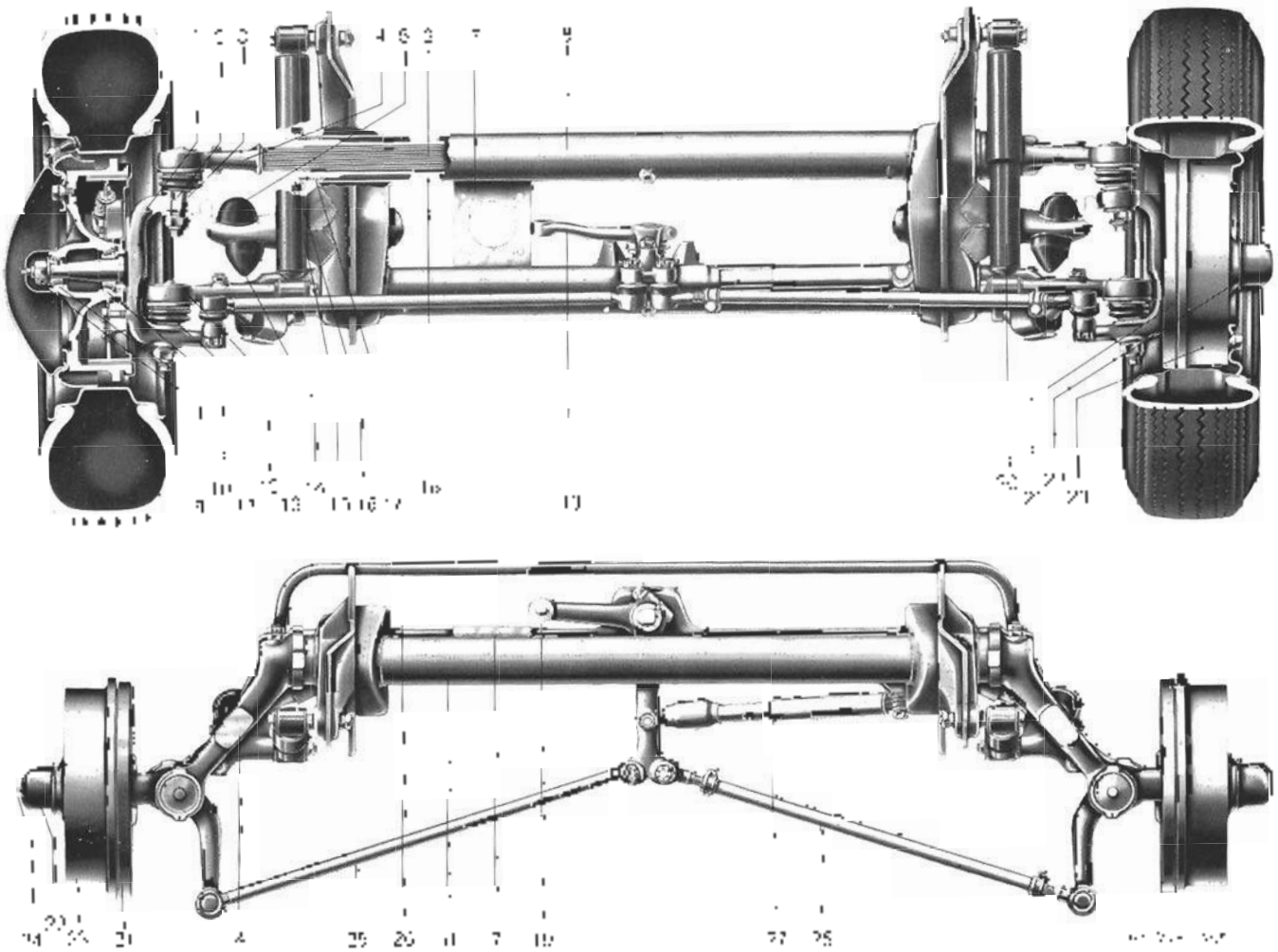
Many repair procedures require special equipment that car owners and small repair shops may not have—a hydraulic press and precision measuring jigs, for example. If you lack the skills, tools, or a clean workshop for servicing the front axle and steering, we suggest you leave such repairs to an Authorized VW Dealer or other qualified shop. We especially urge you to consult your Authorized VW Dealer before attempting repairs on a car still covered by the new-car warranty.

1. GENERAL DESCRIPTION

The front axle is a rigid beam with pivoting members that provide suspension movement, steering movement and rotational movement of the wheels. The steering gearbox is coupled to the front wheels by a linkage that is an inherent part of the front axle. Therefore, all steering adjustments and repairs are covered in this section of the Manual. The names and positions of the front axle's parts are shown in Fig. 1-1.

Axle Beam

The axle beam itself is an electrically welded assembly consisting of two large parallel steel tubes and a number of heavy-gauge steel stampings. The axle is mounted on the vehicle by bolting its end plates, which incorporate the upper shock absorber mountings, solidly to the frame sidemembers. The axle beam tubes contain the torsion bars, torsion bar mounts, and torsion arm bearings. The bearings for the steering relay lever shaft are housed in a mounting welded to the front of the lower axle tube.



1 Steering knuckle
2 Upper ball joint
3 Eccentric cam bolt adjusting bushing
4 Upper torsion arm
5 Upper check arm stop
6 Torsion bar
7 Brake servo mounting plate
8 Front axle beam
9 Wheel bearing clamp nut
10 Outer wheel bearing
11 Inner wheel bearing
12 Lower ball joint
13 Lower torsion arm
14 Lower check arm stop
15 Torsion arm seal retainer
16 Torsion arm seal
17 Torsion bar needle bearing
18 Plastic seal and metal bushing
19 Relay lever
20 Shock absorber
21 Brake backing plate
22 Dust cap
23 Brake drum
24 Speedometer cable
25 Tie rods
26 Stabilizer bar
27 Steering damper

Fig. 1-1. Cutaway and top view of the front axle

4 FRONT AXLE

Suspension

Multi-leaf torsion bars provide the springing. There are two bars, one in the upper axle tube and one in the lower. Setscrews hold the bars stationary in their center bushings. Each half of each torsion bar has a torsion arm mounted at its outer end. The lower torsion arms are joined by a stabilizer bar that increases the front suspension's resistance to roll during cornering.

Steering

Worm and peg steering is used on vehicles built from August 1967 through July 1972. The 1973 and later models have worm and roller steering. Both types can be adjusted, if necessary, to compensate for minor wear.

The ball-joint tie rod ends do not require lubrication during their service life. Since only the right-hand tie rod has threaded ends, you adjust the front wheel toe simply by loosening the locknuts and turning the right-hand tie rod. A hydraulic steering damper is linked to the right-hand tie rod to minimize the road shock transmitted to the steering wheel.

Wheel Bearings

Tapered-roller wheel bearings are used on all vehicles covered by this Manual. The inner race for each of the four bearing assemblies consists of a cone surrounded by a number of caged tapered rollers. The outer races are a press fit in the wheel hub bore. The hub is an integral part of the front wheel brake drum, but is separate from the front wheel brake disc used on 1971 and later models. Tapered-roller bearing adjustment is possible by turning the clamp nut on the steering knuckle's stub axle.

2. MAINTENANCE

The diagnosis and maintenance steps that must be performed at regular mileage intervals are listed here. Lubrication and checking procedures are described fully in **LUBRICATION AND MAINTENANCE** or under the listed headings in this section of the Manual.

1. Lubricating the front axle
2. Lubricating and adjusting the front wheel bearings
3. Checking the dust seals and plugs on the suspension ball joints and the tie rod ends (see **7. Torsion Arms, Suspension Ball Joints, and Torsion Bars** and **9. Steering**)
4. Checking the ball joint play (see **7. Torsion Arms, Suspension Ball Joints, and Torsion Bars**)
5. Checking the steering play (see **9. Steering**)
6. Checking the front wheel camber and toe (see **3. Front Wheel Alignment**)

3. FRONT WHEEL ALIGNMENT

Only camber and toe are adjustable. Caster angle and kingpin inclination are determined by the manufactured dimensions of the suspension parts, so damaged parts must be replaced to correct these alignment factors.

The following preparatory steps are essential to accurate alignment measurements:

1. Have the car on a level surface.
2. Inflate the tires to specifications and unload the car except for the spare wheel and a full fuel tank. Then bounce the car several times and let it settle into its normal position.
3. Check the adjustment of the steering gear and the front wheel bearings. Adjust them if necessary. See **5.2 Adjusting Front Wheel Bearings** and **9.1 Adjusting Worm and Peg Steering** or **9.2 Adjusting Worm and Roller Steering**.
4. Make sure there is no play in the tie rod ends, relay lever, or other parts of the steering linkage.

Measuring wheel camber and toe requires suitable gauges. Professional-grade instruments may cost several hundred dollars, but the modestly priced gauges available from mail order houses are adequate for home use. Instructions are supplied by the manufacturer.

3.1 Checking and Adjusting Camber

Camber is the angle at which wheels depart from the true vertical when viewed from directly in front of the car. If the tops of the wheels lean outward slightly, they are said to have positive camber; if they lean inward, they have negative camber.

To check:

1. After placing the car on a level surface with its front wheels pointing straight ahead, apply a bubble protractor as shown in Fig. 3-1.

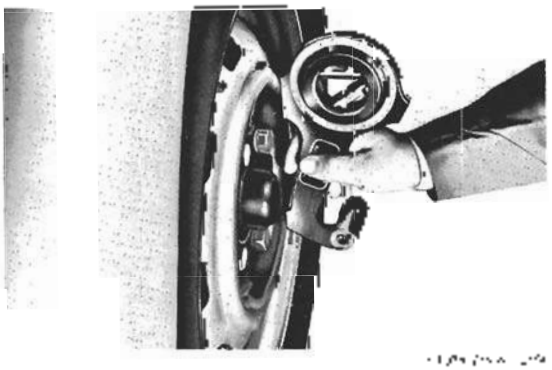


Fig. 3-1 Bubble protractor applied against front wheel

2. Using chalk, mark the wheel at the points where it is contacted by the protractor.
3. Turn the spirit level carrier on the protractor until the bubble is centered, then read the camber angle on the scale.

NOTE —
If you are using some other type of gauge, follow the manufacturer's instructions.

4. Roll the car forward a half-turn on the wheels, then repeat the measurement at the chalk-marked points.
5. Take the new reading and average it with the one you obtained earlier. The result is the camber angle corrected for wheel runout.
6. Repeat the entire procedure on the opposite wheel.

The front wheels should have 40' ± 20' of positive camber. Also, the difference in camber between the wheels should not vary more than 30'. If not within specifications, the camber of each wheel should be adjusted to as near 40' as possible.

To adjust camber:

1. Loosen the self-locking nut on the upper ball joint stud. Make certain the notch in the eccentric camber adjusting bushing is roughly toward the front of the vehicle, as indicated in Fig. 3-2.

NOTE —
The vehicle must be standing on its wheels while adjustments are being made.

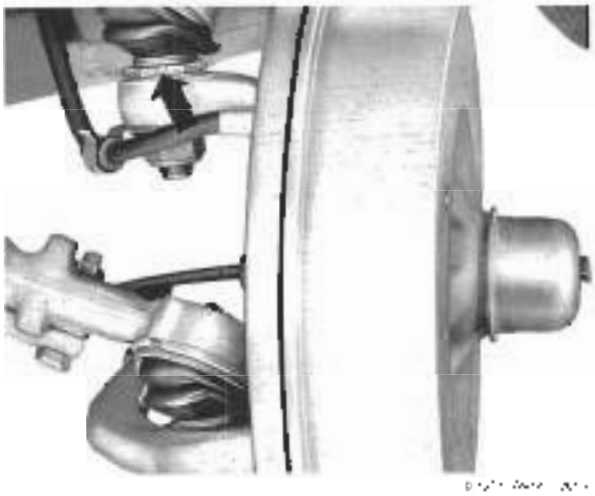


Fig. 3-2. Notch in eccentric bushing (wheel removed for clarity). Adjust camber by turning the bushing a maximum of 90° to either side.

2. Set the spirit level carrier on the protractor to the specified angle of 40' positive camber.
3. Turn the eccentric camber adjusting bushing (Fig. 3-3) until the bubble in the protractor is centered when the protractor is applied to the chalk-marked points.

Fig. 3-3. Eccentric camber adjusting bushing being turned. (Wheel and brake removed for clarity.)

4. Torque the self-locking nut on the ball joint stud to 10 mkg (72 ft-lb). Recheck the camber and, if necessary, repeat the adjustments to bring camber within specifications.
5. Check the toe and adjust it if necessary.

3.2 Checking and Adjusting Toe

All Type 2 vehicles are designed to operate with a small amount of toe-in. This means that the front edges of the tires are slightly closer together than the rear edges. Shops with optical aligning devices should follow the equipment manufacturer's instructions to obtain a toe-in angle of 15' ± 15' — or 5 ± 5 mm after adding 12 to 18 kg (27 to 39 lb) of extra weight above the wheel. The maximum toe change should not exceed 25'.

Most small shops and individual car owners check the toe with a track gauge. This device is used to measure first the distance between two marked points at the front edges of the rims, then the distance between the same two points after the car has been rolled forward until the marks are at the rear. The measurement made at the rear should be 0.0 to 3.3 mm (0.000 to 0.130 in.) or approximately 0 to ⅛ in.) greater.

NOTE —
These specifications apply only when the wheels are in their straight-ahead position. Toe specifications with the wheels turned appear in **10. Front Axle Technical Data.**

To check wheel toe:

1 Turn the steering to its center position.

2 Check the toe. If a track gauge is used, mark the measuring points with chalk. This allows you to make measurements between the same two points after you roll the car ahead a half-turn of the wheels.

3 Adjust the toe if it is not within specifications.

To adjust:

1 Loosen the clamp bolts on both of the clamps on the right-hand tie rod.

2 Correct the toe-in by turning the right-hand tie rod. Rotate the top of the tie rod toward the front of the car to increase the toe-in; to the rear to decrease it. Check toe measurements frequently.

3 When the toe-in is correct, position the tie rod so that the ball joints are not angled. Torque the clamp bolts to 1.5 mkg (11 ft. lb.).

> **NOTE**
> Following adjustments, the steering wheel will normally be centered when the front wheels are in their straight-ahead position. If not, check for bent steering knuckles or bent steering linkage parts, then adjust the steering wheel position as described in 9, **Steering**.

3.3 Checking and Adjusting Steering Lock

A provision for adjusting steering lock has been incorporated on all Type 2 vehicles beginning with chassis No. 211 2060 397, manufactured in November 1970. It consists of two adjusting bolts with locknuts as indicated in Fig. 3-4. The bolt heads limit the travel of the relay lever on both sides.

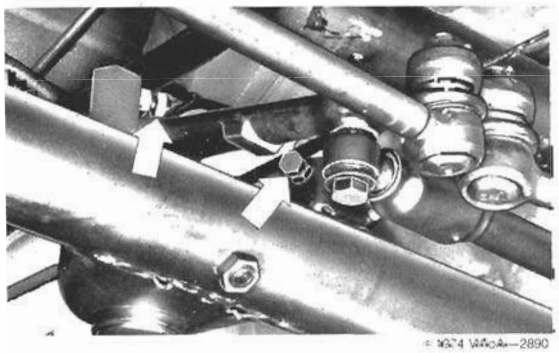


Fig. 3-4. Bolts used to adjust steering lock. On vehicles manufactured before November 1970, steering lock is limited by the position at which the brackets are welded to the cast axle tube.

To check and adjust steering lock:

1 Raise the vehicle—preferably on a hydraulic lift.

2. Turn the front wheels fully to the right and to the left. In either position, the clearance between the tires and the stabilizer bar should be 20 mm (¾ in.) as indicated in Fig. 3-5.

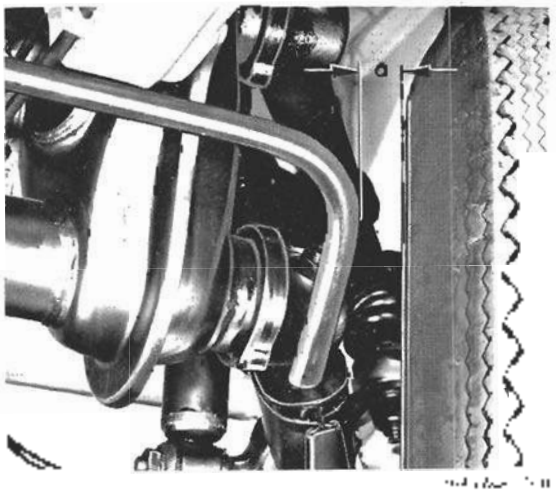


Fig. 3-5. Clearance a between tire and stabilizer bar, should be 20 mm (¾ in.)

3. If clearance is outside the prescribed range, loosen the locknut on the steering lock adjusting bolt(s).

4 Turn the bolt(s) in or out until the prescribed clearance between the tire and stabilizer bar is obtained, then tighten the locknut.

4. SHOCK ABSORBERS

Make sure you install only shock absorbers intended for the front of the vehicle. Mismatched shock absorbers will impair handling and ride. It is not necessary, however, to replace both shock absorbers if only one is defective. Also, front axle shock absorbers of different manufacture can be combined as long as their damping characteristics are identical. If the vehicle is to be subjected to heavy loads, rough roads, or extremely high temperatures, it may be advisable to install heavy-duty shock absorbers in the interest of longer service—despite their effect on the riding qualities of the car.

> ***CAUTION***
> *Install heavy-duty shock absorbers on all four wheels at the same time. Otherwise, handling will be adversely affected.*

4.1 Checking Shock Absorbers

You can quick check the shock absorbers by grasping the front bumper and rocking the car vigorously. When you let go, the vehicle should rebound only once and then settle into its normal attitude. If the car continues to rock or bob, the shock absorbers are worn. Excessive bobbing on the highway also signals defective shock absorbers. Badly worn shock absorbers often make knocking noises when the vehicle is driven.

You can hand-check a shock absorber by extending and compressing it while holding it in its installed position. It should operate smoothly and with uniform resistance throughout its entire stroke. If possible, compare the used shock absorber with a new one. New shock absorbers that have been in storage may have to be pumped several times before they reach full efficiency.

An adequate supply of fluid is placed in the shock absorbers during manufacture to compensate for small leaks. Minor traces of fluid are acceptable if the shock absorber still functions efficiently.

4.2 Replacing Shock Absorbers

Shock absorbers cannot be repaired or serviced and should be replaced if faulty.

To replace:

1. Raise the vehicle and remove the front wheel.
2. Remove the M 12 nut and bolt that hold the upper end of the shock absorber to the front axle end plate.
3. Pull the top of the shock absorber to the rear, then remove the M 10 nut that holds the lower end of the shock absorber on the threaded stud in the lower torsion arm.
4. Remove the old shock absorber.
5. Install the lower end of the new shock absorber on the stud in the lower torsion arm.
6. Incline the top of the shock absorber about 30° to the rear, and then torque the nut to 2.5 to 3.5 mkg (18 to 25 ft. lb.) while the shock absorber is in this position.

NOTE —
This procedure will prevent the lower rubber bushing from twisting as the suspension moves upward. If the vehicle is standing on its wheels while the new shock absorber is being installed, do not incline the shock absorber 30° to the rear. Keep it upright.

7. Move the top end of the shock absorber into line with the upper mounting hole. Install the nut and bolt with a torque of 5.0 mkg (36 ft. lb.).

If only the rubber shock absorber bushings are faulty, it is possible to replace them without replacing the entire shock absorber.

To replace shock absorber bushing:

1. Press the metal sleeve and rubber bushing out of the shock absorber as shown in Fig. 4-1.

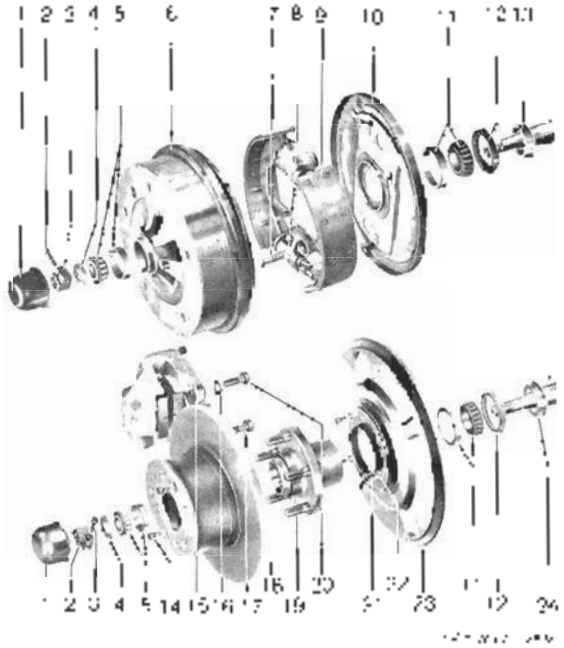
Fig. 4-1. Metal sleeve and rubber bushing being pressed out of the shock absorber

2. Coat the new rubber bushing with talcum powder or silicone spray. Using a vise, press the rubber bushing into the shock absorber until the bushing's shoulder contacts the shock absorber eye.
3. Using the setup shown in Fig. 4-2, press the metal sleeve in from the same side.
4. If necessary, correct the position of the rubber bushing using the same setup used to remove the old sleeve and bushing.

Fig. 4-2. Metal sleeve being pressed in

5. FRONT WHEEL BEARINGS

There are two tapered-roller bearing assemblies at each front wheel. Each bearing has a solid steel outer race and an inner race that consists of a steel cone and a number of caged tapered rollers. The bearings and related parts are shown in Fig. 5-1.



1. Dust cap
2. Socket head clamp screw
3. Clamp nut
4. Thrust washer
5. Outer tapered-roller bearing
6. Brake drum
7. Wheel cylinder mounting bolt
8. Lock washer
9. Front brake shoe
10. Brake backing plate
11. Inner tapered-roller bearing
12. Grease seal
13. Spacer ring (drum brakes)
14. Socket head screw
15. Brake caliper
16. Spring washer
17. Pilot bolt with shoulder
18. Brake disc
19. Wheel hub
20. M 12 bolt
21. Bolt
22. Lock washer
23. Splash shield
24. Spacer ring (disc brakes)

Fig. 5-1. Wheel bearings and related parts

5.1 Removing and Installing Front Wheel Bearings

Before you can remove the brake disc and wheel bearings from vehicles with disc brakes, the brake caliper must be removed as described in **6.1 Removing and Installing Steering Knuckle**. You can remove the inner races with common hand tools. The solid steel outer races, however, are pressed into the brake drum or the wheel hub and should be removed with a hydraulic press and appropriate mandrels.

To remove inner races:

1. Remove the road wheel or, on 1977 and later models, the brake caliper. Then pry off the dust cover.
2. Using a 7-mm (9/32-in.) hex key, loosen the socket head screw in the clamp nut. Then unscrew the clamp nut from the stub axle on the steering knuckle.

   NOTE
   The clamp nut for the left front wheel has a left-hand thread.

3. Pull off the brake drum or disc, being careful not to let the thrust washer and the outer tapered-roller bearing inner race fall out and onto the floor.
4. With the brake drum or disc on the workbench, carefully remove the thrust washer and the outer bearing's inner race. Store them in a clean, dust-free place.

   NOTE
   On vehicles with disc brakes, you can separate the disc from the wheel hub by taking out the socket head screws, then tapping the wheel studs with a rubber mallet.

5. Pry the grease seal out of its recess in the rear of the drum or wheel hub. Then lift out the inner tapered-roller bearing's inner race. Store it with the outer bearing.

To install inner races:

1. Carefully clean the inner bearing races with solvent, then dry them with compressed air.

   CAUTION
   Do not use solvents such as gasoline because they remove all lubrication. Also, do not let blasts of compressed air spin the races. Unlubricated bearings can be damaged by rapid movement.

2. Inspect the inner bearing races. Replace them if they are worn, burred, rough, or heat-blued.
3. Clean the brake drum or wheel hub and inspect the outer bearing races. Replace them if they are worn, burred, rough, or heat-blued.
4. Pack the inner bearing's inner race with multipurpose grease, as described in **LUBRICATION AND MAINTENANCE**. Carefully place it inside the hub.
5. Press a new grease seal into place.
6. Inspect the stub axle for burrs or blued areas. Check the bearing seat dimensions as described in **6.2 Checking Steering Knuckle**. If satisfactory, lightly coat the stub axle with multipurpose grease.

7. Carefully slide the brake drum or wheel hub with or without the brake disc, onto the stub axle so that the grease seal or bearing races are not accidentally damaged by the sharp threads.
8. Pack the outer bearing's inner race with multi purpose grease. Then carefully slide it onto the stub axle and into the hub.
9. Install the thrust washer and the clamp nut. Tighten the clamp nut on the stub axle until the bearings just contact their outer races.
10. Adjust the bearings as described in 5.2 **Checking and Adjusting Front Wheel Bearings**. Install the dust cap, the brake caliper (where fitted), and the road wheel.

To remove outer races:

1. Support the brake drum or wheel hub, outside down, on the press bed. Using a suitable driving mandrel, press out the outer bearing's outer race.
2. Turn over the brake drum or wheel hub.
3. Using a suitable driving mandrel, press out the inner bearing's outer race.

Installation is the reverse of removal. The inner bearing's outer race, being the larger, is pressed out last but the sequence is unimportant to installation. Make certain, however, that the hub recesses are clean and free of burrs or pressure marks that could prevent the races from seating completely.

5.2 Checking and Adjusting Front Wheel Bearings

Wheel bearings should turn smoothly and not have excessive axial play. If the bearings feel gritty, have tight spots, or make noises when the wheel turns, they probably need to be replaced. Excess axial play, though, can be corrected by adjusting.

To adjust bearings:

1. Raise the wheel, then pry off the dust cap.
2. If the bearings have just been installed, torque the clamp nut to about 1.0 mkg (7 ft lb) while you hand-turn the brake disc or drum.

> ***CAUTION —***
> *Never torque the clamp nut to more than 1.0 mkg (7.5 ft lb). Doing so will damage the bearing races.*

3. To measure the bearing axial play, install a dial indicator on one of the wheel lugs or in place of a wheel bolt (or use a dial indicator with a magnetic base).
4. Position the dial indicator pin against the end of the stub axle as shown in Fig. 5-2. Then move the wheel in and out by hand, turning the clamp nut one way or the other until the axial play is between 0.03 and 0.12 mm (.001 and .005 in.).

Fig. 5-2. Dial indicator being used to measure wheel bearing axial play (indicated by arrow)

> **NOTE —**
> Turn the wheel and repeat the measurement at several different points. The readings should not vary greatly and their average should fall within the prescribed range. Replace bearings that will not adjust properly.

5. Torque the socket head clamp screw to 1.5 to 2.0 mkg (11 to 14 ft lb).
6. Install the dust cap and lower the wheel to the ground.

6. STEERING KNUCKLES

The steering knuckles, with their integral steering arms, are held onto the torsion arms by ball joints. For safety as well as drivability, it is important that the steering knuckles are not bent. Check them carefully after an accident or other severe impact.

6.1 Removing and Installing Steering Knuckle

When removing the steering knuckle, take off the brake assembly only if you are planning to replace the steering knuckle itself. The brake assembly can be left in place if only the ball joints require attention.

10 FRONT AXLE

To remove steering knuckle:

1 On vehicles with drum brakes, remove the brake drum and the wheel bearings as described in **5.1 Removing and Installing Front Wheel Bearings.**

2 On cars with disc brakes, remove the brake caliper from the steering knuckle by removing the two bolts and the brake hose clamp indicated in Fig. 6-1

CAUTION —
The caliper must have cooled to room temperature before you remove it. Otherwise, it may be damaged by heat distortion.

Fig. 6-1. Bolts and brake hose clamp that hold disc brake caliper on steering knuckle

3 Using a stiff wire hook, suspend the brake caliper from the car body so that it is not being supported by the brake hose.

WARNING —
Never let a brake caliper or brake backing plate assembly hang by the brake hose. Doing so could weaken the hose and cause subsequent brake failure.

4 On cars with drum brakes, remove the four M 10 bolts that hold the brake backing plate assembly on the steering knuckle. Remove the backing plate assembly and suspend it from the car body so that its weight is not supported by the brake hose.

5 Remove the cotter pin and the castellated nut from the tie rod end stud. Then press out the tie rod end as shown in Fig. 6-2.

CAUTION —
Do not hammer out the tie rod end. Doing so will ruin the threads and make reinstallation impossible.

Fig. 6-2. Tie rod end being pressed out. Tie rod sleeve prevents damage to the threads on the tie rod end stud

6 On cars with disc brakes, remove the three bolts that hold the splash shield on the steering knuckle. Then remove the splash shield.

7 Remove the M 12 self-locking nut from the lower suspension ball joint stud. Then install an M 18 x 1.5 cap nut and press the ball joint stud loose as shown in Fig. 6-3.

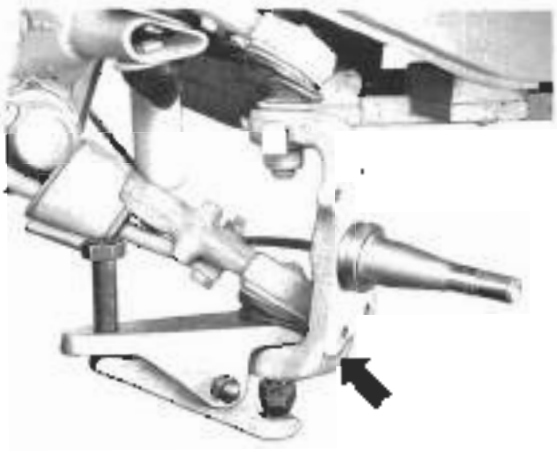


Fig. 6-3. Ball joint being pressed loose of steering knuckle (arrow)

8 Remove the M 18 self-locking nut from the upper ball joint stud. Then turn the eccentric camber adjusting bushing to free the steering knuckle from the upper ball joint. See Fig. 6-4

Fig. 6-4. Eccentric camber adjusting bushing being turned. Support the steering knuckle so that it does not drop off suddenly.

NOTE —
If the steering knuckle is being removed so that the upper ball joint can be repaired or replaced, press the ball joint stud out of the eccentric camber adjusting bushing. See 7.4 **Repairing and Replacing Ball Joints**

To install:

1. Loosely attach the steering knuckle to the lower ball joint
2. Using a tool similar to the one shown in Fig. 6-5, lift the lower torsion arm until the upper ball joint stud enters the steering knuckle.

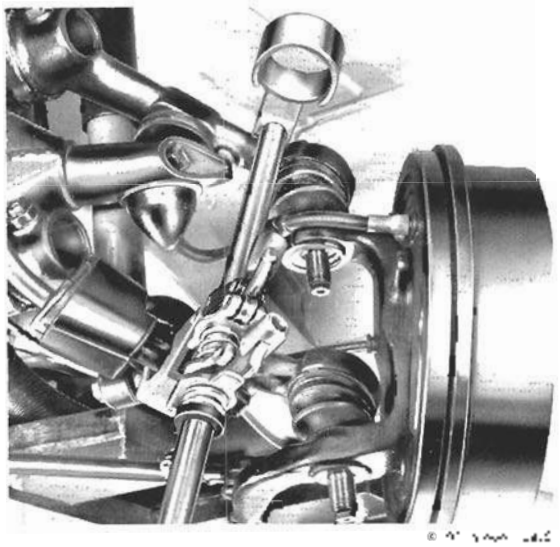


Fig. 6-5. Special tool used to lift torsion arm

3. Position the eccentric camber adjusting bushing so that its notch points forward as shown in Fig. 6-6

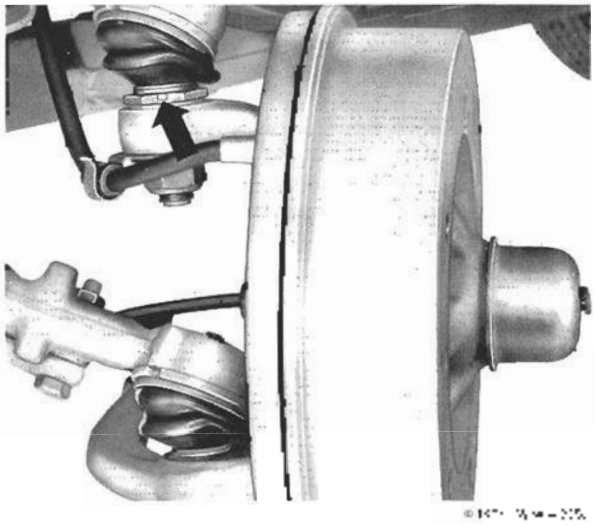


Fig. 6-6. The notch on the eccentric camber adjusting bushing

4. Install new self-locking nuts on the ball joint studs. Torque only the nut on the lower ball joint stud to 10 mkg (72 ft. lb.).
5. Install the tie rod end in the steering knuckle. Torque the castellated nut to 3.0 mkg (22 ft. lb.). Advance the nut, if necessary, to uncover the cotter pin hole, then install a new cotter pin.
6. On vehicles with drum brakes, install the brake backing plate assembly. Torque the M 10 bolts to 5.5 to 6.0 mkg (40 to 43 ft. lb.)
7. On vehicles with disc brakes, install the splash shield. Torque the bolts to 1.0 mkg (7.0 ft. lb.)
8. Install the brake drum or disc. Then adjust the front wheel bearings as described in **5.2 Checking and Adjusting Front Wheel Bearings**
9. On vehicles with disc brakes, install the brake caliper. Torque the M 12 bolts used on 1968 through 1972 models to 10 mkg (72 ft. lb.). Torque the M 14 bolts used on 1973 and later models to 16 mkg (116 ft. lb.)
10. Install the road wheel. Torque the wheel bolts used on 1968 through 1970 models to 13 mkg (94 ft. lb.). Torque the wheel nuts used on 1971 and later models to 12 to 14 mkg (87 to 101 ft. lb.)

WARNING —
Tighten the wheel bolts or nuts with the vehicle on the ground. The leverage needed for this job is enough to topple a car off the lift.

11. Adjust the camber and toe as described in **3. Front Wheel Alignment**. Torque the self locking nut on the upper ball joint stud to 10 mkg (72 ft. lb.).

6.2 Checking Steering Knuckle

The steering knuckle can be checked either on or off the car. Measure the stub axle at the three points indicated in Fig. 6-7. The diameter of the outer bearing seat (A) should be 19.03 to 19.05 mm (.7491 to .7499 in.). The diameter of the inner bearing seat (B) should be 31.73 to 31.75 mm (1.2492 to 1.2499 in.). The spacer ring seat (C) should have a diameter of 38.04 to 38.08 mm (1.4976 to 1.4992 in.). Check the dimensions with a micrometer or a vernier caliper.

Fig. 6-7. Stub axle measuring points. Dimensions are given in preceding text.

You can check the steering knuckle's stub axle for bending using a vernier caliper and a machinist's square as shown in Fig. 6-8. Make your measurements at not less than three points around the stub axle. The difference between any two measurements should not exceed 0.25 mm (.010 in.).

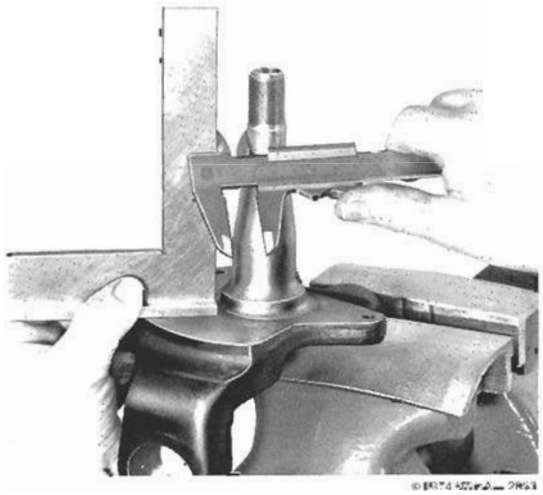


Fig. 6-8. A vernier caliper and machinist's square being used to check the stub axle for bending.

On vehicles with drum front brakes, use tool VW 2581/2 to check the steering arm for bending. The steering knuckle is within tolerances when the hole in the steering arm is in line with another hole in the gauge, and when the top face of the steering arm eye is parallel to the surface of the gauge as indicated by **a** in Fig. 6-9.

Fig. 6-9. Special gauge in position with its center plate slipped over the stub axle. Check the steering arm at **a**, as described in the text.

On vehicles with disc front brakes, use a straightedge and vernier caliper to check the steering arm for bending (Fig. 6-10). The distance from the straightedge to the outer edge of the tie rod hole should be 110.50 to 111.50 mm (4.350 to 4.389 in.).

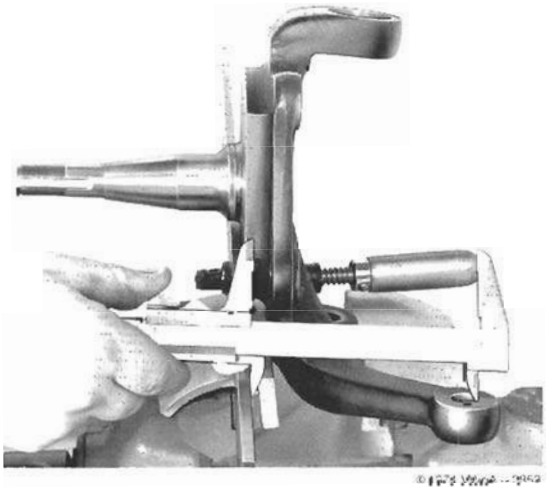


Fig. 6-10. Steering arm being checked for bending.

CAUTION —
Bent steering knuckles must be replaced and not straightened. Bending them back to their original shape will seriously weaken them structurally.

7. TORSION ARMS, SUSPENSION BALL JOINTS, AND TORSION BARS

The torsion bars that provide springing for the front wheels are housed inside the axle beam. Socket head setscrews hold the torsion arms on the outer ends of the bars. The suspension ball joints are a press fit in the torsion arms.

7.1 Checking Ball Joints

A special lever and vernier caliper should be used to check the ball joint play. If the steering knuckle has been removed, check the ball joints as described in **7.4 Repairing and Replacing Ball Joints.**

To check:

1. Lift the car. Then turn the steering to one side.
2. Install the special lever as shown in Fig. 7-1.
3. Place a vernier caliper over the ball joint with one jaw on the steering knuckle and the other on the torsion arm. Note the reading.
4. Pull down on the lever in order to raise the torsion bar and expand the ball joint. Note the new reading on the vernier caliper.

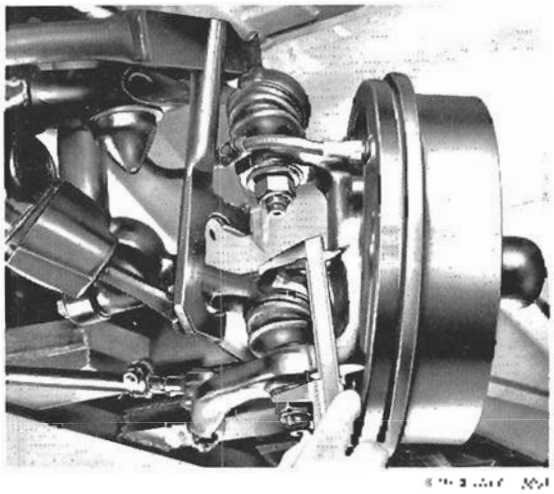


Fig. 7-1. Lever and vernier caliper in position. Lever should draw the two torsion arms toward one another when the handle is raised.

5. Compare the two readings. The difference between them is the ball joint play.

NOTE —
Neither the upper or lower ball joint should exceed 2.00 mm (.080 in.) play. Joints that exceed this must be replaced.

7.2 Removing and Installing Torsion Arm

Each torsion arm is held on its torsion bar by a socket head setscrew and locknut.

To remove:

1. Remove the steering knuckle complete with brake assembly.
2. If the lower torsion arm is to be removed, disconnect the stabilizer bar by driving the retainers off the two stabilizer bar rubber mounting clamps.

NOTE —
It is necessary to bend down the locking tabs on the retainers before driving them off. Obtain new retainers for use during assembly.

3. Remove the nut from the stabilizer bar mounting bolt on the lower torsion arm, then take off the stabilizer bar.
4. Loosen the locknut on the socket head setscrew that holds the torsion arm on the torsion bar. Then remove the setscrew.
5. Remove the torsion arm from the end of the torsion bar.

Installation is the reverse of removal. Inspect the rubber seal for the torsion arm. Replace the seal if it is worn, cracked, or loose-fitting.

7.3 Checking Torsion Arms

The torsion arms can be checked for bending only after they have been removed from the car. A special measuring jig, VW 262d, is required for this job.

CAUTION —
If you lack the skills or special tools needed for checking the torsion arms or replacing the suspension ball joints, we suggest you leave such repairs to an Authorized VW Dealer or other qualified shop. We especially urge you to consult your Authorized VW Dealer before attempting repairs on a car still covered by the new-car warranty.

Suspension ball joints used prior to the 1973 model year have screw-in plastic plugs in their end plates. The latest type ball joints do not have these plugs. Instead, there is a small depression in the end plate with a 6-mm (.236-in.) diameter test surface. This modification has necessitated a minor change in the test jig. When checking

torsion arms with the late-type ball joints the test plates on the test jig must be changed.

The ball joint without a plastic plug is shown in Fig 7-2.

Fig. 7-2. Late-type ball joint with test surface (arrow) instead of plastic plug

To check torsion arms:

1 Carefully clean the torsion arm and ball joint

2 Inspect the bearing surfaces on the torsion arm. If they are worm, replace the torsion arm complete with the ball joint and also the needle bearing and metal bushing in the axle tube

3 On early-type ball joints, remove the plastic plug from the end plate and install the test point in its place as shown in Fig 7-3

Fig. 7-3. Test point being installed. Screw the point into the hole for the plastic plug

4. With the late-type ball joints, install the proper measuring plates on the test jig and screw the measuring pin into the appropriate hole in the measuring plate.

5 Using the correct bushings from the set supplied with the VW 282d, install the torsion arm in the test jig. Use bushing VW 282d/12 for the torsion arm's inner bearing surface and spacer ring VW 282d/21 for the outer bearing surface.

6 See whether the test point contacts the test jig measuring plate (or the point on the measuring plate contacts the test surface on the ball joint) as shown in Fig. 7-4 or Fig. 7-5.

Fig. 7-4. Early-type ball joint. Test point should contact the boss on test plate.

NOTE —
The lower torsion arms should contact the small, outer boss on the test jig, as shown in Fig. 7-4. Upper torsion arms should contact the taller, outer boss that is just to the left of the small boss being contacted in the illustration. The threaded holes for the test point used with late-type ball joints are in the same relative locations as the bosses used with the early ball joints.

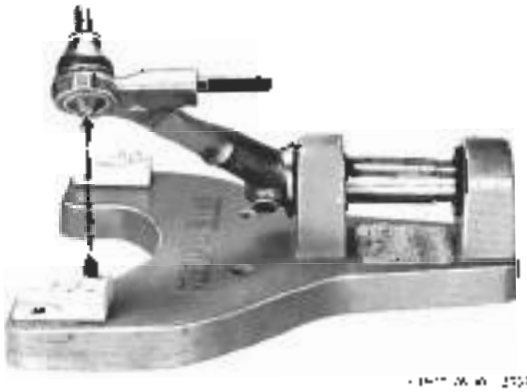


Fig. 7-5. Late-type ball joint. Point on jig should contact test surface on ball joint. Torsion arm shown is not for a Type 3 vehicle

CAUTION —
Bent torsion arms must be replaced complete with ball joints and not straightened. Bending them back to their original shape will seriously weaken them structurally.

7. On early type ball joints, remove the test point and screw in a new plastic plug.

7.4 Repairing and Replacing Ball Joints

To check the ball joint play after the torsion arm has been removed, place a vernier caliper over the ball joint as shown in Fig. 7-6. Press the stud in all the way and note the measurement. Then pull the stud out and take another measurement. Compare the two readings. The difference between them is the ball joint play.

Fig. 7-6. Ball joint play being checked. Move measuring jaws with the stud all the way in and all the way out.

NOTE —
New ball joints must not exceed 0.30 mm (.012 in.) play. Used ball joints must not exceed 2.00 mm (.080 in.) play. Used ball joints that are at or near this wear limit must be replaced.

Damaged ball joint seals can be replaced. However, the late-type ball joints without plastic plugs must be replaced if dirt has entered them. The early-type ball joints should be thoroughly cleaned in solvent after the damaged seal has been removed. Then remove the plastic plug from the tapped hole and install a grease fitting. Force multipurpose grease through the joint until all traces of dirt have been expelled.

Install the small steel retaining ring on the new dust seal. Then fill the new dust seal with approximately 10 g (⅓ oz.) of multipurpose grease.

Install the dust seal on the ball joint. Then place a conical sleeve over the seal as shown in Fig. 7-7. Slide the new retaining ring over the conical sleeve and off its large end onto the ball joint seal. The conical sleeve will keep the retaining ring from accidentally puncturing the new seal.

Fig. 7-7. Retaining ring being slipped off large end of conical sleeve and onto dust seal. The retaining ring groove must be crossed.

After the new dust seal has been installed, remove the grease fitting. Then seal the tapped hole with a new plug.

CAUTION —
Do not hammer in the plug; screw it in. Otherwise it will soon fall out!

Depending on the tolerance range of the torsion arm, either a standard size ball joint or an oversize ball joint is installed. The torsion arms with oversize holes—0.30 mm (.012 in.) larger—are identified by a letter **B** stamped in the locations shown in Fig. 7-8.

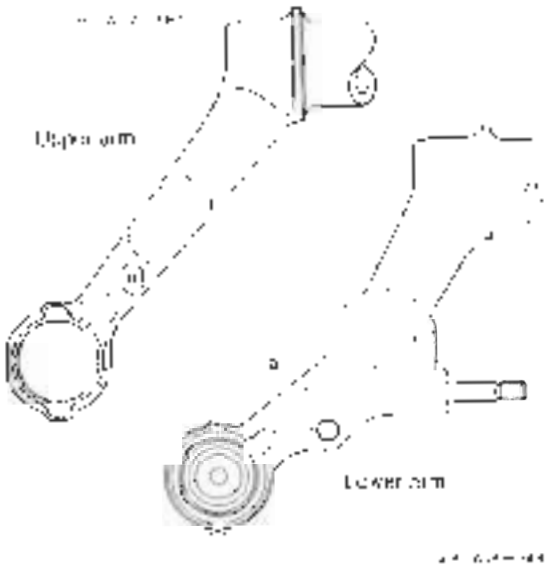


Fig. 7-8. Making locations of torsion arms with oversize ball joint holes.

The oversize ball joints are 0.30 mm (.012 in.) larger in diameter and are identified by two additional V-shaped notches as indicated in Fig. 7-9. These notches are located 45° from the two square installation-position grooves found on both standard and oversize ball joints.

Fig. 7-9. V notches (arrows) that identify an oversize ball joint

The ball joints are a press fit in the torsion arms. They must fit properly and, once pressed out, must never be reinstalled in a torsion arm.

To replace ball joint:

1. Press the old ball joint out of the torsion arm as shown in Fig. 7-10.

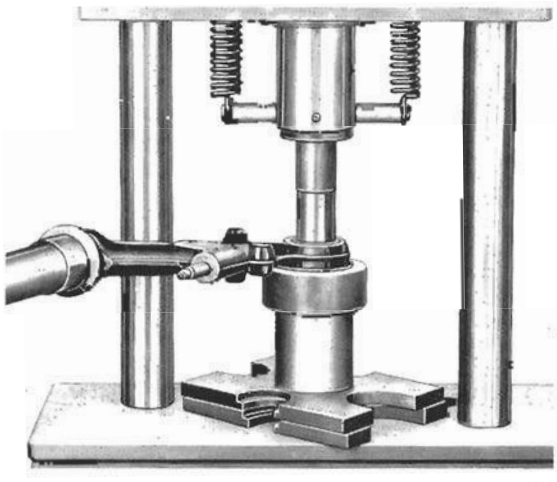


Fig. 7-10. Hydraulic repair press being used to press the ball joint out of the torsion arm

2. If necessary, press the eccentric camber adjusting bushing off the ball joint for an upper torsion arm as shown in Fig. 7-11.

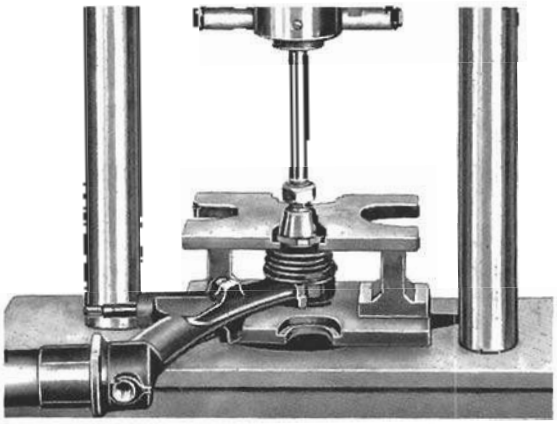


Fig. 7-11. Ball joint being pressed loose from eccentric camber adjusting bushing. Note the nut installed on the ball joint stud. This nut will keep the ball joint from being lost suddenly.

3. Align the installation-position groove with the boss on the torsion arm (Fig. 7-12).

WARNING —
Never reinstall used ball joints. They will not fit tightly and could come out of the torsion arm while the car is being driven.

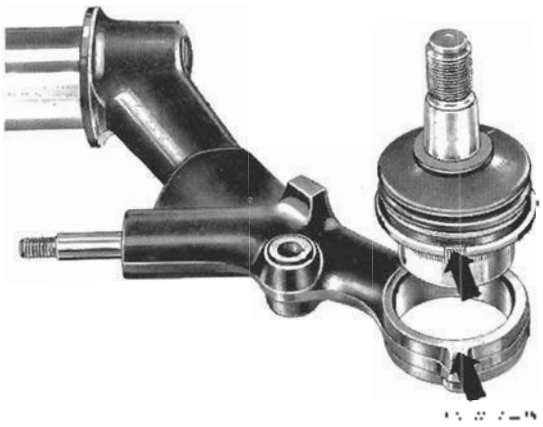


Fig. 7-12. Groove in ball joint (one arrow). When you install the ball joint, align the groove with the boss on the torsion arm (bottom arrow).

4. Being careful to keep the groove and the forged boss aligned, press the new ball joint into the torsion arm. Use a sleeve-type driving mandrel that will apply pressure to the outer part of the ball joint only.

NOTE —
Press the ball joint in from the bottom of the torsion arm.

5. Using suitable mandrels and adaptors, install peening tool VW 471 on the press ram. Prein the ball joint cover to obtain the pattern indicated by a in Fig. 7-13.

NOTE —
The peening tool must be applied three times with a pressure of 6 tons to ensure that the joint fits tightly in the arm.

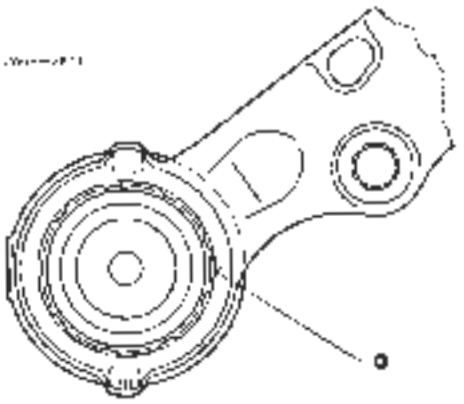


Fig. 7-13. Preinstall ball joint cover. Cover indentation is expanded as indicated by a

Replacing Shock Absorber Stud

An oversize shock absorber stud is available to replace studs that are bent, broken, or corroded. First drive out the dowel pin, then extract the shock absorber stud. If the stud is broken, centerpunch the remaining part and drill a 3-mm (⅛-in.) pilot hole. Then drill out the stud with a 10.75-mm (27/64-in.) drill. The broken part will usually come out with the last few turns of the drill. Enlarge the hole to 12.3 mm (31/64 in.); then ream the hole with a 12.455 to 12.482-mm (.4904 to .4914 in.) reamer. (Alternately, you can grind the oversize stud down to obtain a 0.01 to 0.05-mm [.0004 to .002-in.] press fit.) Press in the oversize stud until it projects 45.00 to 45.50 mm (1.771 to 1.791 in.) as shown by dimension b in Fig. 7-14. Drill a 4.00 to 4.08-mm (.157 to .161 or about 5/32 in.) hole at dimension a. Then drive in the dowel pin.

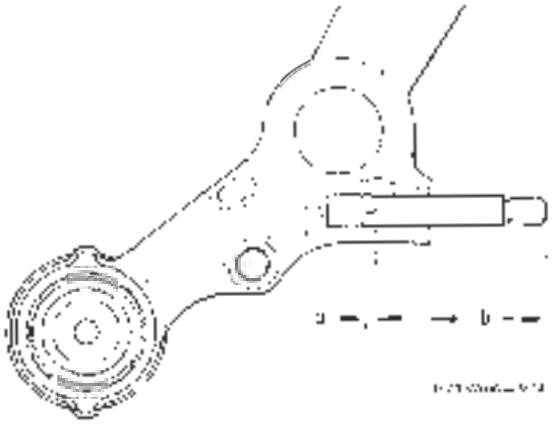


Fig. 7-14. Oversize stud fitting dimensions (see text)

7.5 Removing and Installing Torsion Bars

From August 1969 the torsion bars have a white paint spot on one end. This end must be on the left side of the car. Use only unmarked bars on earlier models.

To remove:

1. Remove both steering knuckles complete with brake assemblies, as described in **6.1 Removing and Installing Steering Knuckle**. Suspend the steering knuckles from the axle tubes with heavy wire hooks.

WARNING —
Never let the knuckle hang by the brake hose. Doing so could weaken the hose and cause subsequent brake failure.

2. On lower torsion bars only, remove the shock absorber. On upper torsion bars only, detach the front gearshift rod at the shift rod coupling, then push the front gearshift rod to one side.
3. Remove the torsion arm from one end of the torsion bar, as described in **7.2 Removing and Installing Torsion Arm**.
4. Loosen the locknut on the socket head setscrew. Then remove the setscrew (Fig. 7-15).

Fig. 7-15. Setscrews with locknuts (arrows) that hold the torsion bars in inner center bushings

5. Gripping the torsion arm that is still installed, pull the torsion bar out of the axle beam tube.

Installation is the reverse of removal. Clean the torsion bar, inspect it for cracks and breakage, and then coat it liberally with multipurpose grease before you install it. Align the countersunk mark in the center of the bar with the setscrew hole. Torque first the setscrew and then the locknut to 4.0 mkg (29 ft. lb.). Then install the torsion arm and both steering knuckles.

7.6 Replacing Needle Bearings And Metal Bushings

The needle bearings are more likely to require replacement than the metal bushings which are subject to very little wear. However, if wear is noted on the torsion arm bearing surface, replace the metal bushing as well as the worn torsion arm.

To remove:

1. Remove the torsion arms and torsion bars as described in 7.5 **Removing and Installing Torsion Bars**.
2. Using an expansion tool or a toggle washer behind the needle bearing, pull out the needle bearing with a slide hammer as shown in Fig. 7-16.

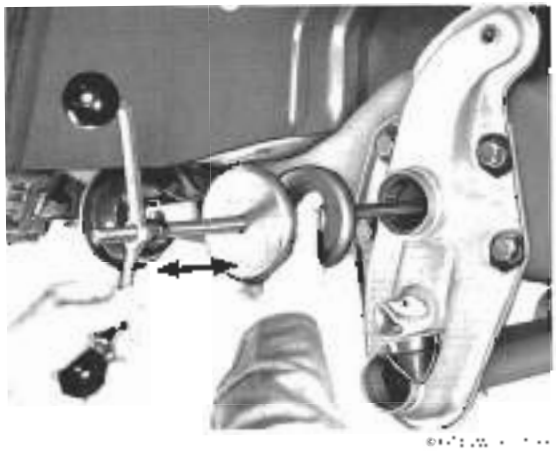


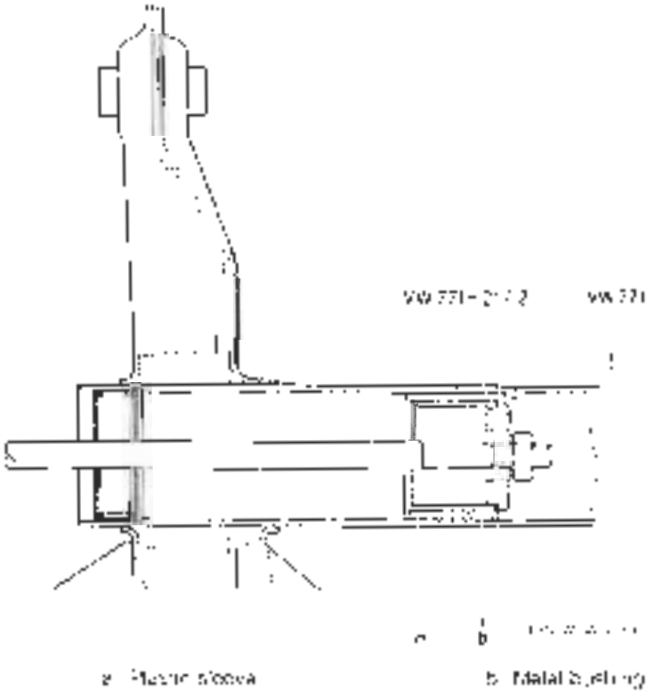
Fig. 7-16. Needle bearing being pulled out of axle tube with slide hammer and toggle washer.

3. Measure the metal bushing for wear as shown in Fig. 7-17.

Fig. 7-17. Internal measuring gauge being used to check inside diameter of metal bushing.

4. If the metal bushing has worn to a diameter greater than 43.40 mm (1.7086 in.), pull it out with a slide hammer and the tools shown in Fig. 7-18.

CAUTION —
Do not pull out the plastic sleeve as it is not subject to wear. Replacement sleeves are not supplied, so if you remove or damage them the entire axle beam must be replaced.



a - Plastic sleeve b - Metal bushing

Fig. 7-18. Toggle washer in position to pull out metal bushing without removing plastic sleeve.

5. Clean the needle bearing seats. Then, using the internal measuring gauge illustrated in Fig. 7-17, check the diameter of the needle bearing seats.

NOTE —
This measurement is essential since both standard and oversize needle bearings are used.

Install standard bearings in either upper or lower tubes that measure 56.97 to 56.99 mm (2.2429 to 2.2437 in.). Install oversize bearings in either upper or lower tubes that measure 57.17 to 57.19 mm (2.2507 to 2.2515 in.). Standard bearings are 56.96 to 56.99 mm (2.2425 to 2.2437 in.) in diameter; oversize bearings are 57.17 to 57.19 mm (2.2507 to 2.2515 in.) in diameter.

Oversize bearings are marked with the letter **U** on the chamfered end which faces outward. If the bearing seats are no longer within tolerance, replace the axle beam.

Clean the axle tubes particularly at the needle bearing and metal bushing seats. Then drive in the needle bearing hardened face outward, until the shoulder on the special drift (VW 772) contacts the axle tube as shown in Fig. 7–19. Using the needle bearing as a pilot for the drift drive the metal bushings in with VW 772

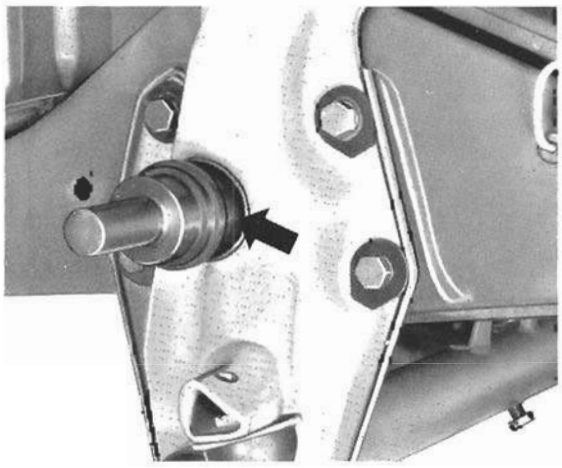


Fig. 7–19. Drift used to drive in needle bearing and metal bushing. Arrow points to contact face at arrow

If the special drift is unavailable, position the needle bearing and the metal bushing as shown in Fig. 7–20. Dimension a is 141.00 – 1.00 mm (5.551 – .040 in.). Dimension b is 7.00 – 0.50 mm (.276 – .020 in.)

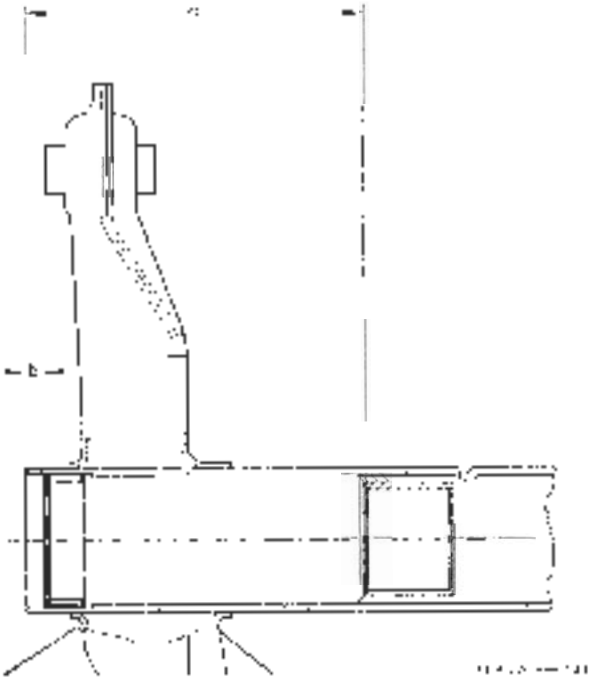


Fig. 7–20. Needle bearing and metal bushing positions

After the needle bearing and metal bushing are driven into place, install the seal retainers with their lugs in a vertical position as shown in Fig. 7–21.

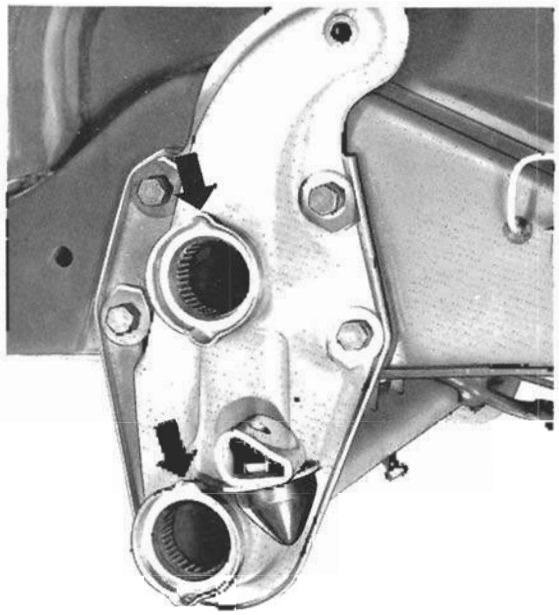


Fig. 7–21. Seal retainers installed over needle bearings. The lugs should be vertical as indicated by the two arrows

NOTE

Oversize seal retainers are available for use with oversize needle bearings. The oversize seal retainers are marked with a groove as indicated by the arrow in Fig. 7–22

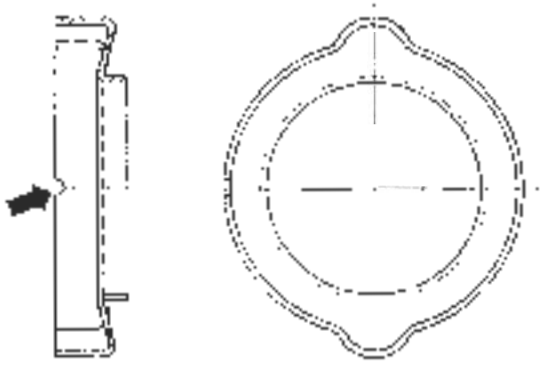


Fig. 7–22. Oversize seal retainer marked by groove

After the seal retainers have been correctly installed, install new rubber seals. Then reinstall the torsion bars and torsion arms, the steering knuckle and brake assembly, and other remaining parts.

8. REMOVING AND INSTALLING AXLE BEAM

Through most front axle repairs can be carried out with the axle beam mounted on the car, it may be necessary to remove the axle beam when correcting body or frame damage or to facilitate a complete front axle rebuild. If you suspect that the axle beam has been bent by accident damage, you can check the axle tubes with a straightedge.

CAUTION
Front axle beams must be replaced and not straightened. Bending them back to their original shape will seriously weaken them structurally.

To remove:

1. Raise the car and remove the front road wheels.
2. Disconnect the brake hoses at the brackets. Plug the brake lines with new bleeder valve dust caps.
3. Remove the cotter pin from the speedometer cable where the cable end projects from the left dust cap. Then, working behind the steering knuckle, pull out the cable complete with its housing.
4. Working under the car, remove the cover plate that is beneath the pedal cluster.
5. Engage either first or third gear. Then disconnect the gearshift rod at the coupling indicated in Fig. 8-1.

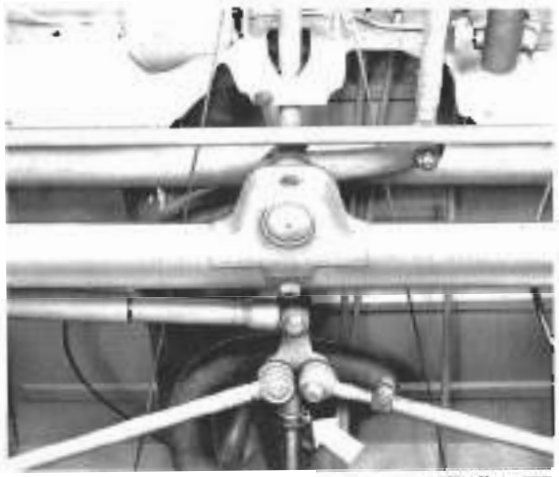


Fig. 8-1. Coupling (arrow) where gearshift rod can be disconnected.

6. On vehicles with manual transmissions, remove the gearshift lever and front gearshift rod. On vehicles with automatic transmissions, remove the front gearshift rod by unbolting it from the lower part of the selector lever. *See* **TRANSMISSION AND REAR AXLE** or **AUTOMATIC TRANSMISSION**.
7. Disconnect the clutch cable from the pedal arm at the point indicated in Fig. 8-2.

Fig. 8-2. Clutch cable disconnecting point (arrow).

8. Disconnect the parking brake cables from the parking brake lever.
9. Remove the cotter pin and castellated nut from the drag link end stud. Then press the drag link end out of the relay lever with the tool shown in Fig. 8-3.

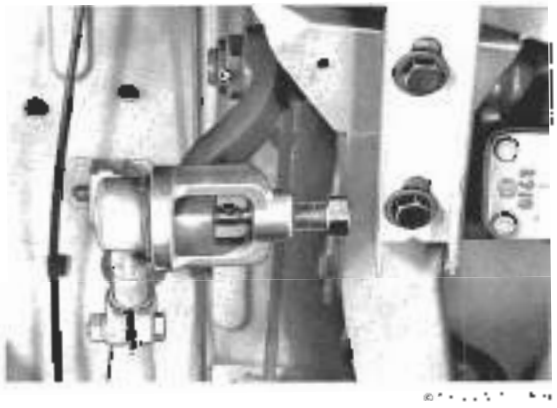


Fig. 8-3. Drag link end being pressed out. The drag link is shown being pressed out of the steering gearbox drop arm, but the same tool should be used to press it out of the relay lever.

CAUTION
Do not hammer out the drag link end. Doing so will ruin the threads and make reinstallation impossible.

10. So that the steering damper will not be accidentally damaged by the floor jack's supporting adapter, unbolt the damper from the bracket on the axle tube. Then swing the damper out of the way to the rear.

11. Position a floor jack with the VW 610 front axle supporting adapter under the front axle. Then raise the jack until the adapter is in firm contact with the axle beam.

> ***WARNING —***
> *If you do not have a suitable jack and adapter, have at least two helpers support the front axle while you are unbolting it. Trying to handle this job alone could lead to serious injury owing to the weight of the axle.*

12. Remove the four axle beam mounting bolts from each side plate. Then, using the floor jack, lower the axle and pull it from under the vehicle.

To install:

1. Place the axle on the floor jack front axle adapter VW 610. Then raise the axle and position it on the vehicle.

> **NOTE —**
> If there is a gap between the axle end plates and the frame side members, take up the gap with spacers, which are available in thicknesses of 0.50 and 1.00 mm (.020 and .040 in.).

2. Using new lock washers, install, but do not tighten, the four mounting bolts in each end plate.

3. To ensure that braking stresses will not loosen the mounting bolts, tilt the axle forward to take up the play between the mounting bolts and the bolt holes in the axle beam end plates. Then torque the mounting bolts to 9.0 to 12.5 mkg (65 to 90 ft. lb.).

4. Install the drag link in the relay lever. Torque the castellated nut to 3.0 mkg (22 ft. lb.). Advance the nut, if necessary, to uncover the cotter pin hole. Then install a new cotter pin.

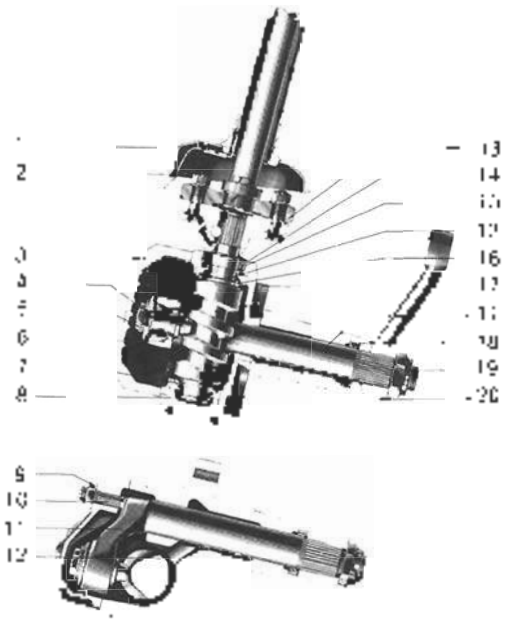
5. Using a new lockplate, install the steering damper on its bracket on the lower axle beam tube. Torque the mounting bolt to 4.0 to 4.5 mkg (29 to 32 ft. lb.).

6. Install the front gearshift rod. If the vehicle has a square head setscrew at the coupling, lock it with safety wire.

The remainder of installation is the reverse of removal. Make sure the brake hoses are not twisted and use a new cotter pin in the end of the speedometer cable. Following axle installation, bleed the brakes, adjust the parking brake, and adjust the front wheel camber and toe.

9. STEERING

The worm and peg steering gearbox used on 1968 through 1972 Type 2 vehicles is shown in Fig. 9-1.



1. Column tube retaining ring
2. Column tube cover
3. Steering gearbox cover
4. Peg
5. Peg securing nut
6. Rollers (16 each type)
7. Thrust bearing
8. End plate
9. Locknut for adjusting screw
10. Adjusting screw
11. Peg shaft
12. Worm spindle
13. Steering coupling
14. Worm spindle cap
15. Worm spindle oil seal
16. Upper bearing
17. Steering gearbox case
18. Peg shaft oil seal
19. Lockplate nut
20. Drop arm

Fig. 9-1. Worm and peg steering gearbox

The steering system normally requires no maintenance. However, the steering gearbox can be damaged if the vehicle is operated for a long time with improperly adjusted steering. Replacement parts are available for the worm and peg steering gearbox. Complete data for rebuilding this unit are given later in this section.

Although the removal and installation procedures given in this section are illustrated with photos of the worm and peg unit, the procedures apply equally to the worm and roller gearbox. For the most part, the worm and roller steering gearbox must be replaced as a unit if it is worn or damaged. However, the roller shaft oil seal, Part No. 211 415 275A is available as a replacement part.

Fig. 9-2 is a cross-section of the worm and roller steering gearbox. It shows the location of the sole replaceable component, the roller shaft oil seal.

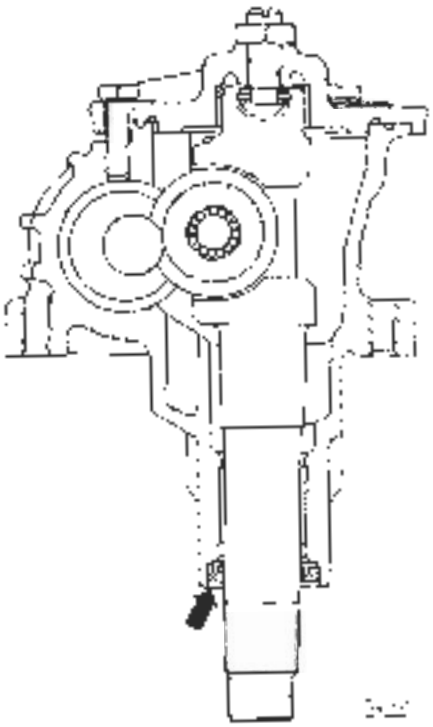


Fig. 9-2. Roller shaft oil seal (arrowed) in worm and roller steering gearbox

To replace seal:

1. Remove the drop arm as described in **9.5 Removing and Installing Drag Link and Drop Arm.**
2. Using a sharp-edged screwdriver, pry out the faulty seal.

> ***CAUTION —***
> *Be careful not to scratch the roller shaft, as doing this will cause rapid wear of the new seal and renewed leakage.*

3. Thoroughly clean the seal recess in the steering gearbox housing and wipe clean the exposed end of the roller shaft.
4. Wrap the splines of the roller shaft with thin plastic electrical tape in order to protect the seal from being cut by the splines as the seal is installed.
5. Lightly lubricate the seal lip and pack the groove in the seal with multipurpose grease. Then slide the oil seal onto the shaft—with the seal's grooved side toward the steering gearbox.
6. Using an appropriate tool, drive the oil seal fully into position.

> **NOTE —**
> A suitable driving tool is a tube that has an inside diameter of 32 mm (1¼" or more), an outside diameter of 36 mm (1⅜" or more), and a length of 100 mm (4 in.).

7. Reinstall the drop arm. Use a new lock plate and torque the nut to 14.0 mkg (101 ft. lb.).
8. Using a dipstick, check the steering gearbox oil level. If necessary, add hypoid gear oil until the roller shaft is covered.

9.1 Adjusting Worm and Peg Steering

Check the worm and peg steering with the vehicle lifted. Turn the steering back and forth through its centered position several times. You should feel resistance as the steering passes through its centerpoint, but it should do so smoothly—without sticking. If there is no resistance or if the steering binds, adjust the steering.

To adjust:

1. Torque the steering gearbox mounting bolts to 3.5 to 5.0 mkg (25 to 36 ft. lb.); and the steering gearbox cover bolts to 1.5 mkg (11 ft. lb.).
2. Loosen the locknut for the adjusting screw. Have someone gradually turn the adjusting screw (Fig. 9-3) until you feel the correct resistance as the steering passes through the centerpoint.

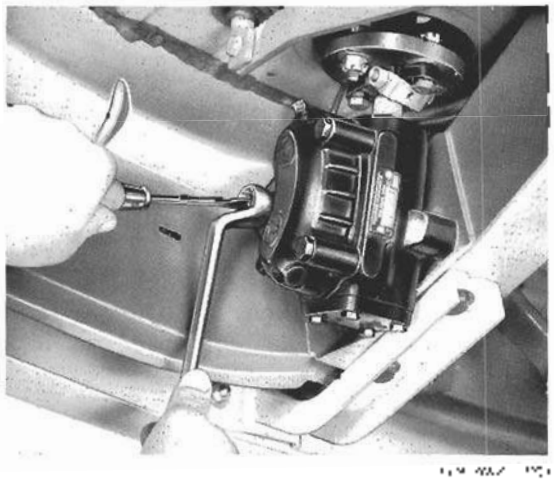


Fig. 9-3. Worm and peg steering being adjusted

5. If you lack an experienced helper, attach a torque gauge as shown in Fig. 9-4.

Fig. 9-4 Torque gauge being used to check worm and roller steering adjustment

NOTE —
Take off the horn button and disconnect the horn wire so that the torque gauge can be attached to the steering wheel nut. Also, the drag link must be disconnected from the drop arm as described in **9.5 Removing and Installing Drag Link and Drop Arm**

4. Turn the adjusting screw one way or the other in small increments until it is possible to turn the steering through the centerpoint with a torque of 8 to 10 cmkg (7 to 9 in. lb.)

NOTE —
The torque given in Step 4 applies only to gearboxes that have had at least 3000 miles (5000 km) of service. New gearboxes—or gearboxes that have new cases, peg and worm sets, bearings, or seals—should be adjusted to a turning torque of 24 cmkg (21 in. lb.)

9.2 Adjusting Worm and Roller Steering

To check the adjustment of the worm and roller steering, lift the vehicle—or support the front axle on safety stands. With the front wheels in their straight-ahead position, grip one steering wheel spoke at its extreme outer end. Turn the steering wheel lightly in both directions. The freeplay should not exceed 15 mm (⅝ in.) measured at the wheel rim.

If the steering freeplay is excessive, check to see that the looseness is not caused by worn tie rod ends, a loose drop arm, or a worn relay lever shaft. Make sure that the steering gearbox is mounted firmly and that its cover bolts are torqued to 2.5 mkg (18 ft. lb.). If no faults are found, correct excessive centerpoint freeplay by making adjustments at the steering gearbox.

To adjust

1. Disconnect the drag link from the drop arm as described in **9.5 Removing and Installing Drag Link and Drop Arm**
2. Turn the steering wheel 180° to 200° to either the left or the right.

NOTE —
The steering is centered when the pointer on the worm spindle dust cap is in line with the 7-mm (¼ in.) square boss on the worm spindle cap. For all repair operations with the steering centered, the pointer on the dust cap must be within the 7 mm (¼ in.) limits of the square boss (Fig. 9-5).

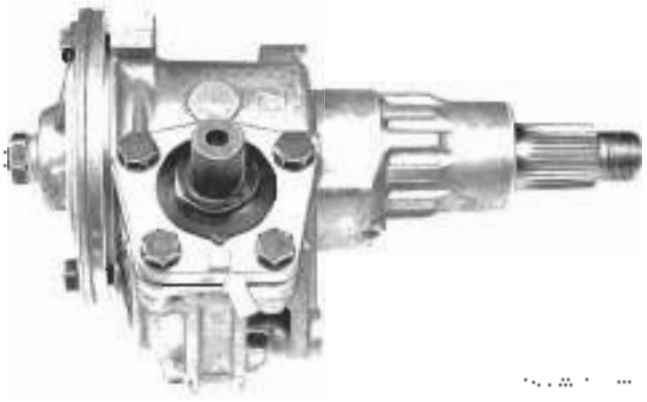


Fig. 9-5 Square boss (arrow) that pointer on dust cap must be lined with when the steering is centered

3. Loosen the locknut for the adjusting screw. Then turn out the adjusting screw one complete turn.
4. Working under the vehicle, move the drop arm back and forth. Gradually turn in the adjusting screw until no play is felt at the drop arm.
5. Hold the adjuster in its optimum position while tightening the locknut to 5.0 to 6.0 mkg (36 to 43 ft. lb.).
6. Take off the horn button and disconnect the horn wire. Then attach a torque gauge to the steering wheel nut as shown earlier in Fig. 9-4.
7. Turn the steering wheel until the steering is nearly centered. Using the torque gauge, move the steering through its centerpoint. The steering is correctly adjusted if a turning torque of 8 to 12 cmkg (7 to 11 in. lb.) is required.
8. If necessary, correct the adjustment, then recheck it with the torque gauge.

9.3 Removing and Checking Steering Damper

The steering damper is a hydraulic cylinder mounted between an eye in the relay lever and a bracket on the axle beam. To remove it, take out the cotter pin and unscrew the M 10 nut from the bolt through the relay lever. Then remove the bolt that holds the damper on the axle beam.

Hand-check the steering damper by extending and compressing it while holding it in its installed position. It must operate with uniform resistance throughout its entire stroke. If necessary, compare the used unit with a new steering damper. Minor fluid leakage does not make replacement necessary as long as efficiency is not impaired.

To prevent steering trouble due to premature failure of the steering damper, make certain that the damper you install is the correct one for the vehicle. Check the rubber bushing and sleeves in the removed damper before reinstallation. If they are worn or damaged, replace them.

During installation, make sure that the large flat washer is between the damper bushing and the relay lever. Use a new cotter pin at the relay lever and a new lock washer under the head of the bolt that holds the damper on the axle beam.

9.4 Removing and Checking Tie Rods

To remove the tie rods, first disconnect the steering damper from the relay lever. Then take out the cotter pins in the tie rod end studs and remove the castellated nuts. Use a tool such as the one shown in Fig. 9-6 to press the tie rod ends out of the relay lever and the steering arms.

CAUTION —
Do not hammer out the tie rod ends. Doing so will ruin the threads and make reinstallation impossible.

Fig. 9-6. Tool used to press out tie rod ends

Installation is the reverse of removal. Carefully inspect the tie rods for cracks. Bending can be detected by rolling the tie rods over a flat surface.

CAUTION —
Bent tie rods must be replaced and not straightened. Bending them back to their original shape will seriously weaken them structurally.

Check the tie rod ends for play and replace any that are worn. If you cannot hand-move the tie rod end stud, replace the tie rod end. If the tie rod end boots are torn or cracked, they can be replaced. However, the entire tie rod end should be replaced if dirt has entered the ball socket. If in doubt, replace the tie rod end.

After installing the tie rod ends in the relay lever and the steering arms, torque the castellated nuts to 2.5 mkg (18 ft. lb.). Advance the nuts, if necessary, to uncover the cotter pin holes. Then install new cotter pins in all four tie rod end studs.

NOTE —
When you install the right hand tie rod, the tie rod end with right-hand threads should be at the steering knuckle end.

Check the front wheel toe and adjust it to the specifications given in **3.2 Checking and Adjusting Toe**. Twist the right-hand tie rod as far as it will go so that the tie rod ends are parallel. Then torque the clamp bolts for the right-hand tie rod to 1.5 mkg (11 ft. lb.).

9.5 Removing and Installing Drag Link and Drop Arm

The drop arm must be removed before the steering gearbox can be removed from the frame.

To remove:

1. Working under the vehicle, remove the cover plate that is beneath the pedal cluster.
2. Remove the cotter pins and then the castellated nuts from the drag link ends.
3. Using the tool illustrated earlier in Fig. 9-6, press the drag link ends out of the drop arm and the relay lever.

CAUTION —
Do not hammer out the drag link ends. Doing so will ruin the threads and make reinstallation impossible.

4. Remove the cotter pin and then the castellated nut from the peg shaft or roller shaft of the steering gearbox.

5. Using a puller as shown in Fig. 9-7, remove the drop arm from the shaft.

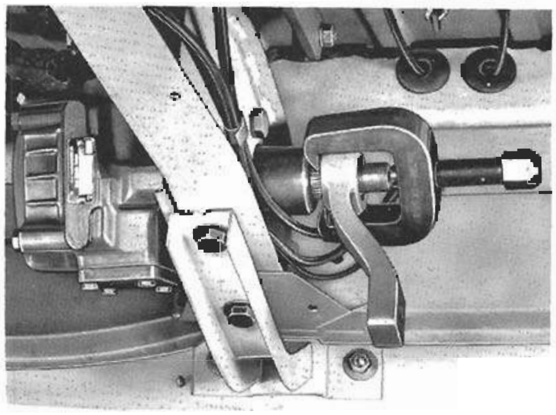


Fig. 9-7. Puller being used to remove drop arm from peg (or roller) shaft.

Installation is the reverse of removal. Make sure that the splines both in the drop arm and on the shaft are in good condition and that the splines in the replacement arm match those of the shaft. Align the arm with the shaft as shown in Fig. 9-8. On early models, torque the nut to 8.0 to 11.0 mkg (58 to 80 ft. lb.); on 1973 and later models, to 14.0 mkg (101 ft. lb.). Torque the castellated nuts on the drag link ends to 3.0 mkg (22 ft. lb.). Advance the nuts, if necessary, to uncover the cotter pin holes. Then install the new cotter pins.

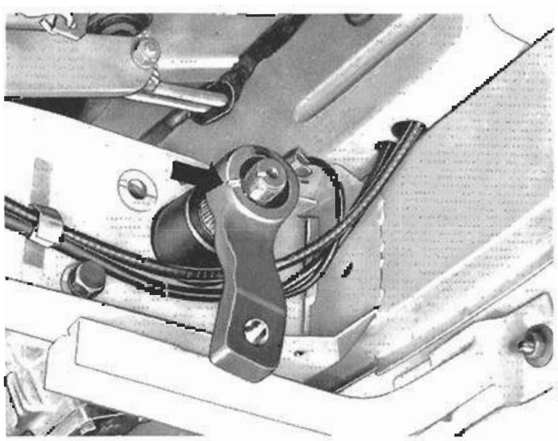


Fig. 9-8. Mark on drop arm (arrow) that must be aligned with notch in shaft. From chassis No. 212 2004 103, there are two marks. Align the mark labeled L on vehicles with left-hand drive. Align the mark labeled R on vehicles with right-hand drive.

9.6 Removing and Installing Relay Lever, Lever Shaft, and Bushings

Play in the relay lever can usually be corrected by replacing the relay lever shaft and its bearings.

To remove relay lever and shaft:

1. Working under the vehicle, remove the cover plate that is beneath the pedal cluster.

2. Disconnect the tie rods, the steering damper, and the drag link from the relay lever. These jobs are described under the three preceding headings.

3. To prevent the spring washer from forcing the lever up and damaging the bolt, clamp the relay lever as shown in Fig. 9-9. Then remove the nut and clamp bolt from the relay lever.

4. Remove the clamp and then the relay lever.

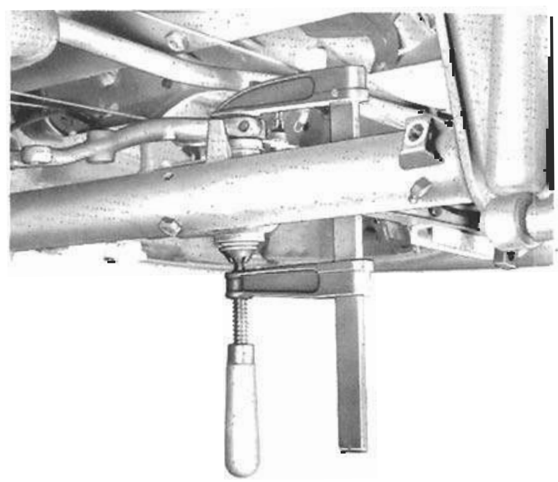


Fig. 9-9. Clamp installed on relay lever and shaft.

5. Using a screwdriver, pry the end cap off the bottom of the relay lever shaft mounting. (Alternately, you can drive it off with a hammer and cold chisel.)

6. Pull the relay lever shaft out downward.

NOTE —
Normally, the shaft will fall out of its bushings when the end cap is removed. Because there is a head on the lower end of the shaft, it cannot be driven out upward. Check the top end of the shaft for burrs if it is stuck.

7. Inspect the end cap, the upper protection cap, and its gasket. Obtain replacements for any worn or damaged parts.

2

To replace lever shaft bushings:

1. Remove the grease nipple. Then, using a slide hammer and appropriate extraction tools, drive the old bushings out downward (Fig. 9-10).

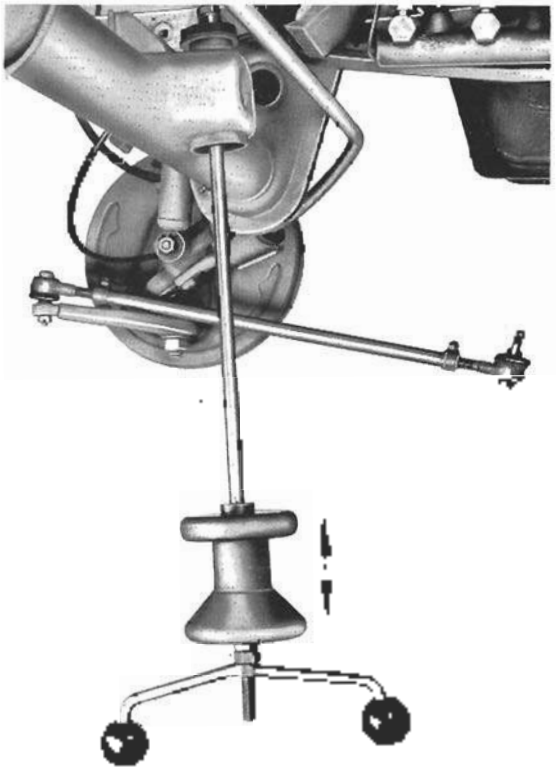


Fig. 9-10. Bushing being driven out. Move the hammer as indicated by the double arrow.

2. Using the tools shown in Fig. 9-10, drive in the new lower bushing from above until it is flush with the bottom of the mounting.
3. Drive the upper bushing in only until its upper edge projects 1.10 mm (.043 in.) above the mounting. Measure this by placing a feeler gauge between the driving tool and the top of the mount, or by measuring the projecting part of the bushing with a vernier caliper or depth micrometer.

Installation of the relay lever and shaft is the reverse of removal. Before you install the clamp bolt and nut, compress the spring washer by installing a clamp, as shown in Fig. 9-9. Torque the nut to 8.0 to 11.0 mkg (58 to 80 ft. lb.).

Install the end cap and the grease nipple. Then lubricate the relay lever shaft. Following tie rod installation, torque the castellated nuts on the tie rod ends to 2.5 mkg (18 ft. lb.) and the steering damper bolt to 4.0 to 4.5 mkg (29 to 32 ft. lb.).

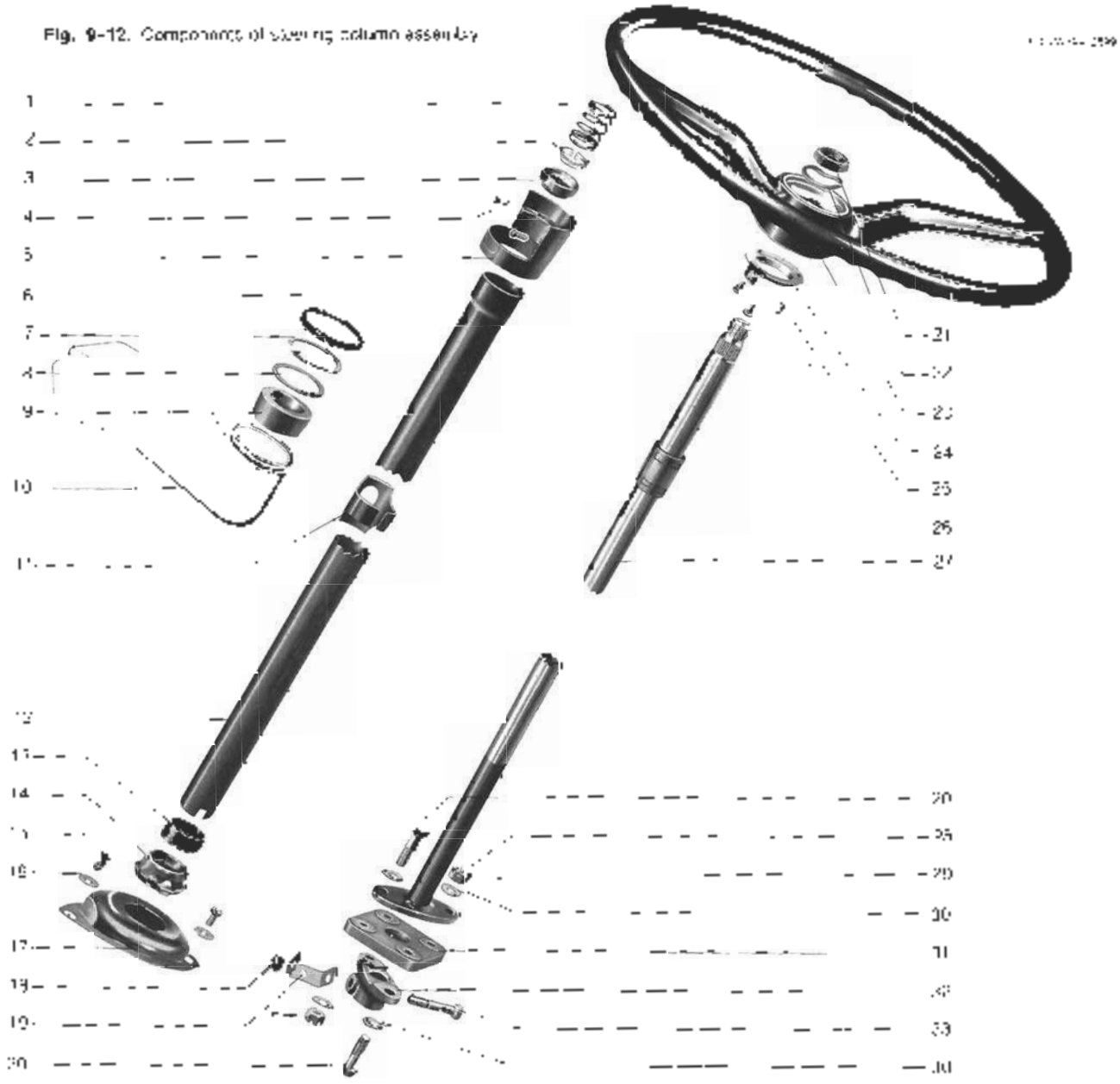
9.7 Removing and Installing Steering Wheel, Steering Column, and Steering Column Tube

A new steering column was introduced on the 1975 models. This column is different in two major ways from the steering column used from 1968 through 1974. The new steering column has a different column switch assembly that is similar to the switch assembly used on late-model VW Beetles. Secondly, the new column tube mounting's support and energy absorbing bracket are welded to the steering column tube instead of being separate parts as on the earlier models. Fig. 9-11 is an exploded view of the new steering column.

Fig. 9-11. Steering column of 1975 and later models. Identify components by comparing this illustration with Fig. 9-12.

The components of the steering column used on 1968 through 1974 vehicles are identified in Fig. 9-12. This illustration will be helpful if you must replace any of the individual parts. The illustration also gives the names and locations of the parts. The part names will appear frequently in the following procedures. The turn signal switch which is not shown in this illustration, should be removed or installed as described in **ELECTRICAL SYSTEM**.

Fig. 9-12. Components of steering column assembly



1. Spring
2. Support ring
3. Steering column bearing
4. Fillister head screw
5. Retainer for turn signal switch
6. Insulating washer for ignition steering lock
7. Circlip
8. Washer for rubber bushing
9. Rubber bushing for column tube
10. Mounting
11. Insulating ring
12. Column tube
13. Seal
14. Plastic clamping ring
15. Binding screw
16. Spring washer
17. Cover plate
18. M 8 nut
19. Lock plate
20. M 8 bolt
21. Steering wheel nut
22. Spring washer
23. Steering wheel
24. Centralling ring
25. Lock washer
26. Fillister head screw
27. Column with locking shells
28. M 8 castellated nut
29. Cotter pin
30. Spring washer
31. Coupling disc
32. Coupling flange
33. M 8 clamp bolt

The entire steering column, together with the steering wheel and the steering column tube, can be removed from the vehicle as a unit. Individual steering column assembly components need only be removed if you are repairing the steering column.

To remove steering column assembly as a unit:

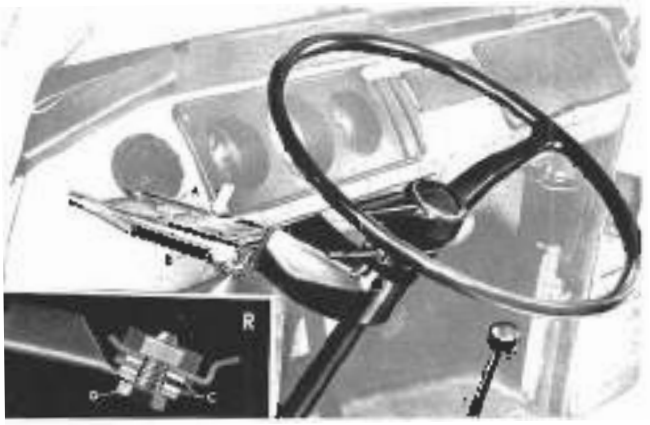
1. Disconnect the battery ground strap.
2. Disconnect the wiring of the column-mounted switches as described in **ELECTRICAL SYSTEM**.
3. Working under the vehicle, disconnect the horn ground wire from the steering column. Then unbolt the steering column coupling from the steering gear box worm spindle.
4. Working inside the vehicle, remove the screws that hold the cover plate between the pedals.
5. Unbolt the column tube mounting's support from the dashboard. Then remove the steering column assembly from the vehicle as a unit.
6. Inspect the coupling disc. If the flexible material is worn or deteriorating, replace the disc.

> **CAUTION —**
> *If the vehicle has been in an accident, you should also check the bracket and the support carefully. If you find cracks or bending, replace the bracket and the support. On 1973 and later models, you must replace the entire steering column tube. Do not attempt to weld or straighten the parts. Doing so will destroy the effectiveness of the energy absorbing system.*

Installation is the reverse of removal. During installation of the steering column on 1970 and later vehicles, install the plastic coated washers for the energy absorbing column tube support as shown in Fig. 9-13. The redesigned steering column tube, introduced on the 1975 models, is installed in a similar way even though the column tube mounting's support and energy absorbing bracket are integral with the steering column tube.

> **NOTE —**
> The purpose of the plastic coated washers is to let the support detach itself smoothly from the bolts in the dashboard—should sufficient stress be imposed on the mounting. The bracket then collapses at the predetermined location and the support is deflected to the side.

If the plastic coated washers are in any way damaged—or if the column tube support has been forced off the bolt by impact—you should always replace the washers.



A. Bracket
B. Support
C. Plastic coated washers
D. Self-tapping bolt

Fig. 9-13. Energy absorbing column tube support used on 1970 through 1974 vehicles. The inset (R) shows the proper installation position for the plastic coated washers. The arrow indicates the bracket's predetermined collapse point.

To remove steering wheel:

1. Disconnect the horn ground wire either at the horn or at the bottom of the steering column tube.
2. On 1968 through 1974 models only, remove the screws that hold the turn signal switch to the steering column tube. Move the turn signal switch aside.
3. Carefully pry out the horn button, then remove the steering wheel nut. On 1975 and later models, lift the steering wheel off the steering column.
4. On 1968 through 1974 models, use a puller such as the one shown in Fig. 9-14, to pull the steering wheel off the steering column.

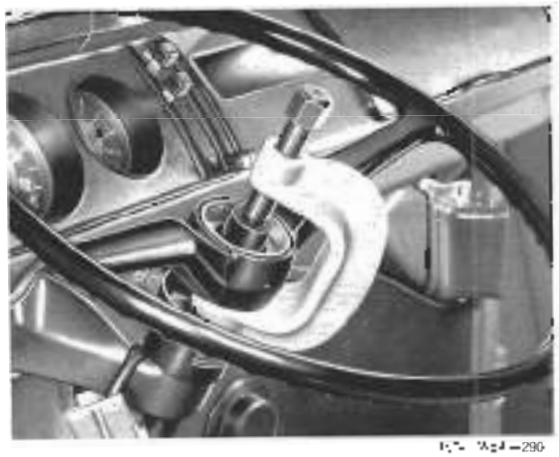


Fig. 9-14. Puller being used to remove steering wheel from pre-1975 steering column.

5. If you intend to replace the steering wheel, take out the three screws that hold the cancelling ring to the bottom of the steering wheel hub. Then remove the cancelling ring so that it can be installed on the new steering wheel.

To install:

1. If necessary, install the cancelling ring on the steering wheel.
2. Center the steering. Then install the steering wheel so that its spokes are horizontal and the tab on the cancelling ring is to the left.
3. Install the steering wheel nut. On 1968 through 1974 models, torque the nut to 2.5 to 3.0 mkg (18 to 22 ft. lb.). On 1975 and later models, torque the nut to 5.0 mkg (36 ft. lb.).
4. Reinstall the horn button so that the crest is upright when the steering wheel's spokes are in a horizontal position.
5. On 1968 through 1974 models, loosely install the turn signal switch. Adjust the switch on the column tube to obtain a gap of from 2.00 to 3.00 mm (.080 to .120 in.) between the switch and the steering wheel. Then tighten the screws.

To remove steering column:

1. Disconnect the battery ground strap. Remove the steering wheel. On vehicles with the ignition/steering lock, turn the ignition key to its on position.
2. Working between the pedals, remove the two binding screws that hold the cover plate to the floor panel.
3. Working under the vehicle, remove the cover plate that is beneath the pedal cluster.
4. Bend the lockplate away from the nut, and then remove the M 8 clamp bolt that holds the coupling flange on the steering gearbox worm spindle.
5. Remove the steering gearbox as described in **9.8 Removing and Installing Steering Gearbox.**
6. Take the steering column out downward complete with the steering coupling.

Installation is the reverse of removal. If necessary, refer to **9.8 Removing and Installing Steering Gearbox.** Install the drop arm and drag link as described in **9.5 Removing and Installing Drop Arm and Drag Link.** Torque the steering gearbox mounting bolts to 3.5 to 5.0 mkg (25 to 36 ft. lb.). On early models, torque the drop arm nut to 8.0 to 11.0 mkg (58 to 80 ft. lb.); on 1973 and later models, torque to 14.0 mkg (101 ft. lb.). Torque the castellated nut on the drag link end to 3.0 mkg (22 ft. lb.). Advance the nut, if necessary, to uncover the cotter pin hole, then install a new cotter pin. Torque the steering wheel nut to 2.5 to 3.0 mkg (18 to 22 ft. lb.).

The column tubes of 1975 and later vehicles cannot be removed separately as described in the following procedure. Instead, remove the steering column assembly as a unit, then separate it into its individual components.

To remove 1968 through 1974 column tube:

1. Disconnect the battery ground strap. Remove the steering wheel. On vehicles with the ignition steering lock, turn the ignition key to its on position.
2. Remove the circlip from its groove above the rubber bushing for the steering column.
3. Working between the pedals, remove the two binding screws that hold the cover plate to the floor panel.
4. Slightly lift the column tube together with the cover plate, pull the horn ground wire off the terminal on the column tube, and then straighten the terminal. (See Fig. 9-15.)

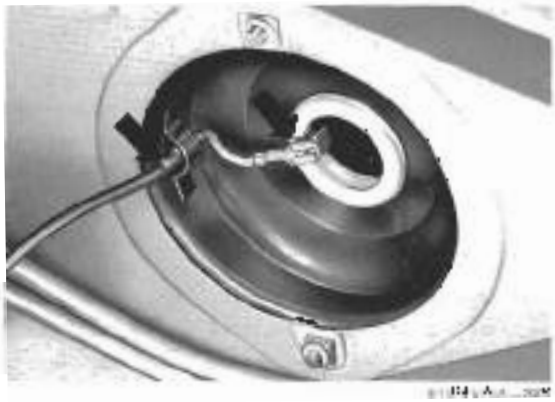


Fig. 9-15. Horn ground wire (steering column and coupling removed for clarity). The wire passes through a retainer on the cover plate (left arrow). The terminal on the column tube (right arrow) must be bent to one side as shown when the column tube is installed.

5. Pull the cover plate off the lower end of the column tube together with the plastic clamping ring. The cover can remain in the car attached to the horn ground wire.
6. Pull the column tube upward out of the steering/ignition lock and the mounting.

To install:

1. Align the insulating ring on the column tube so that both elongated holes match.
2. Coat the rubber bushing with talcum powder. Then push the column tube into the mounting and steering ignition lock complete with the rubber bushing and the insulating ring.
3. Slide the cover plate together with the plastic clamping ring upward onto the column tube.
4. Install the horn ground wire on the terminal on the column tube. Then bend the terminal to roughly a right angle with the tube.
5. Push the column tube down until the hole in the tube is aligned with the locking pin of the steering ignition lock. Check the lock's operation.
6. Mount the cover plate on the floor panel so that the column tube is centered with the steering column.
7. Install the washer and circlip above the rubber bushing for the column tube.
8. Inspect the steering column bearing and replace it if it is faulty. Install the bearing and the support ring with the shoulder on the support ring upward.
9. Install the steering wheel as previously described.

9.8 Removing and Installing Gearbox

Although the worm and peg steering gearbox is shown in the illustrations, the procedure for removing the late-model worm and roller gearbox is the same.

To remove:

1. On 1968 through 1974 models, remove the screws that hold the turn signal switch to the column tube, and then move the turn signal switch aside. On 1975 and later models, remove the steering column assembly as a unit.
2. Working under the vehicle, remove the cover plate that is beneath the pedal cluster.
3. Remove the drag link and drop arm as described in **9.5 Removing and Installing Drag Link and Drop Arm**.
4. Bend the lockplate away from the nut, and then remove the M 8 clamp bolt that holds the coupling flange on the steering gearbox worm spindle. (See Fig. 9-16.)

NOTE —
The clamp bolt is the horizontal bolt. It is not necessary to remove the cotter pins and then remove the castellated nuts from the bolts that hold the steering coupling together.

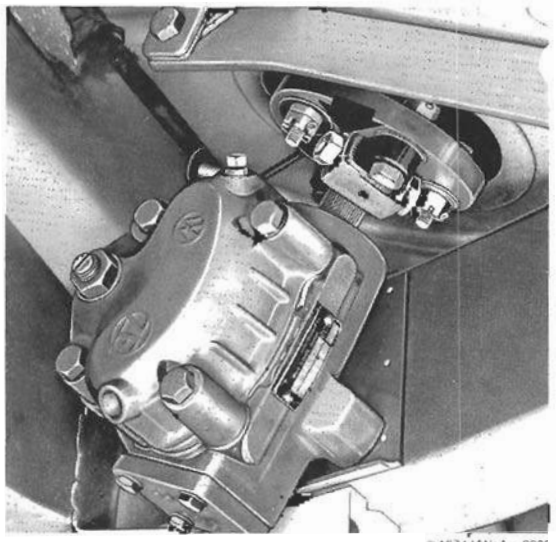


Fig. 9-16. Clamp bolt (arrow) that holds steering coupling flange on worm spindle

5. Remove the bolts indicated in Fig. 9-17. Then push the steering column upward and remove the gearbox from the frame sidemember.

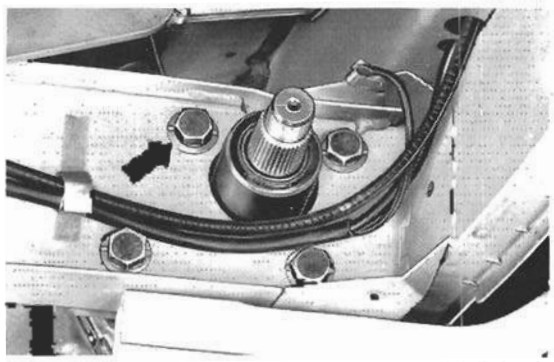


Fig. 9-17. Bolts that hold gearbox to frame

Installation is the reverse of removal. Make sure the gearbox is filled with oil. (See **9.9 Disassembling, Assembling, and Adjusting Steering Gearbox.**) Install the drop arm and drag link as described in **9.5 Removing and Installing Drag Link and Drop Arm**. Torque the steering gearbox mounting bolts to 3.5 to 5.0 mkg (25 to 36 ft. lb.). On early models, torque the drop arm nut to 8.0 to 11.0 mkg (58 to 80 ft. lb.); on 1973 and later models, torque to 14.0 mkg (101 ft. lb.). Torque the castellated nut on the drag link end to 3.0 mkg (22 ft. lb.). Advance the nut, if necessary, to uncover the cotter pin hole, then install a new cotter pin. During installation, adjust the pre-1975 turn signal switch on the column tube to obtain a gap of from 2.00 to 3.00 mm (.080 to .120 in.) between the switch and the steering wheel. Then tighten the screws.

9.9 Disassembling, Assembling, and Adjusting Steering Gearbox

Only the worm and peg steering gearbox (Fig. 9-18) installed on 1968 through 1972 models can be repaired. The worm and roller gearbox installed on 1973 and later models should be replaced as a unit if it is worn or damaged. Replacement gearboxes are supplied dry and must be filled with 8½ U.S. oz. (8 Imperial oz., 284 ml) of hypoid oil prior to installation.

Unless you have a torque gauge such as the one shown in the illustrations, it is not possible to adjust accurately the worm and peg steering gearbox. If the bearings are too tight, they will bind and produce excessive wear. If they are too loose, there will be excessive play in the steering.

CAUTION —

If you lack the skills, tools, or a clean workshop for servicing the worm and peg steering gearbox, we suggest you leave such repairs to an Authorized VW Dealer or other qualified shop. We especially urge you to consult your Authorized VW Dealer before attempting repairs on a car still covered by the new-car warranty.

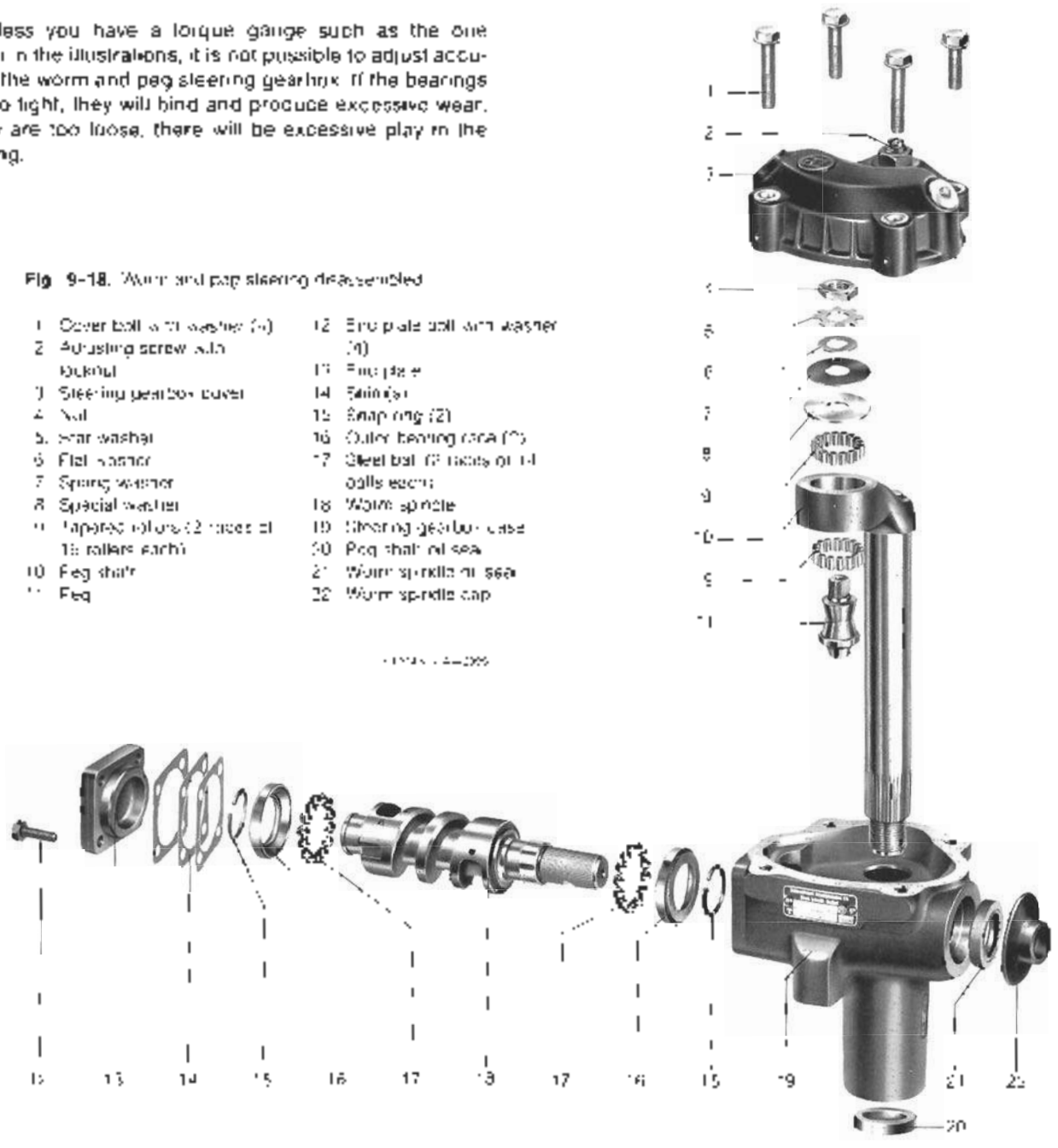


Fig. 9-18. Worm and peg steering disassembled

1. Cover bolt and lock washer (4)
2. Adjusting screw and locknut
3. Steering gearbox cover
4. Nut
5. Gear washer
6. Flat washer
7. Spring washer
8. Special washer
9. Tapered rollers (2 races and 18 rollers each)
10. Peg shaft
11. Peg
12. End plate bolt and washer (4)
13. End plate
14. Shim(s)
15. Snap ring (2)
16. Outer bearing race (2)
17. Steel ball (2 races of 14 balls each)
18. Worm spindle
19. Steering gearbox case
20. Peg shaft oil seal
21. Worm spindle oil seal
22. Worm spindle cap

To disassemble:

1. Thoroughly clean the outside of the gearbox—especially the parts of the worm spindle and peg shaft that project from the case.
2. Remove the four cover bolts with washers. Then remove the steering gearbox cover complete with adjusting screw and adjusting screw locknut.
3. Lift the peg shaft out upward. To remove the peg and rollers from the shaft, turn the peg clockwise as indicated in Fig. 9-19.

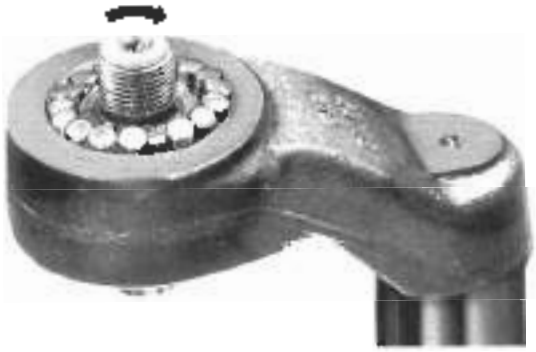


Fig. 9-19. Director peg should be turned (arrow) when removing peg and tapered rollers.

4. Remove the four end plate bolts with washers. Then remove the endplate and the shims.
5. Withdraw the worm spindle from the steering gearbox case. If necessary, remove the snap rings and disassemble the ball bearing races.

To assemble and adjust:

1. Inspect the oil seals and replace them if they are worn or cracked. Then install the worm spindle, the original shims, and the end plate. Attach a torque gauge as shown in Fig. 9-20.

Fig. 9-20. Torque gauge installed on worm spindle.

2. Using the torque gauge, turn the worm spindle. Turning torque should be 2.0 to 5.0 cmkg (2 to 4 in. lb.).
3. If the turning torque is too great, add shims between the end plate and the steering gearbox case (Fig. 9-21). If the turning torque is too little, remove the shims.

NOTE
Shims are available in the following thicknesses: 0.10, 0.125, 0.15, and 0.30 mm (.004, .0049, .0059, and .0118 in.).

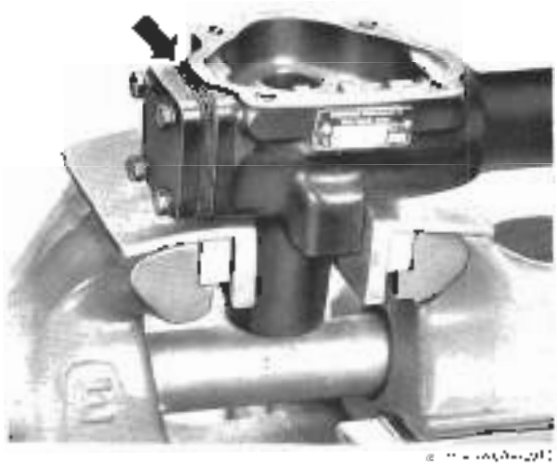


Fig. 9-21. Point (arrow) at which shims are installed.

4. When worm spindle turning torque is correct, assemble the peg shaft. Use grease as an adhesive to hold the tapered rollers on the peg as shown in Fig. 9-22.

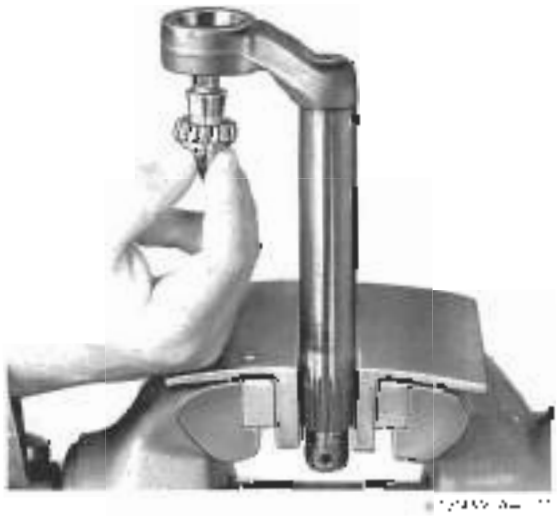


Fig. 9-22. Peg with tapered rollers being installed on peg shaft.

5. With the cylindrical end of the peg clamped between hardwood blocks in a vise, install the special washer over the threaded end of the peg with the washer's shoulder toward the tapered rollers.

6. Install the spring washer, flat washer, star washer, and nut on the peg. Then torque the nut to 25 cmkg (22 in. lb.).

7. Remove the peg shaft from the vise. Then clamp the lower end of the shaft in the vise between soft jaws so that the peg is free to turn.

8. Install the torque gauge shown in Fig. 9-20 on the nut. Check the turning torque of the peg. It must be from 2 to 3 cmkg (or 2 to 3 in. lb.).

9. Adjust the peg's turning torque, if necessary, by tightening or loosening the nut. Then lock the nut by bending over one tab on the star washer as shown in Fig. 9-23.

Fig. 9-23. Tab on star washer (arrow) bent over against one flat of the nut.

10. Being careful not to damage the oil seal, install the peg shaft in the gearbox so that the peg engages the center of the worm.

11. Thoroughly clean the mating surfaces of the gearbox case and the gearbox cover.

12. Coat the mating surface of the case with sealing compound. Install the cover. Then torque the four cover bolts with washers to 2.5 mkg (18 ft. lb.).

CAUTION —
Loosen the adjusting screw before installing the cover. The cover can be damaged if the adjusting screw contacts the peg shaft before the cover is sealed on the case.

13. Fill the gearbox with 0.5 U.S. oz. (8 Imperial oz. 284 ml) of hypoid transmission oil.

14. Install the torque gauge as shown in Fig. 9-24. Then turn the steering away from its centerpoint. (See **9.10 Locating Steering Centerpoint.**)

Fig. 9-24. Torque gauge installed on worm spindle.

15. Using the torque gauge, turn the worm spindle back and forth through its centerpoint. Gradually tighten the adjusting screw until it requires approximately 24 cmkg (21 in. lb.) to turn the steering through the central pressure point.

16. When the correct turning torque is obtained, hold the adjuster in its optimum position while you tighten the locknut as shown in Fig. 9-25.

NOTE —
The 24 cmkg (21 in. lb.) specification applies only if the gearbox is new or if a new case, peg and worm set, bearing, or seal has been installed. If these parts have had at least 3000 miles (5000 km) of service, adjust to 8 to 10 cmkg (7 to 9 in. lb.).

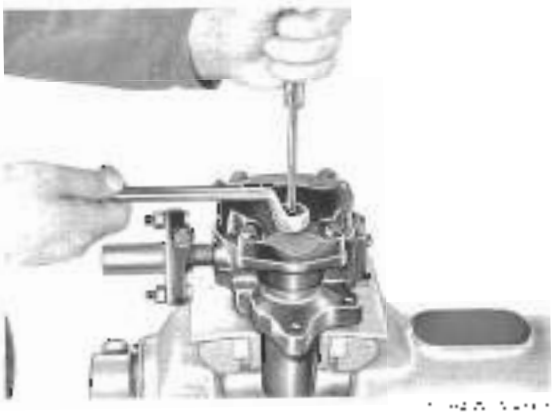


Fig. 9-25. Locknut being tightened while adjusting screw is held stationary with screwdriver.

9.10 Locating Steering Centerpoint

Beginning with chassis No. 211 2249 275 manufactured during June 1971, centering marks were placed on the steering gearbox. These marks, which are indicated in Fig. 9-26, are on the steering gear case and the worm spindle cap.

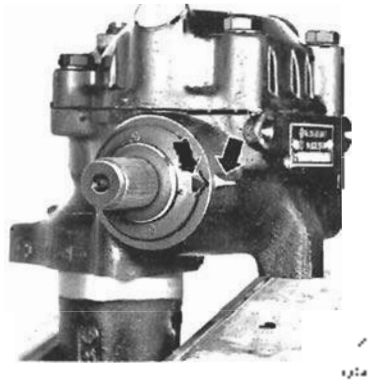


Fig. 9-26. Centerpoint marks (arrows) that appear on late worm and peg steering gearboxes

Whenever the worm spindle cap has been removed during repairs, the position of the cap on the worm spindle must be determined following assembly and adjustment of the steering gearbox.

To mark centerpoint:

1. Draw a thin paint or chalk line somewhere on the worm spindle as indicated in Fig. 9-27. Then install the torque gauge on the worm spindle.

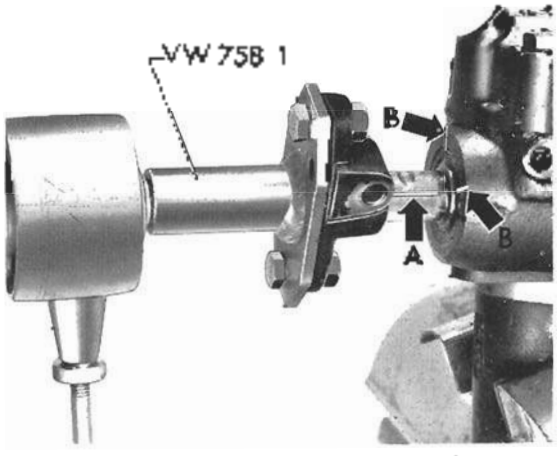


Fig. 9-27. Paint or chalk line on worm spindle, indicated by arrow A. The two arrows labeled B point to the marks that must be located with the help of the torque gauge

2. Turning the worm spindle with the torque gauge, approach the central pressure point from both directions. Exactly at the point where the gauge starts to indicate a higher torque—more than 5 cmkg (4.4 in. lb.)—make marks on the case in line with the line on the worm spindle.

3. Set the mark on the spindle (arrow **A** in Fig. 9-28) exactly half-way between the two marks on the case (arrows **B** in Fig. 9-27).

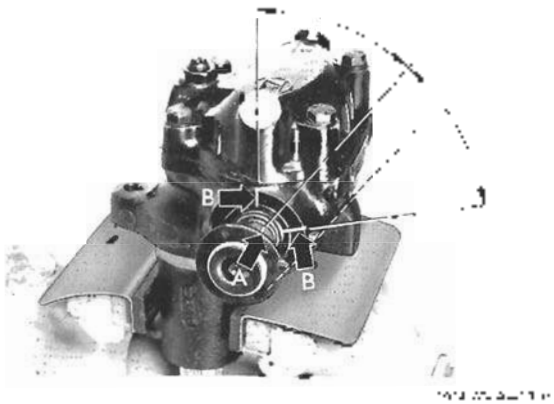


Fig. 9-28. Line on worm spindle (**A**) centered between marks on gearbox case (arrows **B**)

4. Carefully remove torque gauge and adapter without turning the worm spindle. (Alternately, you can make a third mark on the gearbox case that is in line with the centered mark on the worm spindle.)

5. Liberally coat the underside of the worm spindle cap with multipurpose grease. Then, using a tube type driver, push the cap onto the worm spindle so that the lug on the cap is in line with the boss on the case.

NOTE —
The alignment of the lug on the cap with the boss on the case is indicated by the dotted line in Fig. 9-28.

6. Again check the adjustment with the torque gauge to make sure that the cap has been properly installed.

10. FRONT AXLE TECHNICAL DATA

The technical data on the following pages contain all the dimensions and adjustment specifications needed to service, repair or rebuild the front axle and steering. Further data on adjusting the alignment of the rear suspension can be found in **TRANSMISSION AND REAR AXLE**. The data given there apply equally to vehicles with manual and automatic transmission.

2

I. Wheel Alignment Specifications

Designation	Value
1. Wheel base	2400 mm (94.5 in.)
2. Turning circle	12.3 m (40 ft 4 in.)
3. Track at front	1385 mm (54.5 in.)
4. Total toe with wheels not pressed	+10' ± 15' or 0.2 to 3.4 mm (0 to ⅛ in.)
5. Total toe with wheels pressed	+5' ± 15'
6. Pressure applied to wheels	15 ± 3 kg (33 ± 6.6 lb.)
7. Maximum permissible difference between toe with wheels pressed and not pressed	20'
8. Front wheel camber in straight-ahead position Maximum permissible difference between sides	+40' ± 20' 20'
9. Toe-out at a 20° lock to left and right (wheels not pressed)	1°20' ± 30'
10. Offset between stub axles	max. 0.40 mm (.016 in.)
11. Caster angle at 2° swivel equals the camber difference of a wheel at a 20° lock to left and right	3° ± 30' 2° ± 35'

II. Tolerances, Wear Limits, and Settings

Designation		New Part mm (in.)	Wear Limit mm (in.)
A. Front torsion bars	number of leaves	5	—
	length	980 (38.58")	
Setting (1968–1969)	angle	58° ± 30'	—
Setting (1970–1974)	angle	60° ± 1°	—
B. Axle beam and torsion arms			
1. Torsion arm bearings in axle beam			
a. Seat for upper needle bearing	diameter	56.97–56.99 (2.2429–2.2437)	—
Needle bearing	diameter	56.96–56.99 (2.2425–2.2437)	
Oversizes	diameter	57.17–57.19 (2.2507–2.2515)	—
Oversize	diameter	57.17–57.19 (2.2507–2.2515)	
b. Seat for lower needle bearing	diameter	56.97–56.99 (2.2429–2.2437)	—
Needle bearing	diameter	56.96–56.99 (2.2425–2.2437)	
Oversize	diameter	57.17–57.19 (2.2507–2.2515)	
Needle bearing	diameter	57.17–57.19 (2.2507–2.2515)	
2. Bushing for			
a. Torsion arm, upper		43.20–43.27 (1.7007–1.7035)	43.40 (1.7086)
b. Torsion arm, lower		43.20–43.27 (1.7007–1.7035)	43.40 (1.7086)
3. Torsion arm	twist	max. 0.30 (.012)	
C. Ball joints, steering knuckles			
1. Ball joints, upper	play	max. 0.3 (.012)	2.0 (.080)
Ball joints, lower	play	max. 0.3 (.012)	2.0 (.080)
2. Steering knuckle, stub axle (measured with a vernier caliper and square)	distortion	0.40 (.016)	—
3. Wheel bearing, inner	inside diameter	31.75–31.77 (1.2500–1.2507)	
	outside diameter	59.11–59.16 (2.3275–2.3291)	—
4. Wheel bearing, outer	inside diameter	19.05–19.07 (.7500–.7507)	—
	outside diameter	45.24–45.26 (1.7811–1.7819)	—
5. Seat for inner wheel bearing, stub axle	diameter	31.73–31.75 (1.2492–1.2500)	—
Seat in brake disc or drum	diameter	59.04–59.11 (2.3251–2.3271)	—
6. Seat for outer wheel bearing, stub axle	diameter	19.03–19.05 (.7492–.7500)	—
Seat in brake disc or drum	diameter	45.20–45.23 (1.7795–1.7807)	—
7. Wheel bearing	play	0.03–0.12 (.001–.005)	—
D. Steering (through July 1972)			
1. Steering wheel turns from lock to lock		2¾	
2. Steering gear ratio		15:1	—
3. Overall ratio		15.7	—
4. Worm turning torque (for axial adjustment)	without oil seal	2–3 cmkg (1.7–2.6 in. lb.)	—
5. Tightening torque for peg securing nut		25 cmkg (21.7 in. lb.)	—
6. Peg turning torque		2–3 cmkg (1.7–2.6 in. lb.)	
7. Total turning torque (steering gear assembled)		24 cmkg (20.8 in. lb.)	—
E. Steering (from August 1972)			
Worm and roller steering, no repair possible		—	—
Total turning torque through center position (roller shaft adjustment)		8–12 cmkg (7–11 in. lb.)	

III. Tightening Torques for Axle and Steering

Location	Designation	mkg	ft. lb.
Front axle to frame	bolt	9.0-12.5	65-90
Upper shock absorber mounting	nut	5.0	36
Lower shock absorber mounting	nut	2.5-3.5	18-25
Ball cards to steering knuckle (use new nuts in place of nuts that have been removed)	self-locking nut	10	72
Clamp screw for wheel bearing clamp nut	socket head screw	1.5-max. 2.0	11-max. 14
Tie rods and ring link	castellated nut M 12	3.0	22
	castellated nut M 10	2.5	18
Clamps for tie rods and drag link	nut-bolt	1.5	11
Steering damper to relay lever	bolt	4.0-4.5	29-32
Steering damper to axle beam	bolt	4.0-4.5	29-32
Setscrew for torsion bar	setscrew	4.0	29
Locknut for setscrew	locknut	4.0	29
Stabilizer bar to torsion arm	M 10 nut	3.5-5.0	25-36
	M 8 nut	2.5	18
Steering (up to July 1972)			
Steering gear to side member	bolt	3.5-5.0	25-36
Drop arm to shaft	nut	8.0-11.0	58-80
Relay lever to shaft	bolt	6.0	43
Steering wheel to column	nut	2.5-3.0	18-22
Flange to steering worm	nut	2.0	14
Coupling disc to flange	castellated nut	1.5	11
Steering column to floor plate	fillister head screw	0.5	3.5
Steering gear case cover	bolt	2.5	18
Steering gear end cover	bolt	1.5	11
Steering (from August 1972)			
Drop arm to shaft	nut	14.0	101
Locknut for adjuster	nut	5.0-6.0	36-43
Steering wheel to column (1973 and 1974 models)	nut	2.5-3.0	18-22
Steering wheel to column (1975 and later models)	nut	5.0	36

See BRAKES AND WHEELS for torque specifications related to the brakes.

Section 3

FUEL SYSTEM

3

Contents

2 FUEL SYSTEM

TABLES

Fuel System

The fuel system, as covered in this section of the Manual, applies mainly to the 1968 through 1974 vehicles that have carburetors. The electronic fuel injection system, introduced on the 1975 models, is covered separately in **FUEL INJECTION**. The data given in this section under **3. Fuel Tank** and **7.1 Evaporative Emission Control** apply to vehicles both with fuel injection and with carburetors. You should refer to **FUEL INJECTION** for all other information related to fuel injection engines—including emission control data and air cleaner servicing. Whether they have carburetors or fuel injection, VWs covered by this Manual are designed to operate on regular (91 octane) gasoline. Fuel injection vehicles that are equipped with catalytic converters require lead-free gasoline.

The fuel system for dual-carburetor and single carburetor engines handles five main tasks necessary for proper engine operation: (1) it provides storage space for the gasoline; (2) it includes the components necessary for delivering gasoline to the engine; (3) it is responsible for admitting the proper amount of filtered air to the engine; (4) it incorporates a carburetor and distribution system for mixing fuel and air in precisely controlled proportions and delivering it to the cylinders; and (5) it modifies the density of the incoming air so that the combustion process does not produce an excess of undesirable exhaust emissions. The fourth function mentioned above, that of mixing the fuel with air, is handled on 1968 through 1971 models by one single-venturi downdraft carburetor. The 1972 through 1974 models have two single-venturi downdraft carburetors.

On 1968 through 1971 models, the single carburetor is mounted atop a tubular welded-steel intake manifold that has an exhaust-warmed preheating pipe. On 1971 models, the cylinder heads have dual intake ports rather than the single siamesed intake port used in the heads of earlier engines. On the 1971 engines, the two outer ends of the intake manifold are joined to bifurcated cast aluminum intake pipes that conduct the fuel/air mixture into the cylinder head intake ports. The dual-carburetor engine introduced on the 1972 models has each carburetor mounted on a bifurcated cast aluminum intake manifold bolted to the top of each cylinder head. The dual manifolds are connected by a balance pipe and are heated solely by their contact with the cylinder heads.

Because many of the repairs and tune-up procedures described in this section of the Manual have a direct influence on exhaust emissions, they should not be undertaken unless all prescribed equipment is available. If you lack the skills, special equipment, or tools needed for servicing and adjusting the fuel system, we suggest you leave such repairs to an Authorized VW Dealer or other qualified shop. We especially urge you to consult your Authorized VW Dealer before attempting repairs on a car still covered by the new-car warranty.