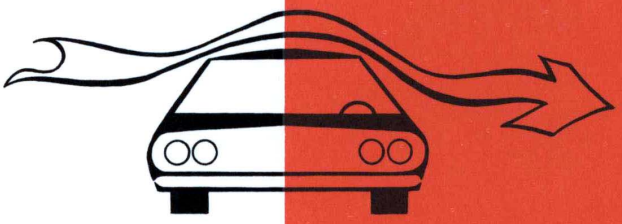
MASTER TECHNICIANS
SERVICE CONFERENCE

REFERENCE
BOOK

70-7

WIND NOISE AND AIR LEAKS



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HISS . . . WHISTLE . . . BUZZ

The repair order reads: "Eliminate wind noise at front of driver's door," and that's all. For some technicians, this is the beginning of the old guessing game; for others, it's the start of a systematic search using common sense and the process of elimination.

As many of you know, the causes of wind noise can hide in the unlikeliest places. You've heard the one that sounds off at ear level, but really starts its mischief at a sealing gap somewhere else. Sometimes the source is easy to find because you get water and dust along with the noise, or from past experience, you recognize the signs of a familiar noisemaker.

In any case, whether the cause of wind noise hits you in the eye or is less obvious, it can take time to pin down. This session is intended to help you find the troublemaker quicker and easier by using simple visual and sound tests. Obviously, there is no universal formula that provides direct answers to all wind noise problems, but a good understanding of common causes of wind noises, as covered in this reference book, should help solve the tough ones.

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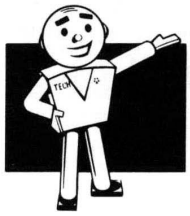


INTRODUCTION

Continued engine and chassis improvement has made the modern automobile mechanically quieter and smoother-running than ever before. As a result, car occupants are now more aware of wind and air leak noises which previously went unheard or were ignored.

Advances in body insulation, sealing, and weatherstripping have also kept pace in making today's cars comfortable and quiet. However, regardless of how well they are designed, the parts which seal out wind and weather must be correctly installed, aligned and held in place so they can do the job they were designed for.

GENERAL NOISE CAUSES

For purposes of troubleshooting, wind noises generally can be grouped as those caused by turbulence and those caused by air leaks. To better understand the common characteristics of these noise causes, we'll cover each in turn.

TURBULENCE IS DISTURBING

Turbulence in the air flow around the car body is a basic cause of wind noise. Generally speaking, turbulence noises can be caused by anything that disturbs smooth air flow around body surfaces. For example, the disturbance cause can be the shape of the body, protruding parts, or loose parts.

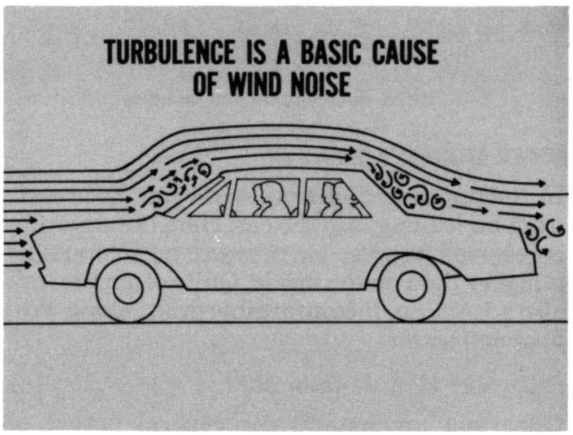


Fig. 1—Smooth air flow is disturbed

SMOOTH FLOW IS IDEAL

A fully streamlined body would be ideal for smooth air flow, but cars have to be designed to carry people comfortably, so some areas of the body have shapes which disrupt air flow and cause turbulence noise. Some of this noise cannot be avoided but it is at a level which is acceptable to car occupants, provided the body is well sealed.

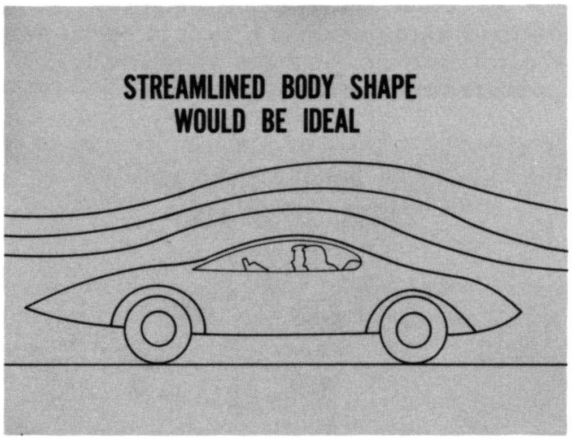


Fig. 2—Full streamlining reduces headroom

SOME TURBULENCE CAN BE CORRECTED

Turbulence noise caused by some protruding parts is a different story because it can often be altered or eliminated. Common examples of this condition are doors with front edges set out from the body surface and moldings that are loose or distorted.

PARTS CAN VIBRATE

Loose parts not only set up air turbulence but also tend to vibrate or buzz. This kind of noise can be quite disturbing, but in most cases, it's fairly easy to track down and correct.

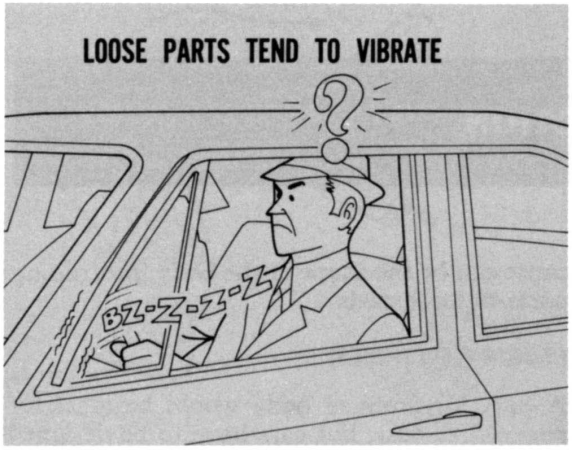


Fig. 3—Vibration noise can be disturbing

AIR LEAKS CAN BE NOISY

Another basic source of noise is body air leaks. In many cases, the sound results from air leaking *out* rather than *into* the car. You see, with the doors and windows closed and cowl vents open, forward motion of the car forces air into the car interior, resulting in relatively high pressure inside the car.

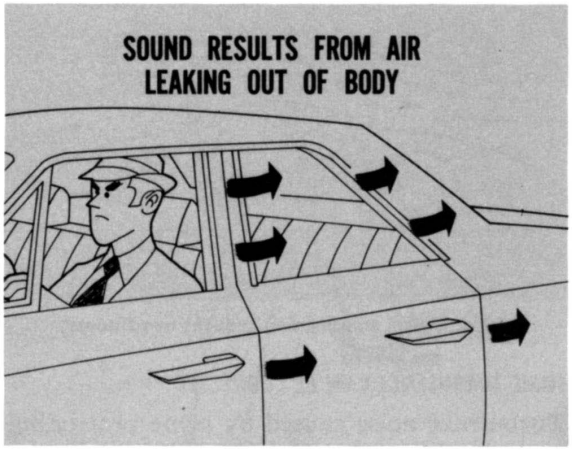


Fig. 4—Interior pressure forces air out

FLOW PRODUCES LOW PRESSURE

Besides the interior pressure buildup, air flow around the outside of the body produces low pressure outside the door glass on both sides of the car, especially near the vent wing area. From this you can see that the addition of low pressure on the outside, makes the effect of the inside pressure buildup even greater.

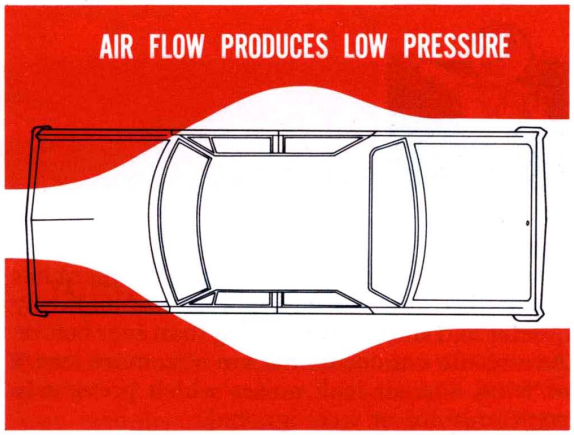


Fig. 5—Body shape deflects air flow

PRESSURE TRIES TO MOVE GLASS OUT

In hardtop models at high speeds, the difference between inside and outside pressure tends to force the top edge of the door glass outward. If the glass loses contact with the weatherstrip, the air that leaks out can cause noise.

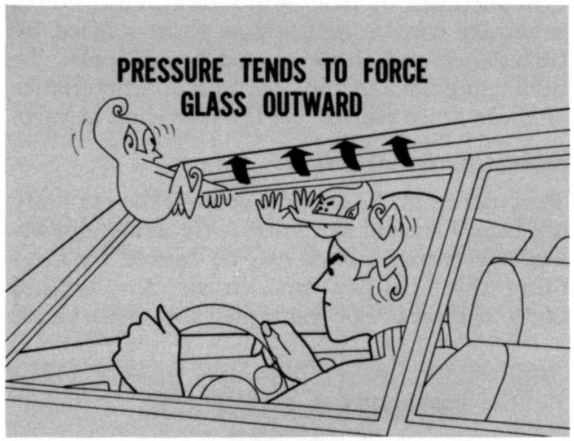


Fig. 6—Escaping air can be noisy

IT CAN BE NOISY COMING IN

In the opposite direction, noise can also result from air leaking *into* the car. Here the situation is reversed because air pressure on the outside is higher than on the inside. Quite often the leak also admits an uncomfortable draft, along with dust and water.

THERE MAY BE MORE THAN ONE

Once you understand the general nature of turbulence noises and air leak noises, you can

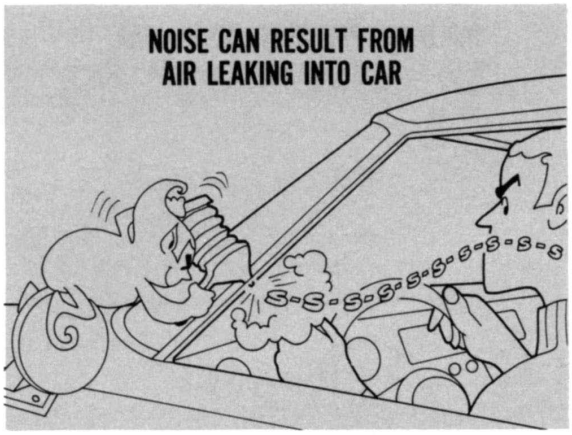
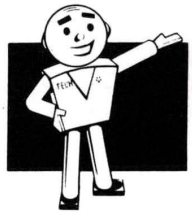


Fig. 7—Incoming air causes drafts

apply simple tests and common sense to tell which is which. In some cases, you may find more than one source contributing to the disturbing sounds, so correcting one condition can leave you with another. In fact, when turbulence and air leaks sound off together, you may have to eliminate one noise so you can find the other.

DO IT YOURSELF

The repair order may give you only a vague, general description of the wind noise complaint, so find out all you can about the reported condition before you make a false start at correction. You're probably familiar with the situation where the customer "knows" what's causing the trouble. Of course, he may be right, but it's always good practice to do your own checking when tracking down the causes of wind noise or air leaks.



CHECKING IN THE SHOP

You'll find that wind noise and air leak problems are most critical in the upper areas of the car. You see, this is where outside and inside pressures differ most. Mainly for this reason, most wind and air leak noise complaints are caused by leaks in the upper side areas of the car down to about a foot below the belt line, or around the windshield. Leaks lower down can cause drafts or admit dust and water, but they seldom cause bothersome noises.

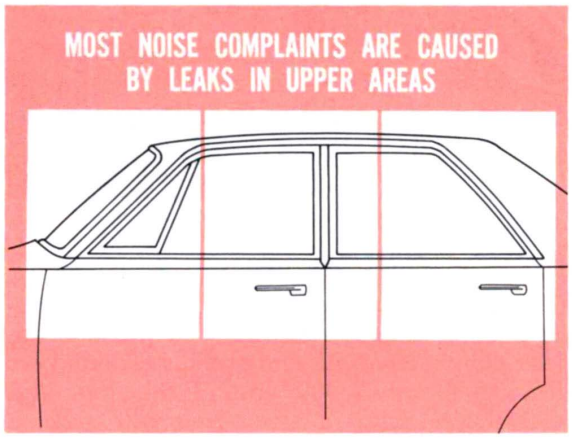


Fig. 8—Area of greatest pressure difference

GIVE IT THE EYE

You should begin your search for wind noise causes right in the shop by looking for the obvious. Check the weatherstrip in the reported noisy area for being loose, out of place, torn, or distorted. The condition can often be corrected by simply repositioning the existing weatherstrip. When you have to replace a weatherstrip, make sure that the new strip is not exposed to the condition that damaged the old one.

CLOSE THE GAPS

Inspect the front and rear faces of the door for holes in the sheet-metal joints that can let air enter or escape. Seal any of these openings you find, because even a small hole can produce a whistling noise, or a pop-bottle tone.

SMOOTH 'EM OUT

Look for solder lumps or other uneven spots on the door opening surface which can prevent

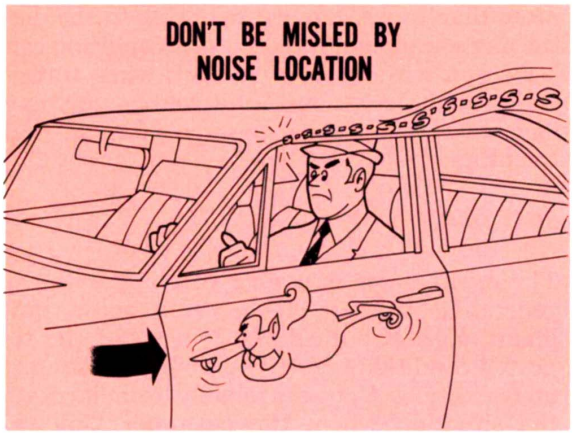


Fig. 9—Source may be remote from sound

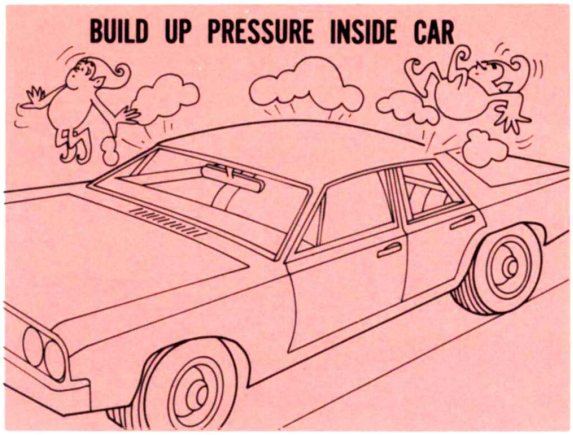


Fig. 10—Run blower at top speed

full weatherstrip contact. Any high spots should be smoothed down and low spots built up to provide an even surface for the weatherstrip to seal against.

FIX IT REGARDLESS

Don't be misled by the reported noise location. The cause may actually be some distance away, so don't pass up anything that should be corrected just because it isn't near the noisy point. And be sure to remember that small holes can make large noises.

PREPARE FOR TESTING

When you are satisfied with the general condition of the weatherstrip and door or body surfaces in the noise area, roll up all the windows and shut the fresh-air inlet doors so you can close off the interior of the car to run a body air leak test.

USE THE BLOWER

The main idea here is to use the heater or air-conditioner blower to build up pressure inside the car. This lets you check on the outside for air escaping around the door and window openings. Any leaks you find will help you locate holes or gaps which can cause noise.

BUILD UP THE PRESSURE

Set the heater or air-conditioner controls to admit outside air at top blower speed. Start the engine to move any vacuum-operated air doors into position and then switch the ignition to accessory position to keep the blower running with the engine shut off. Connect a charger at the battery to assure high fan speed with the alternator not running. Close the car doors and let the pressure build up.

FEEL FOR ESCAPING AIR

When the car is pressurized, the easiest way to check for air leaks is to move your hand slowly around the edges of the door, the vent, and all around the window glass. Mark any places where you feel air escaping so you can come back to them later on.

Fig. 11—Move hand around door edges

LISTEN FOR THE HISS

You can also use a short length of small-diameter hose as a sound pickup to help you locate leak points. Hold one end to your ear and pass the other end slowly around the door and glass edges. Even a small leak will make a noise that can be heard through the hose.

IT PICKS UP THE TONE

Electronic air leak detectors have been used successfully by many technicians. Basically, these are two-piece testers with a signal generator unit placed inside the closed car and a separate detecting unit used on the outside to pick up the generated tone signal at leak points. Incidentally, even with these devices you still need inside pressure from the blower to locate places where the air leaks out.

SMALL LEAKS OR LARGE

If you find an air leak which is limited to a small part of the weatherstrip area, you may be able to eliminate it by inserting a shim under the weatherstrip. Large leak areas are usually caused by poor alignment of the door or window glass.

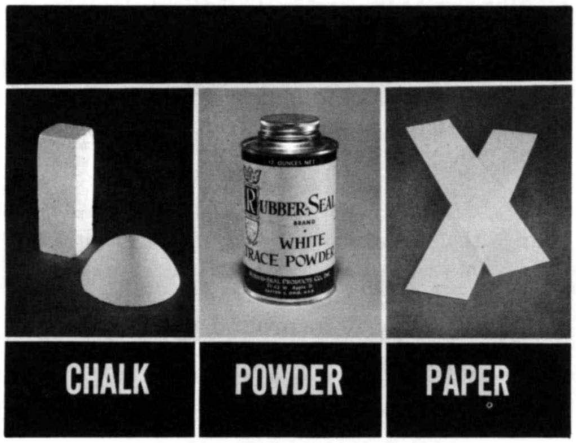


Fig. 12—Materials for leak testing

Fig. 13—Chalk transfers to door opening

PINPOINT THE LOCATION

In either case, whether the leak area is large or small, you can zero in on its location and extent by using carpenter's chalk, tracing powder, or paper strips to find places where the weatherstrip does not make good contact.

These materials are easy to use and each has specific advantages.

RUB ON PLENTY OF CHALK

To make a chalk print, simply open the door and rub soft carpenter's chalk on the sealing surfaces of the weatherstrip all the way around. The chalk transfers from the weatherstrip to the door opening surfaces when the door is closed, so you can see where the weatherstrip makes contact.

Fig. 14—Slamming distorts chalk print

CLOSE IT EASY

With a good coating of chalk applied, hold the door latch released so you can control the door closing. Then slowly push the door closed and then reopen it to check the print. If you slam the door, the weatherstrip can momentarily flatten and produce a misleading chalk print. Slamming can also blow the chalk around causing a fuzzy print.

WAX THE SURFACE

If you have trouble getting a good chalk transfer, coat the door opening surfaces with a thin film of body wax where they are contacted by the weatherstrip. The wax will pick up chalk and leave a distinct imprint. The wax also removes chalk from the weatherstrip at the con-

Fig. 15—Inspect chalk print all around

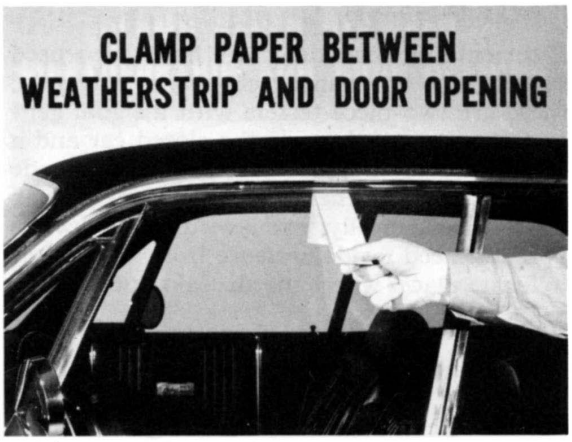


Fig. 16—Strip should pull with slight resistance

tact line so it gives you a stronger trace. If a follow-up chalk print is needed, wipe off the wax which has transferred to the weatherstrip so a new chalk coating will adhere.

LOOK FOR GAPS

With the door open, examine the chalk print closely at the sides, top, and bottom of the door opening. A gap or light trace in the chalk print indicates poor weatherstrip contact at that point and gives you an idea of the correction needed.

BUILD UP LOW SPOTS

If the chalk test shows gaps at body joints around the door opening, it may be necessary to build up the low point to get good weatherstrip sealing. You can usually level these spots with plastic solder and cover the repair with touch-up paint.

LEVEL THE HIGH SPOTS

The chalk print will also show up any high spots on the door opening seal contact surface. These high spots may be lumps of body solder or seam putty. In any case, the raised spots must be smoothed down and repainted.

USE OTHER METHODS

On hardtop models, the chalk test is used only on the door part of the weatherstrip because the contact edge of the roof rail weatherstrip is visible with the doors closed. If you suspect poor sealing between the window glass and the weatherstrip, your best bets for further checking are the paper strips or tracing powder.

PAPER IS PROPER

If chalking the weatherstrip is not practical, you can use paper instead. Clamp a narrow strip of flexible paper between the weatherstrip and the door opening at the suspected location. If the paper pulls out easily at some point, you've found a possible leak.

DUSTING IS DANDY

Many technicians prefer to use dusting or tracing powder to check for leak points. All you need for this test is the powder and a syringe to blow it in around the door edges and other test areas.

Fig. 17—Detect poor seal with powder

JUST SQUEEZE THE BULB

Vent wings and hardtop windows are prime

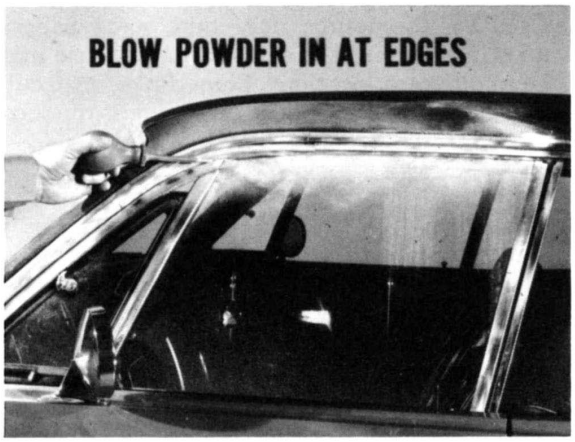


Fig. 18—Check door and vent wing sealing

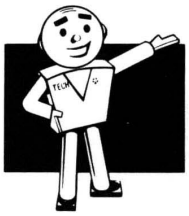
places for powder checking because leaks show up well with this method. In any case, procedure is simple. Close the doors and windows and blow the powder in at the edges of the door on the outer side of the weatherstrip in the reported noise area. Where necessary, treat vent wing and hardtop roof rail weatherstripping in the same manner.

CHECK FOR TRACES

Check for traces of powder on the inner side of the weatherstrip or the vent wing seal. Traces of powder that get past the outer edges of the weatherstrip or seal will pinpoint the place that does not seal properly. Window and vent wing leaks can be corrected by adjustment in some cases, but may require complete seal replacement in others. Door weatherstripping may require shimming, relocating, or replacement according to the situation.

ALWAYS CLEAN UP

After you check for leaks with powder or chalk, always be sure to clean up the test area so the customer won't be bothered by messed-up clothes or upholstery.



ROAD TESTING

Although some causes of wind noise and air leaks can be found by simple inspection or testing in the shop, locating the sources of turbulence noise without a road test is largely a matter of guesswork.

CHECK THE MOLDINGS

Of course, you should suspect obvious things like trim molding that is loose, raised, or out of place. You can either correct the condition, being reasonably sure it is the noise source, or cover it temporarily with masking tape so you can check the effect in further tests.

GOOD GUESSING SAVES TIME

Even after you fix obvious things like loose moldings or open body joints, trying to find the cause of turbulence noise in the shop is largely guesswork. However, since road testing takes time, it's a good idea to eliminate the possible troublemakers in the shop.

ROAD TEST IS BEST

The surest way to locate turbulence noise sources is with a road test. It lets you repeat

Fig. 19—Make corrections as you test

the conditions under which the reported noise occurs so you can analyze the condition as it happens. Besides, road testing also lets you check any corrective work you've already done in the shop.

NOT ON THE FREEWAY

The ideal testing route is an open, low-traffic area where you can drive the car at cruising speed with areas where you can pull off and stop for tests or adjustments. Be sure to take along sealing materials and masking tape so you can isolate noise sources and make corrections without returning to the shop.

SET UP FOR TESTING

The antenna should be all the way down to minimize turbulence at this point, and all the doors and windows closed tightly. Also make sure the radio and any blowers are turned off. Set the heater and air-conditioning controls on the OFF position and move the fresh-air inlet doors closed.

CHECK IT COMING AND GOING

Drive the car at the speed where the reported noise is most noticeable, so you can get an idea of the kind of sound you're concerned with. Sometimes a change in wind direction will vary or stop the noise, so be sure to check the effect of driving into and away from the wind.

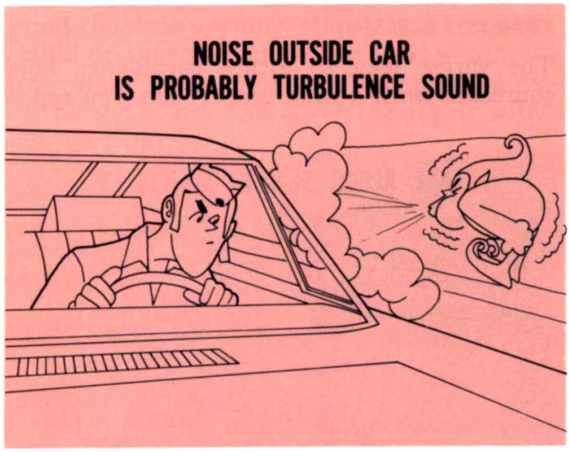


Fig. 20—Analyze type of sound

TURBULENCE IS OUT THERE

If the noise seems to be somewhere *outside* the car, it's probably a turbulence sound.

Locating the source may take some experimenting because the sound and its cause may be in different locations. Sometimes, it's a cut-and-try process, and experience is the best teacher.

AIR LEAK SOUNDS ARE IN

When the noise sounds off *inside* the car, it usually means that air is leaking into or out of the car body. In most cases, you can identify an air leak noise by opening the fresh-air inlet doors so ram air can build up pressure in the car body.

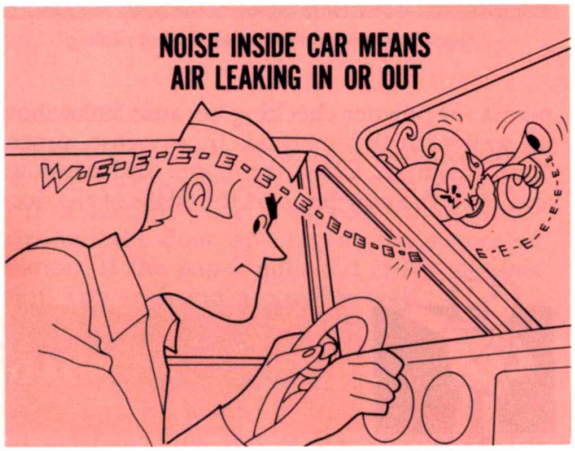


Fig. 21—Check for sound change

SOUND CHANGE IS A CLUE

As air pressure inside the car body varies, a change in the noise level indicates that the cause is an air leak, and making it louder makes it easier to find.

VENT WING AREA IS CRITICAL

As mentioned earlier, most wind noise problems seem to be found in the upper section of the car body. In fact, experience shows that the vent wing area is more critical than others, so it's a good place to start when tracking down any wind noise.

BLOCK OFF THE AREA

You can usually pinpoint a noise source in the vent area if you isolate that portion of the weatherstrip. Block off the pillar area with walls of rope-type sealer between the weatherstrip and the door edge so you can pick out vent area noises from any others.

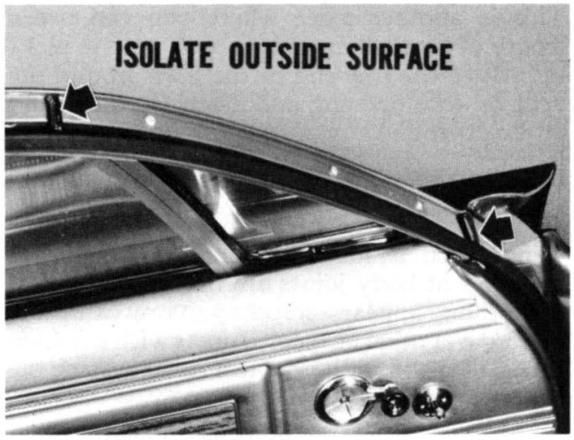


Fig. 22—Block off pillar area

SEAL THE OPENINGS

Close the door and cover the space between the windshield pillar and the door edge with masking tape to block off the outside door opening, covering the area you have isolated with rope-type sealer. Also tape the inside edges of the vent wing all around to completely cover any openings in the vent weatherstrip

Fig. 23—Close off space for test

TRY IT AGAIN

With the pillar and vent wing area sealed off, test-drive the car again. If the reported noise can still be heard, the leak is elsewhere. However, if the sound is changed, you may have a leak in the vent wing area *plus* a leak somewhere else along the door weatherstrip.

UNTAPE THE PILLAR

If the noise is gone, stop the car so you can pull

Fig. 24—Expose pillar area to air stream

the tape away from the pillar and then make another test run. If the noise returns, you'll know that the source is somewhere in the pillar area.

CHECK THE VENT WING

If no wind noise is noticed when all the tape is removed from the pillar, repeat the same testing process, but pull the remaining tape away from the vent wing in sections. When you get to a place where the noise sounds off again, you're near its source.

Fig. 25—Leaks show up as tape is removed

CHECK OTHER LOCATIONS

When you are faced with finding the location of an air leak at other locations on the door weatherstrip, you can use the pillar and vent wing testing procedure to localize the leak point. Just make sure you isolate the outside of

the weatherstrip with rope-type sealer, section by section, so you can tell where the sound is coming from.

LEND AN EAR

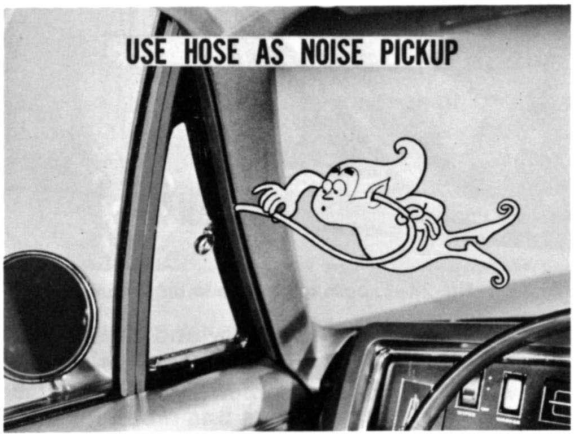


Fig. 26—Listen for air leaks

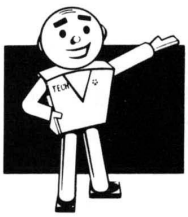
This is another place where you can use a length of small-diameter hose as a noise pick-up. Move the free end of the hose around the vent or door opening and listen for the sound at the other end.

LOOK IT OVER

To track down turbulence noises, the obvious things such as loose moldings, and gaps or openings at body joints are first on the list. If everything appears shipshape, you can close off or cover other suspected areas with masking tape and make additional test runs to check the effect of the covering.

CHANGE THE SHAPE

Sometimes you can locate a turbulence noise source by changing the shape of suspected parts with masking tape or rope-type sealer. If the wind noise changes after the alteration, you've found the cause.



THINGS TO LOOK FOR

Looking for the obvious is largely a case of recognizing conditions which would be considered as troublemakers even by technicians without car body service know-how. Some less obvious signs, gained from experience, can also be helpful in correcting some causes of wind noise or air leaks without time-consuming testing.

LOOK FOR LEAK SIGNS

After a rainstorm the dried road splash around the door opening surface helps you to spot leaks. If the weatherstrip lets in water, it can also let air in or out.

CHECK THE FIT

Check the alignment of the door in the body opening and also note whether it is flush with the adjacent body surfaces. Ideally, the gap all around the door should be uniform with the forward edge of the door flush or slightly below the body surface. However, because some variations are normal both in the door and the body door opening, you'll probably have to average out the alignment if adjustment is necessary. Just remember that you have some leeway in door and window alignment, but serious misalignment can prevent good weatherstrip sealing.

IT ACTS LIKE A SCOOP

If the forward edge of the door sets out, it's open to the air stream resulting from the forward motion of the car and can cause wind noise. This open edge can also act as a scoop for dirt and water.

KEEP THE EDGE DOWN

The rear edge of the door should also be nearly flush when the door is fully latched. If the latch striker adjustment is not correct, the door may not close properly. This can prevent a good seal between the weatherstrip and the body, or may result in weatherstrip damage.

SET IT RIGHT

When the door latches fully with its rear edge set out from adjacent body surfaces, the edge can normally be brought flush by moving the latch striker inward as required. However, if the striker pin is set inward too far, the door may latch only on its intermediate step and will not close flush even with the striker set to its inner limit.

Always make sure that the door latches FULLY after adjusting the striker pin. Do not try to force the striker inward beyond its normal adjustment limit.

CLOSE WITHOUT CRUSHING

When a door is properly fitted, the weatherstrip compresses slightly as the door closes. This allows the weatherstrip to make firm, even contact all around the door opening so it can maintain a good seal without being flattened or crushed.

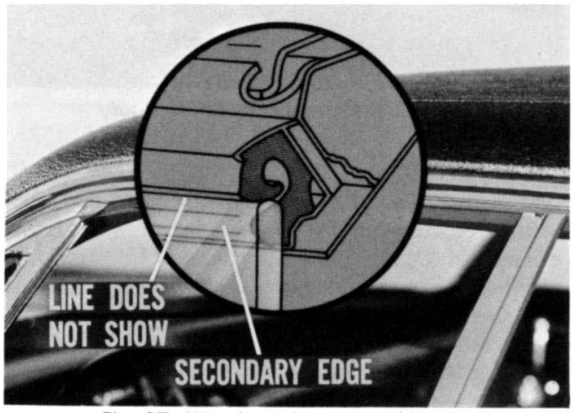


Fig. 27—Weatherstrip must seal properly

YOU NEED BOTH

On hardtop models, good weatherstrip sealing depends on proper alignment of both the door and the glass. The standards for door alignment and closing are the same as for sedan and two-door models.

ALIGN THE EDGE

The top edge of the door glass must align with the roof rail weatherstrip to make a tight seal. You may have to realign the glass, but remember that any adjustment you make will also affect the fit and alignment of the front and rear edges.

DON'T LET IT SHOW

When fully raised, a properly adjusted door glass should raise the main lip of the weatherstrip so its shoulder line does not show. In this position, the glass should also contact the weatherstrip secondary edge.

PARALLEL IN FRONT

When you realign the top edge of a door glass, remember that the front edge of the glass or the vent wing frame should be parallel to the front pillar weatherstrip retainer with equal separation top and bottom.

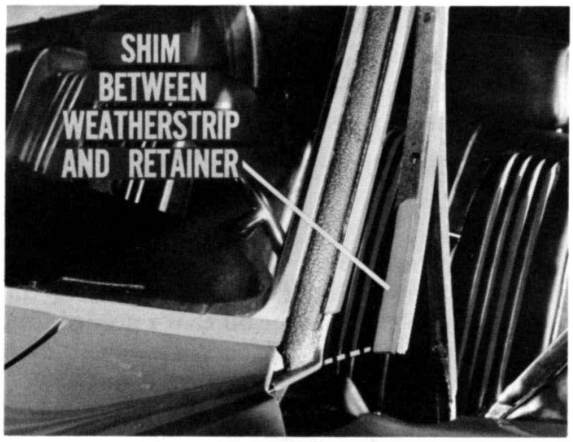


Fig. 28—Shim to align with vent or glass edge

SHIMMING SEALS SPACE

For minor corrections in pillar weatherstrip contact, you can shim it out by cementing a strip of closed-cell sponge seal tape between the weatherstrip and its retainer. If extra shimming is needed, insert the sponge tape between the pillar and the weatherstrip retainer.

GO ALL THE WAY

You can open an air leak gap if you don't make sure that the shim strip under the retainer extends to the end of the retainer. Even without a shim, the existing foam seal strip must reach to the retainer end to seal properly.

IT GETS IN UNDERNEATH

In some cars, a wind noise can result from a gap under the molded ends of the door weatherstrip. The best solution for this condition is to install a strip of closed-cell sponge seal tape between the weatherstrip and the door surface.

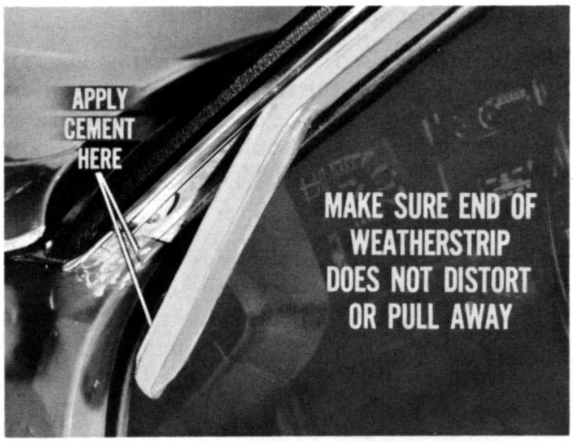


Fig. 29—Align index notch with locating tab

You'll have to remove the screws or retainers which hold the weatherstrip end in place so you can attach the seal tape.

KEEP THE ENDS DOWN

When you check door and window sealing, make sure the end of the weatherstrip does not distort or pull away from the door opening surface when the door closes. Cementing the weatherstrip end may be all that's needed, but make sure that the weatherstrip index notch lines up with the locating tab in the retainer.

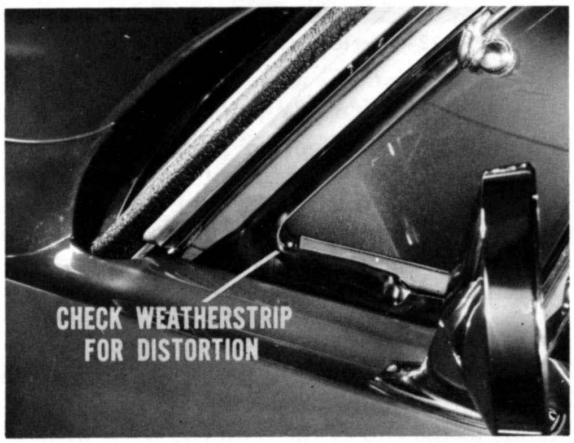


Fig. 30—Weatherstrip pucker leaks air

LOOK FOR PUCKERS

During your inspection, check the vent wing weatherstrip for puckers or distortion, especially at the front lower corner of the lip that contacts the vent glass. This type of distortion can be caused by the vent glass moving out too far, possibly due to regulator over-travel.

RESHAPE THE STRIP

On some cars you can get rid of a pucker in the vent weatherstrip by softening it with a heat gun. When the material is pliable, smooth out the pucker carefully and work the weatherstrip into shape as it cools. Holding the reshaped weatherstrip in place with masking tape can save time in some cases, but the distorted spot may need a couple of heat applications before it stays smooth.

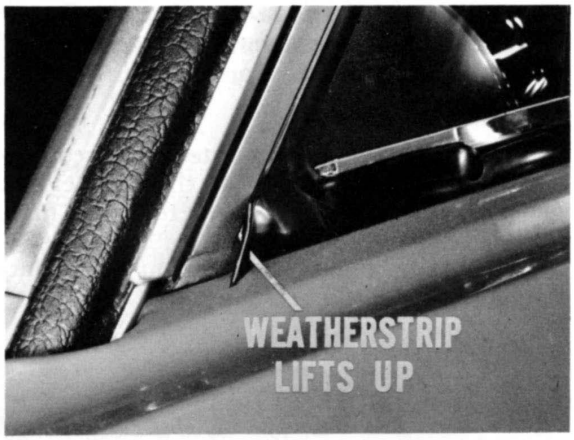


Fig. 31—Cement corner if necessary

COVER THE CORNER

Make sure that the lower front end of the vent wing weatherstrip lays flat and covers the front corner of the vent wing frame, because the strip can lift at this point and cause a leak. If the weatherstrip is otherwise in good condition, the lifted section can be cemented down to keep it in place.

FILL THE POCKETS

Also check the vent glass frame at the step-off from the glass to the frame channel. The step-off should be caulked with rope-type sealer so the weatherstrip can seal properly. If the end of the step-off is not filled or faired into the glass, it can leave an open pocket which may leak or cause noise. Apply only enough sealer to fill the open space between the vent wing glass and the weatherstrip. Too much sealer at this point will distort the lip of the weatherstrip when the vent wing closes.

TUCK IN THE FLAP

Make sure that the bottom flap of the vent wing weatherstrip is in firm contact with the

inner edge of the door panel opening. The bottom edge of the flap should extend down into the door and completely fill the space between the weatherstrip and the edge of the door panel.

However, if a portion of the flap edge has been distorted and forced out onto the upper surface of the door panel, it should not be disturbed unless it causes noise or a leak.

DRAFTS ARE AIR LEAKS, TOO

While not directly concerned with wind noise, some cars have been found with air leaks which cause an uncomfortable draft in the vicinity of the door armrest. In such cases, you'll have to remove the inside door trim so you can make sure that the watershield is properly installed and sealed. Also make sure that the foam seal is in place under the trim panel in the latch handle area.

ANOTHER POCKET TO FILL

The joint in the upper corner of the vent frame can be the source of wind noise, especially if there's a low spot at the point where the front and rear vent frame channel join. Here again, as with other openings, you can fill any gaps with rope-type sealer to make the surface even.

BUMPERS MUST FIT

The bumper at the top of the vent wing frame can distort the roof rail weatherstrip if it is out of position. Usually, you can correct this condition by simply repositioning the bumper.

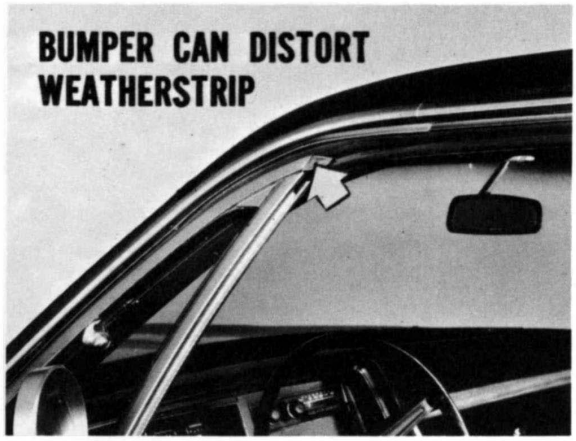


Fig. 32—Adjust bumper position

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